

## **APPENDIX 3.2:**

### **EXISTING (2015) CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

**Intersection**

Intersection Delay, s/veh 11.7

Intersection LOS B

| Movement          | EBU  | EBL  | EBT  | EBR  | WBU  | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
|-------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Vol, veh/h        | 0    | 0    | 228  | 247  | 0    | 68   | 165  | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor  | 0.92 | 0.89 | 0.89 | 0.89 | 0.92 | 0.89 | 0.89 | 0.89 | 0.92 | 0.89 | 0.89 | 0.89 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 0    | 256  | 278  | 0    | 76   | 185  | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes   | 0    | 0    | 1    | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |

**Approach**

EB

WB

Opposing Approach

WB

EB

Opposing Lanes

2

2

Conflicting Approach Left

SB

Conflicting Lanes Left

1

0

Conflicting Approach Right

SB

Conflicting Lanes Right

0

1

HCM Control Delay

11.5

11.1

HCM LOS

B

B

| Lane                   | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |
|------------------------|-------|-------|-------|-------|-------|
| Vol Left, %            | 0%    | 0%    | 100%  | 0%    | 68%   |
| Vol Thru, %            | 100%  | 0%    | 0%    | 100%  | 3%    |
| Vol Right, %           | 0%    | 100%  | 0%    | 0%    | 28%   |
| Sign Control           | Stop  | Stop  | Stop  | Stop  | Stop  |
| Traffic Vol by Lane    | 228   | 247   | 68    | 165   | 241   |
| LT Vol                 | 0     | 0     | 68    | 0     | 165   |
| Through Vol            | 228   | 0     | 0     | 165   | 8     |
| RT Vol                 | 0     | 247   | 0     | 0     | 68    |
| Lane Flow Rate         | 256   | 278   | 76    | 185   | 271   |
| Geometry Grp           | 7     | 7     | 7     | 7     | 2     |
| Degree of Util (X)     | 0.405 | 0.384 | 0.138 | 0.308 | 0.426 |
| Departure Headway (Hd) | 5.695 | 4.986 | 6.479 | 5.972 | 5.658 |
| Convergence, Y/N       | Yes   | Yes   | Yes   | Yes   | Yes   |
| Cap                    | 633   | 722   | 554   | 603   | 636   |
| Service Time           | 3.425 | 2.716 | 4.214 | 3.707 | 3.69  |
| HCM Lane V/C Ratio     | 0.404 | 0.385 | 0.137 | 0.307 | 0.426 |
| HCM Control Delay      | 12.3  | 10.8  | 10.3  | 11.4  | 12.8  |
| HCM Lane LOS           | B     | B     | B     | B     | B     |
| HCM 95th-tile Q        | 2     | 1.8   | 0.5   | 1.3   | 2.1   |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 165  | 8    | 68   |
| Peak Hour Factor  | 0.92 | 0.89 | 0.89 | 0.89 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 185  | 9    | 76   |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 12.8

HCM LOS B

Lane



| Intersection             |        |       |      |        |      |      |        |      |      |      |      |      |
|--------------------------|--------|-------|------|--------|------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 5.5    |       |      |        |      |      |        |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT   | EBR  | WBL    | WBT  | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Vol, veh/h               | 65     | 328   | 0    | 0      | 138  | 92   | 95     | 1    | 127  | 0    | 0    | 0    |
| Conflicting Peds, #/hr   | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free   | Free  | Free | Free   | Free | Free | Stop   | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -      | -     | None | -      | -    | None | -      | -    | None | -    | -    | None |
| Storage Length           | 230    | -     | -    | -      | -    | -    | -      | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 75     | 75    | 75   | 75     | 75   | 75   | 75     | 75   | 75   | 75   | 75   | 75   |
| Heavy Vehicles, %        | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 87     | 437   | 0    | 0      | 184  | 123  | 127    | 1    | 169  | 0    | 0    | 0    |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Major/Minor              | Major1 |       |      | Major2 |      |      | Minor1 |      |      |      |      |      |
| Conflicting Flow All     | 307    | 0     | 0    | 437    | 0    | 0    | 856    | 918  | 437  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 611    | 611  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 245    | 307  | -    |      |      |      |
| Critical Hdwy            | 4.1    | -     | -    | 4.1    | -    | -    | 5      | 5    | 5    |      |      |      |
| Critical Hdwy Stg 1      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Critical Hdwy Stg 2      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Follow-up Hdwy           | 2.2    | -     | -    | 2.2    | -    | -    | 3.5    | 4    | 3.3  |      |      |      |
| Pot Cap-1 Maneuver       | 1265   | -     | -    | 1134   | -    | -    | 461    | 401  | 722  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 546    | 487  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 800    | 665  | -    |      |      |      |
| Platoon blocked, %       |        | -     | -    |        | -    | -    |        |      |      |      |      |      |
| Mov Cap-1 Maneuver       | 1265   | -     | -    | 1134   | -    | -    | 429    | 0    | 722  |      |      |      |
| Mov Cap-2 Maneuver       | -      | -     | -    | -      | -    | -    | 429    | 0    | -    |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 508    | 0    | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 800    | 0    | -    |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Approach                 | EB     |       |      | WB     |      |      | NB     |      |      |      |      |      |
| HCM Control Delay, s     | 1.3    |       |      | 0      |      |      | 18.5   |      |      |      |      |      |
| HCM LOS                  |        |       |      |        |      |      | C      |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBLn1  | EBL   | EBT  | EBR    | WBL  | WBT  | WBR    |      |      |      |      |      |
| Capacity (veh/h)         | 559    | 1265  | -    | -      | 1134 | -    | -      |      |      |      |      |      |
| HCM Lane V/C Ratio       | 0.532  | 0.069 | -    | -      | -    | -    | -      |      |      |      |      |      |
| HCM Control Delay (s)    | 18.5   | 8.1   | -    | -      | 0    | -    | -      |      |      |      |      |      |
| HCM Lane LOS             | C      | A     | -    | -      | A    | -    | -      |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | 3.1    | 0.2   | -    | -      | 0    | -    | -      |      |      |      |      |      |

| Intersection             |        |      |        |      |        |       |
|--------------------------|--------|------|--------|------|--------|-------|
| Int Delay, s/veh         | 0.6    |      |        |      |        |       |
|                          |        |      |        |      |        |       |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR   |
| Vol, veh/h               | 0      | 455  | 187    | 0    | 0      | 42    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0     |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop  |
| RT Channelized           | -      | None | -      | None | -      | Yield |
| Storage Length           | -      | -    | -      | -    | -      | 0     |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -     |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -     |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67    |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0     |
| Mvmt Flow                | 0      | 679  | 279    | 0    | 0      | 63    |
|                          |        |      |        |      |        |       |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |       |
| Conflicting Flow All     | 279    | 0    | -      | 0    | 958    | 279   |
| Stage 1                  | -      | -    | -      | -    | 279    | -     |
| Stage 2                  | -      | -    | -      | -    | 679    | -     |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2   |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -     |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -     |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3   |
| Pot Cap-1 Maneuver       | 1295   | -    | -      | -    | 288    | 765   |
| Stage 1                  | -      | -    | -      | -    | 773    | -     |
| Stage 2                  | -      | -    | -      | -    | 507    | -     |
| Platoon blocked, %       |        | -    | -      | -    |        |       |
| Mov Cap-1 Maneuver       | 1295   | -    | -      | -    | 288    | 765   |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 288    | -     |
| Stage 1                  | -      | -    | -      | -    | 773    | -     |
| Stage 2                  | -      | -    | -      | -    | 507    | -     |
|                          |        |      |        |      |        |       |
| Approach                 | EB     |      | WB     |      | SB     |       |
| HCM Control Delay, s     | 0      |      | 0      |      | 10.1   |       |
| HCM LOS                  | B      |      |        |      |        |       |
|                          |        |      |        |      |        |       |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |       |
| Capacity (veh/h)         | 1295   | -    | -      | -    | 765    |       |
| HCM Lane V/C Ratio       | -      | -    | -      | -    | 0.082  |       |
| HCM Control Delay (s)    | 0      | -    | -      | -    | 10.1   |       |
| HCM Lane LOS             | A      | -    | -      | -    | B      |       |
| HCM 95th %tile Q(veh)    | 0      | -    | -      | -    | 0.3    |       |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.6    |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 47     | 408  | 187    | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 70     | 609  | 279    | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 279    | 0    | -      | 0    | 1028   | 279  |
| Stage 1                  | -      | -    | -      | -    | 279    | -    |
| Stage 2                  | -      | -    | -      | -    | 749    | -    |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -    |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3  |
| Pot Cap-1 Maneuver       | 1295   | -    | -      | -    | 262    | 765  |
| Stage 1                  | -      | -    | -      | -    | 773    | -    |
| Stage 2                  | -      | -    | -      | -    | 471    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 1295   | -    | -      | -    | 248    | 765  |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 248    | -    |
| Stage 1                  | -      | -    | -      | -    | 773    | -    |
| Stage 2                  | -      | -    | -      | -    | 446    | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 0.8    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 1295   | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.054  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 7.9    | -    | -      | -    | 0      |      |
| HCM Lane LOS             | A      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0.2    | -    | -      | -    | -      |      |

| Intersection              |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Intersection Delay, s/veh | 12.9 |      |      |      |      |      |      |      |      |      |      |      |
| Intersection LOS          | B    |      |      |      |      |      |      |      |      |      |      |      |
| Movement                  | EBU  | EBL  | EBT  | EBR  | WBU  | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
| Vol, veh/h                | 0    | 0    | 213  | 249  | 0    | 16   | 357  | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor          | 0.92 | 0.95 | 0.95 | 0.95 | 0.92 | 0.95 | 0.95 | 0.95 | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, %         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                 | 0    | 0    | 224  | 262  | 0    | 17   | 376  | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes           | 0    | 0    | 1    | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |

| Approach                   |  |  | EB   | WB   |
|----------------------------|--|--|------|------|
| Opposing Approach          |  |  | WB   | EB   |
| Opposing Lanes             |  |  | 2    | 2    |
| Conflicting Approach Left  |  |  | SB   |      |
| Conflicting Lanes Left     |  |  | 1    | 0    |
| Conflicting Approach Right |  |  |      | SB   |
| Conflicting Lanes Right    |  |  | 0    | 1    |
| HCM Control Delay          |  |  | 10.9 | 16.2 |
| HCM LOS                    |  |  | B    | C    |

| Lane                   | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |
|------------------------|-------|-------|-------|-------|-------|
| Vol Left, %            | 0%    | 0%    | 100%  | 0%    | 31%   |
| Vol Thru, %            | 100%  | 0%    | 0%    | 100%  | 1%    |
| Vol Right, %           | 0%    | 100%  | 0%    | 0%    | 67%   |
| Sign Control           | Stop  | Stop  | Stop  | Stop  | Stop  |
| Traffic Vol by Lane    | 213   | 249   | 16    | 357   | 207   |
| LT Vol                 | 0     | 0     | 16    | 0     | 65    |
| Through Vol            | 213   | 0     | 0     | 357   | 3     |
| RT Vol                 | 0     | 249   | 0     | 0     | 139   |
| Lane Flow Rate         | 224   | 262   | 17    | 376   | 218   |
| Geometry Grp           | 7     | 7     | 7     | 7     | 2     |
| Degree of Util (X)     | 0.351 | 0.359 | 0.029 | 0.596 | 0.338 |
| Departure Headway (Hd) | 5.633 | 4.924 | 6.213 | 5.707 | 5.577 |
| Convergence, Y/N       | Yes   | Yes   | Yes   | Yes   | Yes   |
| Cap                    | 639   | 731   | 577   | 631   | 645   |
| Service Time           | 3.363 | 2.654 | 3.945 | 3.438 | 3.614 |
| HCM Lane V/C Ratio     | 0.351 | 0.358 | 0.029 | 0.596 | 0.338 |
| HCM Control Delay      | 11.4  | 10.4  | 9.1   | 16.5  | 11.5  |
| HCM Lane LOS           | B     | B     | A     | C     | B     |
| HCM 95th-tile Q        | 1.6   | 1.6   | 0.1   | 3.9   | 1.5   |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 65   | 3    | 139  |
| Peak Hour Factor  | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 68   | 3    | 146  |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 11.5

HCM LOS B

Lane

| Intersection             |        |       |      |        |      |      |        |      |      |      |      |      |
|--------------------------|--------|-------|------|--------|------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 11.2   |       |      |        |      |      |        |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT   | EBR  | WBL    | WBT  | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Vol, veh/h               | 135    | 142   | 0    | 0      | 84   | 28   | 288    | 3    | 33   | 0    | 0    | 0    |
| Conflicting Peds, #/hr   | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free   | Free  | Free | Free   | Free | Free | Stop   | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -      | -     | None | -      | -    | None | -      | -    | None | -    | -    | None |
| Storage Length           | 230    | -     | -    | -      | -    | -    | -      | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 90     | 90    | 90   | 90     | 90   | 90   | 90     | 90   | 90   | 90   | 90   | 90   |
| Heavy Vehicles, %        | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 150    | 158   | 0    | 0      | 93   | 31   | 320    | 3    | 37   | 0    | 0    | 0    |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Major/Minor              | Major1 |       |      | Major2 |      |      | Minor1 |      |      |      |      |      |
| Conflicting Flow All     | 124    | 0     | 0    | 158    | 0    | 0    | 567    | 582  | 158  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 458    | 458  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 109    | 124  | -    |      |      |      |
| Critical Hdwy            | 4.1    | -     | -    | 4.1    | -    | -    | 5      | 5    | 5    |      |      |      |
| Critical Hdwy Stg 1      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Critical Hdwy Stg 2      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Follow-up Hdwy           | 2.2    | -     | -    | 2.2    | -    | -    | 3.5    | 4    | 3.3  |      |      |      |
| Pot Cap-1 Maneuver       | 1475   | -     | -    | 1434   | -    | -    | 609    | 545  | 941  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 641    | 570  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 921    | 797  | -    |      |      |      |
| Platoon blocked, %       |        | -     | -    |        | -    | -    |        |      |      |      |      |      |
| Mov Cap-1 Maneuver       | 1475   | -     | -    | 1434   | -    | -    | 547    | 0    | 941  |      |      |      |
| Mov Cap-2 Maneuver       | -      | -     | -    | -      | -    | -    | 547    | 0    | -    |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 576    | 0    | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 921    | 0    | -    |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Approach                 | EB     |       |      | WB     |      |      | NB     |      |      |      |      |      |
| HCM Control Delay, s     | 3.8    |       |      | 0      |      |      | 21.4   |      |      |      |      |      |
| HCM LOS                  |        |       |      |        |      |      | C      |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBLn1  | EBL   | EBT  | EBR    | WBL  | WBT  | WBR    |      |      |      |      |      |
| Capacity (veh/h)         | 572    | 1475  | -    | -      | 1434 | -    | -      |      |      |      |      |      |
| HCM Lane V/C Ratio       | 0.629  | 0.102 | -    | -      | -    | -    | -      |      |      |      |      |      |
| HCM Control Delay (s)    | 21.4   | 7.7   | -    | -      | 0    | -    | -      |      |      |      |      |      |
| HCM Lane LOS             | C      | A     | -    | -      | A    | -    | -      |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | 4.4    | 0.3   | -    | -      | 0    | -    | -      |      |      |      |      |      |

Intersection

Int Delay, s/veh 0.2

| Movement                 | EBL  | EBT  | WBT  | WBR  | SBL  | SBR   |
|--------------------------|------|------|------|------|------|-------|
| Vol, veh/h               | 0    | 175  | 107  | 0    | 0    | 5     |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0     |
| Sign Control             | Free | Free | Free | Free | Stop | Stop  |
| RT Channelized           | -    | None | -    | None | -    | Yield |
| Storage Length           | -    | -    | -    | -    | -    | 0     |
| Veh in Median Storage, # | -    | 0    | 0    | -    | 0    | -     |
| Grade, %                 | -    | 0    | 0    | -    | 0    | -     |
| Peak Hour Factor         | 88   | 88   | 88   | 88   | 88   | 88    |
| Heavy Vehicles, %        | 0    | 0    | 0    | 0    | 0    | 0     |
| Mvmt Flow                | 0    | 199  | 122  | 0    | 0    | 6     |

| Major/Minor          | Major1 | Major2 | Minor2 |
|----------------------|--------|--------|--------|
| Conflicting Flow All | 122    | 0      | 321    |
| Stage 1              | -      | -      | 122    |
| Stage 2              | -      | -      | 199    |
| Critical Hdwy        | 4.1    | -      | 6.4    |
| Critical Hdwy Stg 1  | -      | -      | 5.4    |
| Critical Hdwy Stg 2  | -      | -      | 5.4    |
| Follow-up Hdwy       | 2.2    | -      | 3.5    |
| Pot Cap-1 Maneuver   | 1478   | -      | 677    |
| Stage 1              | -      | -      | 908    |
| Stage 2              | -      | -      | 839    |
| Platoon blocked, %   | -      | -      | -      |
| Mov Cap-1 Maneuver   | 1478   | -      | 677    |
| Mov Cap-2 Maneuver   | -      | -      | 677    |
| Stage 1              | -      | -      | 908    |
| Stage 2              | -      | -      | 839    |

| Approach             | EB | WB | SB  |
|----------------------|----|----|-----|
| HCM Control Delay, s | 0  | 0  | 8.9 |
| HCM LOS              |    |    | A   |

| Minor Lane/Major Mvmt | EBL  | EBT | WBT | WBR | SBLn1 |
|-----------------------|------|-----|-----|-----|-------|
| Capacity (veh/h)      | 1478 | -   | -   | -   | 935   |
| HCM Lane V/C Ratio    | -    | -   | -   | -   | 0.006 |
| HCM Control Delay (s) | 0    | -   | -   | -   | 8.9   |
| HCM Lane LOS          | A    | -   | -   | -   | A     |
| HCM 95th %tile Q(veh) | 0    | -   | -   | -   | 0     |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.1    |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 4      | 171  | 107    | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 84     | 84   | 84     | 84   | 84     | 84   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 5      | 204  | 127    | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 127    | 0    | -      | 0    | 340    | 127  |
| Stage 1                  | -      | -    | -      | -    | 127    | -    |
| Stage 2                  | -      | -    | -      | -    | 213    | -    |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -    |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3  |
| Pot Cap-1 Maneuver       | 1472   | -    | -      | -    | 660    | 929  |
| Stage 1                  | -      | -    | -      | -    | 904    | -    |
| Stage 2                  | -      | -    | -      | -    | 827    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 1472   | -    | -      | -    | 658    | 929  |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 658    | -    |
| Stage 1                  | -      | -    | -      | -    | 904    | -    |
| Stage 2                  | -      | -    | -      | -    | 824    | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 0.2    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 1472   | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.003  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 7.5    | -    | -      | -    | 0      |      |
| HCM Lane LOS             | A      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0      | -    | -      | -    | -      |      |



### **APPENDIX 3.3:**

## **EXISTING (2015) CONDITIONS TRAFFIC SIGNAL WARRANT ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

### Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **Existing (2015) Conditions - Weekday PM Peak Hour**

Major Street Name = **Nichols Road**

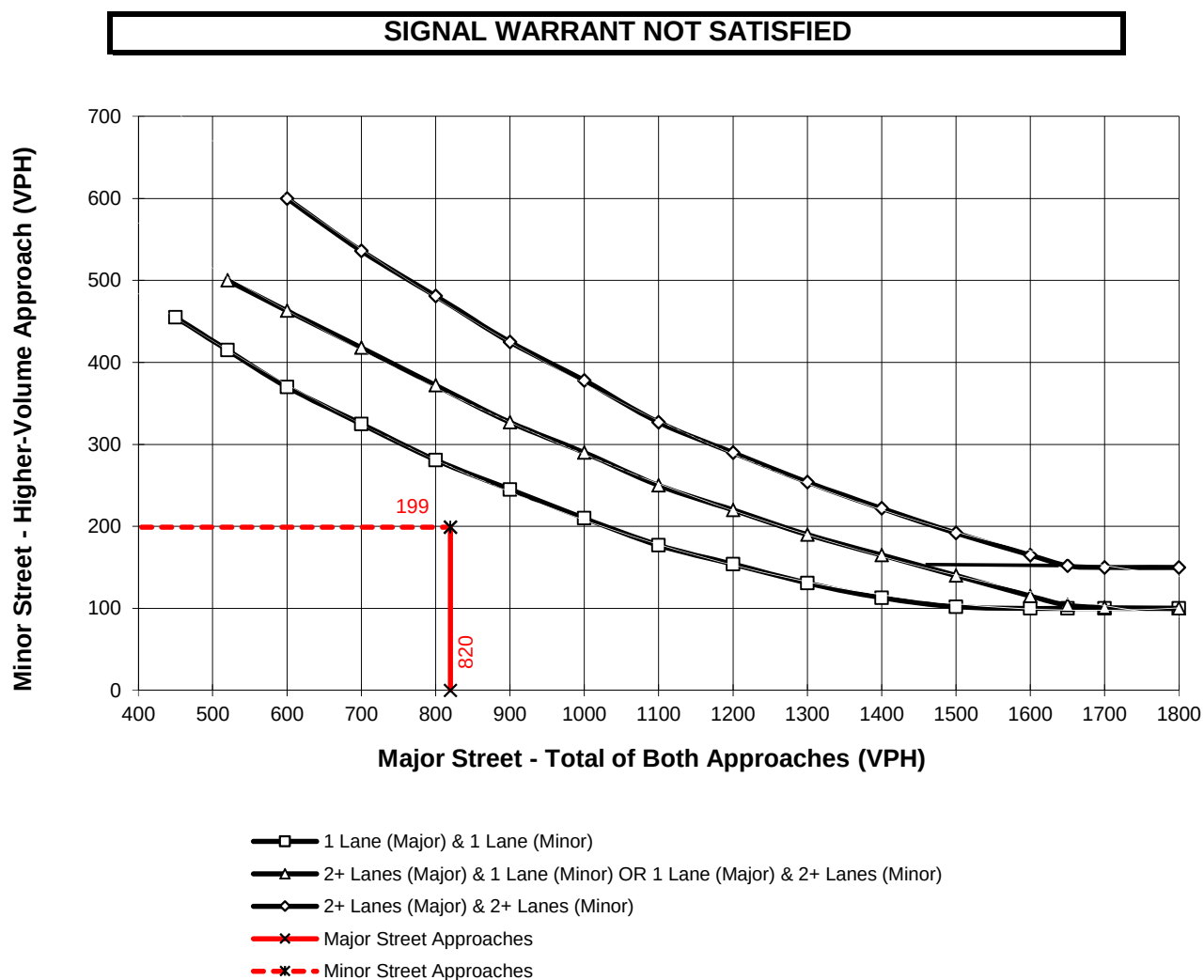
Total of Both Approaches (VPH) = **820**

Number of Approach Lanes on Major Street = **1**

Minor Street Name = **I-15 Southbound Ramps**

High Volume Approach (VPH) = **199**

Number of Approach Lanes On Minor Street = **1**



\*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes  
and 100 vph applies as the lower threshold for a minor-street approach with one lane

### Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **Existing (2015) Conditions - Weekday AM Peak Hour**

Major Street Name = **Nichols Road**

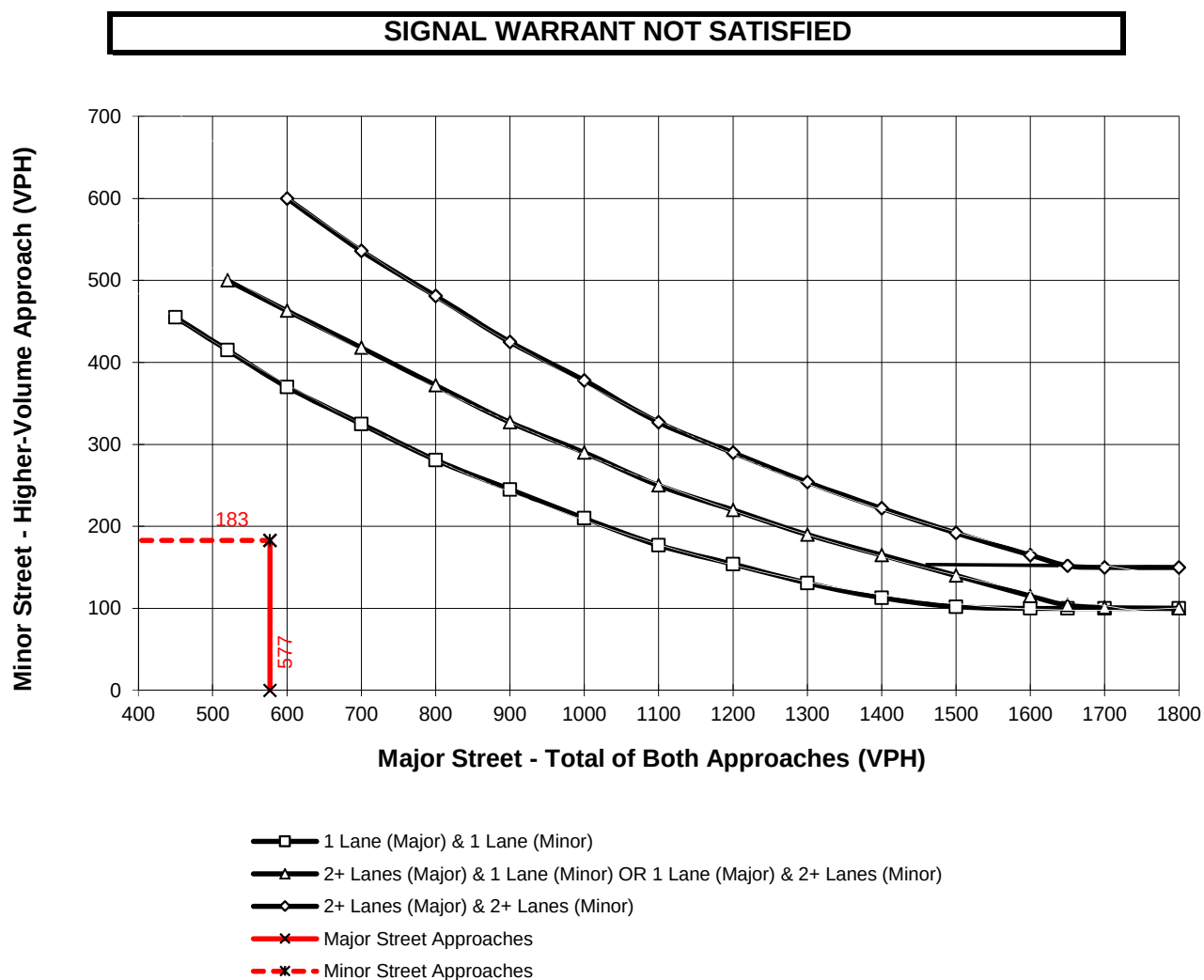
Total of Both Approaches (VPH) = **577**

Number of Approach Lanes on Major Street = **1**

Minor Street Name = **I-15 Northbound Ramps**

High Volume Approach (VPH) = **183**

Number of Approach Lanes On Minor Street = **1**



\*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes  
and 100 vph applies as the lower threshold for a minor-street approach with one lane

## **APPENDIX 3.4:**

### **EXISTING (2015) CONDITIONS BASIC FREEWAY SEGMENT ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

## PeMS Data – May 12-14, 2015

### I-15 Southbound, North of Nichols

| Total Vehicles |             |                |             | Data Quality  |              |
|----------------|-------------|----------------|-------------|---------------|--------------|
| Time           | Minimum     | Mean           | Maximum     | # Lane Points | % Observed   |
| <b>07:00</b>   | <b>2750</b> | <b>2791.67</b> | <b>2859</b> | <b>108</b>    | <b>100.0</b> |
| 08:00          | 2695        | 2703.67        | 2716        | 108           | 100.0        |
| 09:00          | 2376        | 2530           | 2673        | 108           | 100.0        |
| 16:00          | 3654        | 3964.67        | 4205        | 108           | 100.0        |
| <b>17:00</b>   | <b>3985</b> | <b>4100</b>    | <b>4253</b> | <b>108</b>    | <b>100.0</b> |
| 18:00          | 3698        | 3815.33        | 3932        | 108           | 100.0        |

| Trucks       |           |              |           | Data Quality  |              |
|--------------|-----------|--------------|-----------|---------------|--------------|
| Time         | Minimum   | Mean         | Maximum   | # Lane Points | % Observed   |
| <b>07:00</b> | <b>48</b> | <b>50.33</b> | <b>52</b> | <b>108</b>    | <b>100.0</b> |
| 08:00        | 47        | 50.67        | 54        | 108           | 100.0        |
| 09:00        | 48        | 52.33        | 55        | 108           | 100.0        |
| 16:00        | 37        | 43.33        | 47        | 108           | 100.0        |
| <b>17:00</b> | <b>35</b> | <b>39.67</b> | <b>43</b> | <b>108</b>    | <b>100.0</b> |
| 18:00        | 31        | 37.33        | 42        | 108           | 100.0        |

### I-15 Northbound, North of Nichols

| Total Vehicles |             |                |             | Data Quality  |              |
|----------------|-------------|----------------|-------------|---------------|--------------|
| Time           | Minimum     | Mean           | Maximum     | # Lane Points | % Observed   |
| <b>07:00</b>   | <b>3354</b> | <b>3405.67</b> | <b>3476</b> | <b>108</b>    | <b>100.0</b> |
| 08:00          | 3248        | 3315.33        | 3406        | 108           | 100.0        |
| 09:00          | 3071        | 3204           | 3271        | 108           | 100.0        |
| <b>16:00</b>   | <b>2788</b> | <b>3030</b>    | <b>3261</b> | <b>108</b>    | <b>100.0</b> |
| 17:00          | 2735        | 2919.67        | 3088        | 108           | 100.0        |
| 18:00          | 2060        | 2306.33        | 2435        | 108           | 100.0        |

| Trucks       |           |              |           | Data Quality  |              |
|--------------|-----------|--------------|-----------|---------------|--------------|
| Time         | Minimum   | Mean         | Maximum   | # Lane Points | % Observed   |
| <b>07:00</b> | <b>35</b> | <b>38.33</b> | <b>42</b> | <b>108</b>    | <b>100.0</b> |
| 08:00        | 42        | 43.33        | 45        | 108           | 100.0        |
| 09:00        | 45        | 49.67        | 52        | 108           | 100.0        |
| <b>16:00</b> | <b>29</b> | <b>34.67</b> | <b>44</b> | <b>108</b>    | <b>100.0</b> |
| 17:00        | 20        | 29.33        | 41        | 108           | 100.0        |
| 18:00        | 18        | 25.33        | 30        | 108           | 100.0        |

This Page Intentionally Left Blank



| <b>BASIC FREEWAY SEGMENTS WORKSHEET</b>                                                                                |                             |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------|----|
| <b>General Information</b>                                                                                             |                             |          | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |        |    |
| Analyst                                                                                                                | CHS                         |          | Highway/Direction of Travel <i>I-15 Southbound</i>                                                                                                                                                                                                                                                                                                                                                                                                       |        |    |
| Agency or Company                                                                                                      | Urban Crossroads, Inc.      |          | From/To <i>North of Nichols Road</i>                                                                                                                                                                                                                                                                                                                                                                                                                     |        |    |
| Date Performed                                                                                                         | 6/3/2015                    |          | Jurisdiction <i>Caltrans</i>                                                                                                                                                                                                                                                                                                                                                                                                                             |        |    |
| Analysis Time Period                                                                                                   | AM Peak Hour                |          | Analysis Year <i>Existing 2015</i>                                                                                                                                                                                                                                                                                                                                                                                                                       |        |    |
| Project Description <i>Nichols Mine Expansion TIA (JN 09599)</i>                                                       |                             |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
| <input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data |                             |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
| <b>Flow Inputs</b>                                                                                                     |                             |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
| Volume, V                                                                                                              | 2859                        | veh/h    | Peak-Hour Factor, PHF                                                                                                                                                                                                                                                                                                                                                                                                                                    | 0.92   |    |
| AADT                                                                                                                   |                             | veh/day  | %Trucks and Buses, P <sub>T</sub>                                                                                                                                                                                                                                                                                                                                                                                                                        | 2      |    |
| Peak-Hr Prop. of AADT, K                                                                                               |                             |          | %RVs, P <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                     | 0      |    |
| Peak-Hr Direction Prop, D                                                                                              |                             |          | General Terrain:                                                                                                                                                                                                                                                                                                                                                                                                                                         | Level  |    |
| DDHV = AADT x K x D                                                                                                    |                             | veh/h    | Grade %                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Length | mi |
| Up/Down %                                                                                                              |                             |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
| <b>Calculate Flow Adjustments</b>                                                                                      |                             |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
| f <sub>p</sub>                                                                                                         | 1.00                        |          | E <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1.2    |    |
| E <sub>T</sub>                                                                                                         | 1.5                         |          | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] 0.990                                                                                                                                                                                                                                                                                                                                                  |        |    |
| <b>Speed Inputs</b>                                                                                                    |                             |          | <b>Calc Speed Adj and FFS</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |        |    |
| Lane Width                                                                                                             | ft                          |          | <div style="display: flex; justify-content: space-between;"> <div>f<sub>LW</sub></div> <div>mph</div> </div> <div style="display: flex; justify-content: space-between;"> <div>f<sub>LC</sub></div> <div>mph</div> </div> <div style="display: flex; justify-content: space-between;"> <div>TRD Adjustment</div> <div>mph</div> </div> <div style="display: flex; justify-content: space-between;"> <div>FFS</div> <div>70.0</div> <div>mph</div> </div> |        |    |
| Rt-Side Lat. Clearance                                                                                                 | ft                          |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
| Number of Lanes, N                                                                                                     | 3                           |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
| Total Ramp Density, TRD                                                                                                | ramps/mi                    |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
| FFS (measured)                                                                                                         | 70.0 mph                    |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
| Base free-flow Speed, BFFS                                                                                             | mph                         |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                          |        |    |
| <b>LOS and Performance Measures</b>                                                                                    |                             |          | <b>Design (N)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |    |
| Operational (LOS)                                                                                                      |                             |          | Design (N)                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |    |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                                            |                             |          | Design LOS                                                                                                                                                                                                                                                                                                                                                                                                                                               |        |    |
| x f <sub>p</sub> )                                                                                                     | 1046                        | pc/h/ln  | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                                                                                                                                                                                                                                                                                                                                                                              |        |    |
| S                                                                                                                      | 70.0                        | mph      | x f <sub>p</sub> )                                                                                                                                                                                                                                                                                                                                                                                                                                       |        |    |
| D = v <sub>p</sub> / S                                                                                                 | 14.9                        | pc/mi/ln | S                                                                                                                                                                                                                                                                                                                                                                                                                                                        |        |    |
| LOS                                                                                                                    | B                           |          | D = v <sub>p</sub> / S                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |    |
|                                                                                                                        |                             |          | Required Number of Lanes, N                                                                                                                                                                                                                                                                                                                                                                                                                              |        |    |
| <b>Glossary</b>                                                                                                        |                             |          | <b>Factor Location</b>                                                                                                                                                                                                                                                                                                                                                                                                                                   |        |    |
| N - Number of lanes                                                                                                    | S - Speed                   |          | E <sub>R</sub> - Exhibits 11-10, 11-12                                                                                                                                                                                                                                                                                                                                                                                                                   |        |    |
| V - Hourly volume                                                                                                      | D - Density                 |          | f <sub>LW</sub> - Exhibit 11-8                                                                                                                                                                                                                                                                                                                                                                                                                           |        |    |
| v <sub>p</sub> - Flow rate                                                                                             | FFS - Free-flow speed       |          | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                                                                                                                                                                                                                                                                                                                                                                            |        |    |
| LOS - Level of service                                                                                                 | BFFS - Base free-flow speed |          | f <sub>LC</sub> - Exhibit 11-9                                                                                                                                                                                                                                                                                                                                                                                                                           |        |    |
| DDHV - Directional design hour volume                                                                                  |                             |          | f <sub>p</sub> - Page 11-18                                                                                                                                                                                                                                                                                                                                                                                                                              |        |    |
|                                                                                                                        |                             |          | TRD - Page 11-11                                                                                                                                                                                                                                                                                                                                                                                                                                         |        |    |
|                                                                                                                        |                             |          | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                                                                                                                                                                                                                                                                                                                                                                        |        |    |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year Existing 2015                                                                       |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 2919                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 2                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.990                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1068                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 15.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                 |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                       |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                          | CHS                         |                                  | Highway/Direction of Travel <i>I-15 Northbound</i>                                                |                                        |     |
| Agency or Company                                                | Urban Crossroads, Inc.      |                                  | From/To <i>North of Nichols Road</i>                                                              |                                        |     |
| Date Performed                                                   | 6/3/2015                    |                                  | Jurisdiction <i>Caltrans</i>                                                                      |                                        |     |
| Analysis Time Period                                             | AM Peak Hour                |                                  | Analysis Year <i>Existing 2015</i>                                                                |                                        |     |
| Project Description <i>Nichols Mine Expansion TIA (JN 09599)</i> |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                   |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                               |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                        | 3476                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                             |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                         |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                        |                             |                                  | General Terrain:                                                                                  | <i>Level</i>                           |     |
| DDHV = AADT x K x D                                              |                             | veh/h                            | Grade % Length                                                                                    | <i>mi</i>                              |     |
|                                                                  |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                                |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                   | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                   | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                              |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                       |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                           |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                               | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                          |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                                   | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                       |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                              |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                         |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )      |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                                  | 1266                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                               |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                                | 69.9                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                           | 18.1                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                              | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                  |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                              | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                       | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                           | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                            |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year Existing 2015                                                                       |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3513                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 2                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.990                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1286                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 69.9                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 18.4                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year Existing 2015                                                                       |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4253                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1549                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 68.6                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 22.6                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year Existing 2015                                                                       |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4316                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1572                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 68.4                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 23.0                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year Existing 2015                                                                       |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3261                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1187                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 17.0                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year Existing 2015                                                                       |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3425                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1247                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 17.8                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |



## **APPENDIX 3.5:**

### **EXISTING (2015) CONDITIONS FREEWAY MERGE/DIVERGE ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | I-15 Southbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Existing 2015    |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 286 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 220              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2859             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 226              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2859            | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.990            | 1.00          | 3139                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 226             | 0.92                            | Level                | 7                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.966            | 1.00          | 254                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 286             | 0.92                            | Level                | 8                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.962            | 1.00          | 323                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.670 using Equation (Exhibit 13-7)<br>$V_{12} =$ 2186 pc/h<br>$V_3$ or $V_{av34}$ 953 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3139             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 2885                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7200             | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 254                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2100             | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2186             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 21.1 (pc/mi/ln)<br>LOS =      C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                     |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.321 (Exhibit 13-12)<br>$S_R =$ 61.0 mph (Exhibit 13-12)<br>$S_0 =$ 76.8 mph (Exhibit 13-12)<br>$S =$ 65.1 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Southbound |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans        |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 | AM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Existing 2015   |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2075$ ft<br><br>$V_u = 226$ veh/h                                                                                                                                                                                                                                                                                             |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3               |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1               |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 230             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2633            |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 286             |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$        | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2633            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995           | 1.00          | 2876                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 286             | 0.92                            | Level    | 8                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.962           | 1.00          | 323                                                                                                                                                                                                |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 226             | 0.92                            | Level    | 7                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.966           | 1.00          | 254                                                                                                                                                                                                |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 738.11$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.584$ using Equation (Exhibit 13-6)<br>$V_{12} = 1679$ pc/h<br>$V_3$ or $V_{av34} = 1197$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 1679$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3199            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2002            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 19.5$ (pc/mi/ln)<br>LOS = B (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |               |                                                                                                                                                                                                    |            |
| $M_S = 0.329$ (Exhibit 13-11)<br>$S_R = 60.8$ mph (Exhibit 13-11)<br>$S_0 = 67.5$ mph (Exhibit 13-11)<br>$S = 63.1$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                 |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |               |                                                                                                                                                                                                    |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | I-15 Northbound |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Nichols On-Ramp |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Caltrans        |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 | AM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Existing 2015   |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} =$ 2130 ft<br><br>$V_u =$ 183 veh/h                                                                                                                                                                                                                                                                                            |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3               |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1               |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 800             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3330            |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 146             |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | $f_{HV}$        | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3330            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.995           | 1.00          | 3638                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 146             | 0.92                            | Level    | 7                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.966           | 1.00          | 164                                                                                                                                                                                                |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 183             | 0.92                            | Level    | 12                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.943           | 1.00          | 211                                                                                                                                                                                                |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ 1120.23 (Equation 13-6 or 13-7)<br>$P_{FM} =$ 0.600 using Equation (Exhibit 13-6)<br>$V_{12} =$ 2182 pc/h<br>$V_3$ or $V_{av34}$ 1456 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ 2182 pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual          | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3802            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual          | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2346            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ 18.7 (pc/mi/ln)<br>LOS = B (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                 |                 |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |               |                                                                                                                                                                                                    |            |
| $M_S =$ 0.290 (Exhibit 13-11)<br>$S_R =$ 61.9 mph (Exhibit 13-11)<br>$S_0 =$ 66.6 mph (Exhibit 13-11)<br>$S =$ 63.6 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                      |                 |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|---------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |         |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |         | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |         | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |         | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |         | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Existing 2015    |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 146 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 225              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3513             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 183              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |         | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |         | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3513            | 0.92                            | Level   | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990            | 1.00          | 3857                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 183             | 0.92                            | Level   | 12                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.943            | 1.00          | 211                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 146             | 0.92                            | Level   | 7                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.966            | 1.00          | 164                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |         |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |         |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |         |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.654 using Equation (Exhibit 13-7)<br>$V_{12} =$ 2595 pc/h<br>$V_3$ or $V_{av34}$ 1262 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |         |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |         | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |         |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3857             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         | $V_{FO} = V_F - V_R$  | 3646                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-8     | 7200          | No                                                                                                                                                                                                                     |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         | $V_R$                 | 211                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Exhibit 13-10    | 2100          | No                                                                                                                                                                                                                     |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |         |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |         | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |         |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2595             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |         |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |         |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 24.5 (pc/mi/ln)<br>LOS =      C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |         |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |         |                       | $D_S =$ 0.317 (Exhibit 13-12)<br>$S_R =$ 61.1 mph (Exhibit 13-12)<br>$S_0 =$ 75.8 mph (Exhibit 13-12)<br>$S =$ 65.3 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Existing 2015    |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 262 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 220              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4253             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 199              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4253            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995            | 1.00          | 4646                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 199             | 0.92                            | Level                | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.985            | 1.00          | 220                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 262             | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990            | 1.00          | 288                                                                                                                                                                                                                    |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                 |                      |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.634 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3025 pc/h<br>$V_3$ or $V_{av34}$ 1621 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4646             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 4426                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200             | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 220                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100             | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3025             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 28.3 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.318 (Exhibit 13-12)<br>$S_R =$ 61.1 mph (Exhibit 13-12)<br>$S_0 =$ 74.4 mph (Exhibit 13-12)<br>$S =$ 65.2 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                |                                                                                                                                                                                                            |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            | CHS                                      |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Southbound |                |                                                                                                                                                                                                            |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | Urban Crossroads, Inc.                   |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp |                |                                                                                                                                                                                                            |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            | 6/3/2015                                 |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans        |                |                                                                                                                                                                                                            |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | PM Peak Hour                             |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Existing 2015   |                |                                                                                                                                                                                                            |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2075 ft<br>V <sub>u</sub> = 199 veh/h                                                                                                                                                                                                                                                                                                                                                                                                   |            | Freeway Number of Lanes, N               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3               |                | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Number of Lanes, N                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1               |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Acceleration Lane Length, L <sub>A</sub> |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 230             |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Deceleration Lane Length L <sub>D</sub>  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Freeway Volume, V <sub>F</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4054            |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Volume, V <sub>R</sub>              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 262             |                |                                                                                                                                                                                                            |            |
| Freeway Free-Flow Speed, S <sub>FF</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                                          |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| Ramp Free-Flow Speed, S <sub>FR</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                          |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | V (Veh/hr) | PHF                                      | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub> | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub>                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4054       | 0.92                                     | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.995           | 1.00           | 4429                                                                                                                                                                                                       |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 262        | 0.92                                     | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.990           | 1.00           | 288                                                                                                                                                                                                        |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 199        | 0.92                                     | Level    | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.985           | 1.00           | 220                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                |                                                                                                                                                                                                            |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                |                                                                                                                                                                                                            |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 1062.96 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.584 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 2586 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 1843 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 2586 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                          |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                 |                |                                                                                                                                                                                                            |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                          |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Capacity                                 |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual          | Capacity       |                                                                                                                                                                                                            | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4717       | Exhibit 13-8                             |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Exhibit 13-10  |                                                                                                                                                                                                            |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Max Desirable                            |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual          | Max Desirable  |                                                                                                                                                                                                            | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2874       | Exhibit 13-8                             | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8   |                                                                                                                                                                                                            |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                |                                                                                                                                                                                                            |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 26.3 (pc/mi/ln)<br>LOS = C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                                                                                                                                                                                                            |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                |                                                                                                                                                                                                            |            |
| M <sub>S</sub> = 0.369 (Exhibit 13-11)<br>S <sub>R</sub> = 59.7 mph (Exhibit 13-11)<br>S <sub>0</sub> = 65.2 mph (Exhibit 13-11)<br>S = 61.7 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                |                                                                                                                                                                                                            |            |



| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Northbound |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans        |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | PM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Existing 2015   |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2130$ ft<br><br>$V_u = 322$ veh/h                                                                                                                                                                                                                                                                                              |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3               |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1               |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 800             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3103            |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 158             |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$        | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3103            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995           | 1.00          | 3390                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 158             | 0.92                            | Level    | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.980           | 1.00          | 175                                                                                                                                                                                                |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 322             | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995           | 1.00          | 352                                                                                                                                                                                                |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 1069.51$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.600$ using Equation (Exhibit 13-6)<br>$V_{12} = 2034$ pc/h<br>$V_3$ or $V_{av34} = 1356$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 2034$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3565            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2209            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 17.6$ (pc/mi/ln)<br>LOS = B (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |               |                                                                                                                                                                                                    |            |
| $M_S = 0.285$ (Exhibit 13-11)<br>$S_R = 62.0$ mph (Exhibit 13-11)<br>$S_0 = 66.9$ mph (Exhibit 13-11)<br>$S = 63.8$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                 |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|---------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |         |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |         | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |         | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |         | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |         | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Existing 2015    |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 158 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 225              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3425             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 322              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |         | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |         | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3425            | 0.92                            | Level   | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995            | 1.00          | 3741                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 322             | 0.92                            | Level   | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995            | 1.00          | 352                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 158             | 0.92                            | Level   | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.980            | 1.00          | 175                                                                                                                                                                                                                    |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                 |         |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |         |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |         |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.650 using Equation (Exhibit 13-7)<br>$V_{12} =$ 2556 pc/h<br>$V_3$ or $V_{av34}$ 1185 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |         |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |         | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |         |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3741             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         | $V_{FO} = V_F - V_R$  | 3389                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-8     | 7200          | No                                                                                                                                                                                                                     |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         | $V_R$                 | 352                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Exhibit 13-10    | 2100          | No                                                                                                                                                                                                                     |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |         |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |         | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |         |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2556             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |         |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |         |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 24.2 (pc/mi/ln)<br>LOS =      C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |         |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |         |                       | $D_S =$ 0.330 (Exhibit 13-12)<br>$S_R =$ 60.8 mph (Exhibit 13-12)<br>$S_0 =$ 76.1 mph (Exhibit 13-12)<br>$S =$ 64.9 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |

**APPENDIX 4.1:**

**CUMULATIVE DEVELOPMENT PROJECT REQUESTS**

This Page Intentionally Left Blank

## Charlene Hwang So

---

**From:** Justin Kirk <jkirk@Lake-Elsinore.org>  
**Sent:** Thursday, June 11, 2015 5:25 PM  
**To:** Charlene Hwang So; Susan Vombaur  
**Cc:** CMS Administrator  
**Subject:** RE: 09599: Nichols Mine Expansion Scope

Charlene,

I looked over the Table-6 and everything in the list looks still valid. I reviewed all of our recent applications and have found only one project that has been applied for and in process that should be included. Please add the following recent applications:

- Ness Industrial Garage: IDR for a 12,956 SF Light industrial building located on a .91 Acre site. The proposed project is generally located on the southwest corner of Minthorn and Birch St. and more specifically referred to as APN: 377-430-060

Please let me know if you need anything else.

Regards,

Justin Kirk  
Senior Planner  
951-674-3124 EXT 284  
[Jkirk@lake-elsinore.org](mailto:Jkirk@lake-elsinore.org)

---

**From:** Charlene Hwang So [mailto:cso@urbanxroads.com]  
**Sent:** Tuesday, June 02, 2015 7:17 PM  
**To:** Justin Kirk; Susan Vombaur  
**Cc:** CMS Administrator  
**Subject:** 09599: Nichols Mine Expansion Scope

Hi Justin,

I am following up on the cumulative list for the Nichols Mine project. Please let me know if you need any information from me! Thanks in advance!

Regards,

**CHARLENE SO, P.E.**  
Senior Transportation Engineer



41 Corporate Park, Suite 300  
Irvine, CA 92606  
(949) 336-5982 Direct  
(949) 861-0177 Cell  
(949) 660-1994 Main  
[urbanxroads.com](http://urbanxroads.com)

---

**From:** Justin Kirk [<mailto:jkirk@Lake-Elsinore.org>]  
**Sent:** Friday, May 29, 2015 4:12 PM  
**To:** Charlene Hwang So; Susan Vombaur  
**Subject:** Re: 09599: Nichols Mine Expansion Scope

Charlene,

I will forward on the list on Monday.

Justin.

---

**From:** Charlene Hwang So <[cs@urbanxroads.com](mailto:cs@urbanxroads.com)>  
**Sent:** Friday, May 29, 2015 9:28 AM  
**To:** Susan Vombaur  
**Cc:** Justin Kirk  
**Subject:** Re: 09599: Nichols Mine Expansion Scope

Thanks Susan! No, I have not received an updated cumulative list from the City yet.

Regards,

**CHARLENE SO, PE**  
Senior Transportation Engineer  
[\(949\) 336-5982](tel:(949)336-5982) Direct  
[\(949\) 861-0177](tel:(949)861-0177) Cell  
[\(949\) 660-1994](tel:(949)660-1994) Main  
[urbanxroads.com](http://urbanxroads.com)

Sent from my iPhone

On May 29, 2015, at 9:23 AM, Susan Vombaur <[susan.vombaur@webbassociates.com](mailto:susan.vombaur@webbassociates.com)> wrote:

Charlene,

Justin and I spoke this morning and the scope is good to go. Did you get the answer to the cumulative list?

Thanks,

Susan

---

**From:** Charlene Hwang So [[cs@urbanxroads.com](mailto:cs@urbanxroads.com)]  
**Sent:** Friday, May 22, 2015 4:18 PM  
**To:** Susan Vombaur; Susan Vombaur  
**Cc:** Justin Kirk; CMS Administrator  
**Subject:** 09599: Nichols Mine Expansion Scope

Hi Susan,

Attached is the revised scoping agreement per our e-mail chain below. As I mentioned, the baseline data is based on historical data which the applicant can supply at the City's request. I did a quick comparison of the actual intersection counts that we took during the AM and PM peak periods and it is very low in comparison to the historical baseline. I think as part of the traffic study, we should bump up

the existing data to reflect the baseline conditions which are summarized on Table 5 of the attached scoping agreement in order to make sure the baseline is consistent. The traffic study will evaluate the delta associated with the projected increase in the production over existing levels. Please let me know if you have any questions/comments.

Hi Justin,

Could you please let me know if you will be providing any updated list of cumulative projects or if I should contact and follow up with someone else there at the City? I have already reached out to and received a list of cumulative projects from the County of Riverside. Thanks in advance!

Regards,

**CHARLENE SO, P.E.**

Senior Transportation Engineer



41 Corporate Park, Suite 300

Irvine, CA 92606

(949) 336-5982 Direct

(949) 861-0177 Cell

(949) 660-1994 Main

[urbanxroads.com](http://urbanxroads.com)

---

**From:** Susan Vombaur [<mailto:susan.vombaur@webbassociates.com>]

**Sent:** Thursday, May 21, 2015 12:54 PM

**To:** Charlene Hwang So

**Subject:** RE: 09599: Nichols Mine Expansion Scope

Hi Charlene. I understand the issue with fluxuations, which is why I asked about records of daily truck counts so the existing trips are based on actual operations. I really feel like the trucks line up outside the gate before 7 AM to load (typical with this operation) and leave early in a higher volume than the more evenly distributed assumptions made. Does that make sense? I've done studies for these uses before and that's pretty normal.

Let me know what you think...

---

**From:** Charlene Hwang So [[cs@urbanxroads.com](mailto:cs@urbanxroads.com)]

**Sent:** Thursday, May 21, 2015 10:50 AM

**To:** Susan Vombaur; Susan Vombaur

**Cc:** CMS Administrator

**Subject:** 09599: Nichols Mine Expansion Scope

Hi Susan,

I wanted to discuss with you the baseline. I had taken it out in our revised scope, but after having a call with the Project team this morning – I think it's appropriate if we add it back. The historic baseline we established is based on historic data over the last 7 years or so. Their concern with taking only 1 day counts and using it as the baseline is that it does not account for the fluctuation in traffic to and from their site. There are days where they have an increase of traffic and others where the traffic is low. The applicant feels that the baseline average we originally provided is a better representation of the traffic that is being generated by the current production levels (650,000 TPY).. Let me know if you are okay with us adding the baseline back and I will keep the other changes you made and get a revised scope back into you today. Feel free to call me if you would like to discuss. Thanks in advance!

Regards,

**CHARLENE SO, P.E.**  
Senior Transportation Engineer



41 Corporate Park, Suite 300

Irvine, CA 92606

(949) 336-5982 Direct

(949) 861-0177 Cell

(949) 660-1994 Main

[urbanxroads.com](http://urbanxroads.com)

Click [here](#) to report this email as spam.

[Join our mailing list!](#)

[Protection Notice](#)

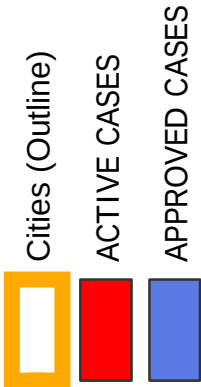


[Join our mailing list!](#)

[Protection Notice](#)







Printed by ktsang on 6/16/10

Active Cases as of 5/14/2015

| <u>CASE NAME</u>                                   | <u>STATUS</u> | <u>APPLIED DATE</u> | <u>APPROVAL DATE</u> | <u>EXPIRED DATE</u> |
|----------------------------------------------------|---------------|---------------------|----------------------|---------------------|
| <u>CASE DESCRIPTION</u>                            |               |                     |                      |                     |
| CUP03114R2                                         | DRT           | 20061016            | 0                    | 20000000            |
| RENEW EXPIRED RVP00134 - WOOD RECYCLING PLANT      |               |                     |                      |                     |
| CUP03651                                           | PC            | 20100630            | 0                    | 20000000            |
| METAL COLLECTION RECYCLING & PROCESSING FACILITY W |               |                     |                      |                     |
| CUP03651                                           | PC            | 20100630            | 0                    | 20000000            |
| CONDITIONAL USE PERMIT NO. 3651 proposes a metal c |               |                     |                      |                     |
| PP10295R1                                          | DRT           | 20040428            | 0                    | 20000000            |
| TO ESTABLISH A LANDSCAPERS CONTRACTOR'S YARD ON 2. |               |                     |                      |                     |
| PP20247                                            | DRT           | 20050209            | 0                    | 20000000            |
| SELF-STORAGE (MINI-WAREHOUSE) & RV PARKING FACILIT |               |                     |                      |                     |
| PP24245                                            | DRT           | 20090917            | 0                    | 20000000            |
| CONTRACTORS STORAGE YARD                           |               |                     |                      |                     |
| PP25342                                            | DRT           | 20130408            | 0                    | 20000000            |
| CONTRACTORS STORAGE YARD                           |               |                     |                      |                     |

PC 4

504 sf / 4.29 AC



Approved Cases as of 05/14/2015

| CASE NAME                                          | STATUS   | APPLIED DATE | APPROVAL DATE | EXPIRED DATE |
|----------------------------------------------------|----------|--------------|---------------|--------------|
| CASE DESCRIPTION                                   |          |              |               |              |
| CUP02662                                           | EXPIRED  | 12/22/2000   | 19840206      | 12/01/2004   |
| EXPANSION OF MINI STORAGE                          |          |              |               |              |
| CUP02685                                           | EXPIRED  | 12/22/2000   | 19840514      | 05/14/2004   |
| 48 SPACE RV PARK                                   |          |              |               |              |
| CUP02704                                           | EXPIRED  | 11/27/2000   | 19840807      | 06/25/2000   |
| MANUFACTURE BRICK AND OTHER RELATED MATERIALS      |          |              |               |              |
| CUP02973                                           | APPROVED | 03/07/1988   | 19920519      | 05/19/1994   |
| MOBILEHOME PARK ANNEXED TO CITY OF LAKE ELSINORE   |          |              |               |              |
| CUP03503                                           | APPROVED | 03/28/2006   | 20060627      | NA           |
| CONSTRUCT 45460 SQ FT FITNESS FACILITY             |          |              |               |              |
| PM24008                                            | APPROVED | 09/22/1988   | 19900123      | 01/23/2000   |
| DIVIDE 6.11 ACRES INTO 10 INDUSTRIAL PARCELS       |          |              |               |              |
| PM26736                                            | APPROVED | 01/15/1991   | 19920114      | 01/14/2000   |
| INDUSTRIAL PARCEL MAP/SUBDIVIDE 32.29 AC INTO 28 L |          |              |               |              |
| PM32964                                            | APPROVED | 05/03/2005   | 20060612      | 06/12/2010   |
| SCHED H DIVISION OF 20.3 AC. INTO 2 10-AC. PARCELS |          |              |               |              |
| PM33840                                            | APPROVED | 03/09/2009   | 20100322      | 03/22/2015   |
| DIVIDE 4.59 AC INTO FOUR RESIDENTIAL LOTS          |          |              |               |              |
| PM34997                                            | APPROVED | 10/17/2007   | 20090223      | 02/23/2012   |
| SCHED H DIVISION OF 5.234 AC INTO 2 RES. PARCELS.  |          |              |               |              |
| PP14691                                            | APPROVED | 06/27/1996   | 19961118      | 11/18/1998   |
| CONSTRUCT A BURGER KING RESTAURANT                 |          |              |               |              |
| PP17125                                            | APPROVED | 05/15/2001   | 20011029      | NA           |
| WOOD PRODUCTS WAREHOUSE AND BAGGING FACILITY,      |          |              |               |              |
| PP18806                                            | APPROVED | 08/05/2003   | 20081215      | 12/15/2010   |
| INDUSTRIAL/MANUFAC BUILD C-6400SF BUILD D-6579SF   |          |              |               |              |
| PP19624                                            | APPROVED | 07/22/2004   | 20050701      | NA           |
| 40' MONOPALM W/UMANNED EQUIPT SHELTER (NEXTEL)     |          |              |               |              |
| PP20158                                            | APPROVED | 01/12/2005   | 20081209      | 12/09/2013   |
| PLOT PLAN FOR MINI STORAGE FACILITY W/RESIDENCE    |          |              |               |              |
| PP20158R1                                          | APPROVED | 10/22/2013   | 20150209      | NA           |
| ADD APPROX 2000 SQ. FT TO TOTAL BUILDING AREA, MOD |          |              |               |              |
| PP24807                                            | APPROVED | 12/16/2010   | 20120206      | 02/06/2014   |
| 70' MONOPINE/12 ANTS/6 TMA/2 GPS/1 MICRO/6 RADIO C |          |              |               |              |
| PUP00780                                           | APPROVED | 06/20/1996   | 19961029      | 10/29/1998   |
| 75' WIRELESS COMMUNICATION FACILITY (UNMANNED). IN |          |              |               |              |
| PUP00787                                           | APPROVED | 10/23/1997   | 19980609      | NA           |
| 85' LATTICE TOWER FOR COLOCATION OF WIRELESS TELEC |          |              |               |              |
| PUP0295                                            | APPROVED | 08/07/2000   | 0             | NA           |
| RVP00068                                           | APPROVED | 07/24/1991   | 19920107      | 01/06/1994   |
| RVP TO SMP 173 - REVISE SMP TO EXTEND FOR 4 YEARS  |          |              |               |              |
| RVP00116                                           | APPROVED | 07/09/1993   | 19940215      | 02/15/1996   |
| RVP TO SMP 173 - EXTEND FOR 4 YEARS                |          |              |               |              |

Approved Cases as of 05/14/2015

| <u>CASE NAME</u>                                   | <u>STATUS</u> | <u>APPLIED DATE</u> | <u>APPROVAL DATE</u> | <u>EXPIRED DATE</u> |
|----------------------------------------------------|---------------|---------------------|----------------------|---------------------|
| <u>CASE DESCRIPTION</u>                            |               |                     |                      |                     |
| RVP00134                                           | APPROVED      | 03/30/1994          | 19950307             | 03/07/2001          |
| RVP TO CUP 3114 - PERMIT WOOD RECYCLING & PROCESS  |               |                     |                      |                     |
| TR27839                                            | APPROVED      | 04/14/1997          | 19981201             | 12/01/2005          |
| SUBDIVIDE 4.9 ACRES INTO SEVEN (7) RESIDENTIAL LTS |               |                     |                      |                     |

**APPENDIX 4.2:**

**POST PROCESSING WORKSHEETS**

This Page Intentionally Left Blank

# INPUT DATA

Project: =====> Nichols Mine Expansion <=== Job #: 09599  
Scenario: =====> GP Buildout Post 2035 With Project <=== Analyst: CHS  
Existing Conditions Model Run ID: ==> RivTAM for MV-Existing Base Model <=== Date: 6/1/2015  
Future Conditions Model Run ID: ==> RivTAM-Lake Elsinore GP <===

| LOCATION:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  | I-15 Southbound Ramps / Nichols Road                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| AM PEAK HOUR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  | PM PEAK HOUR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |
| EXISTING TURNING MOVEMENT VOLUMES:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  | EXISTING TURNING MOVEMENT VOLUMES:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| <b>2015</b><br><div style="display: flex; justify-content: space-between;"> <span>68</span> <span>8</span> <span>165</span> </div> <div style="display: flex; justify-content: space-between;"> <span>&lt;</span> <span>v</span> <span>&gt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>0 ^</span> <span></span> <span>0</span> </div> <div style="display: flex; justify-content: space-between;"> <span>228 &gt;</span> <span>Total =</span> <span>949 &lt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>247 v</span> <span></span> <span>68</span> </div> <div style="display: flex; justify-content: space-between;"> <span>&lt;</span> <span>^</span> <span>&gt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>0</span> <span>0</span> <span>0</span> </div> |  | <b>2015</b><br><div style="display: flex; justify-content: space-between;"> <span>139</span> <span>3</span> <span>65</span> </div> <div style="display: flex; justify-content: space-between;"> <span>&lt;</span> <span>v</span> <span>&gt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>0 ^</span> <span></span> <span>0</span> </div> <div style="display: flex; justify-content: space-between;"> <span>213 &gt;</span> <span>Total =</span> <span>1,042 &lt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>249 v</span> <span></span> <span>16</span> </div> <div style="display: flex; justify-content: space-between;"> <span>&lt;</span> <span>^</span> <span>&gt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>0</span> <span>0</span> <span>0</span> </div> |  |
| EXISTING MODEL YEAR:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  | EXISTING MODEL YEAR:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| <b>2008</b><br><div style="display: flex; justify-content: space-between;"> <span>124</span> <span>0</span> </div> <div style="display: flex; justify-content: space-between;"> <span>v</span> <span>^</span> </div> <div style="display: flex; justify-content: space-between;"> <span>185 &lt;</span> <span>IN =</span> <span>681 &lt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>441 &gt;</span> <span>OUT =</span> <span>681 &gt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>v</span> <span>^</span> </div> <div style="display: flex; justify-content: space-between;"> <span>135</span> <span>0</span> </div>                                                                                                                                                                               |  | <b>2008</b><br><div style="display: flex; justify-content: space-between;"> <span>241</span> <span>0</span> </div> <div style="display: flex; justify-content: space-between;"> <span>v</span> <span>^</span> </div> <div style="display: flex; justify-content: space-between;"> <span>673 &lt;</span> <span>IN =</span> <span>1228 &lt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>377 &gt;</span> <span>OUT =</span> <span>1228 &gt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>v</span> <span>^</span> </div> <div style="display: flex; justify-content: space-between;"> <span>235</span> <span>0</span> </div>                                                                                                                                                                               |  |
| FUTURE MODEL YEAR:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  | FUTURE MODEL YEAR:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| <b>2035</b><br><div style="display: flex; justify-content: space-between;"> <span>543</span> <span>0</span> </div> <div style="display: flex; justify-content: space-between;"> <span>v</span> <span>^</span> </div> <div style="display: flex; justify-content: space-between;"> <span>1426 &lt;</span> <span>IN =</span> <span>3814 &lt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>1932 &gt;</span> <span>OUT =</span> <span>3814 &gt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>v</span> <span>^</span> </div> <div style="display: flex; justify-content: space-between;"> <span>578</span> <span>0</span> </div>                                                                                                                                                                           |  | <b>2035</b><br><div style="display: flex; justify-content: space-between;"> <span>567</span> <span>0</span> </div> <div style="display: flex; justify-content: space-between;"> <span>v</span> <span>^</span> </div> <div style="display: flex; justify-content: space-between;"> <span>2223 &lt;</span> <span>IN =</span> <span>5166 &lt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>2417 &gt;</span> <span>OUT =</span> <span>5166 &gt;</span> </div> <div style="display: flex; justify-content: space-between;"> <span>v</span> <span>^</span> </div> <div style="display: flex; justify-content: space-between;"> <span>657</span> <span>0</span> </div>                                                                                                                                                                             |  |
| EXISTING (COUNTED) ADTs BY LEG:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  | EXISTING (COUNTED) ADTs BY LEG:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |
| <b>2015</b><br><div style="display: flex; justify-content: space-between;"> <span>2,698</span> </div> <div style="display: flex; justify-content: space-between;"> <span>N</span> </div> <div style="display: flex; justify-content: space-between;"> <span>12,519 W</span> <span>LEG</span> <span>E</span> <span>8,499</span> </div> <div style="display: flex; justify-content: space-between;"> <span>S</span> </div> <div style="display: flex; justify-content: space-between;"> <span>3,496</span> </div>                                                                                                                                                                                                                                                                                                                                                               |  | <b>2015</b><br><div style="display: flex; justify-content: space-between;"> <span>2,698</span> </div> <div style="display: flex; justify-content: space-between;"> <span>N</span> </div> <div style="display: flex; justify-content: space-between;"> <span>12,519 W</span> <span>+</span> <span>E</span> <span>8,499</span> </div> <div style="display: flex; justify-content: space-between;"> <span>S</span> </div> <div style="display: flex; justify-content: space-between;"> <span>3,496</span> </div>                                                                                                                                                                                                                                                                                                                                                                   |  |
| REFINED FUTURE ADT'S BY LEG:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  | REFINED FUTURE ADT'S BY LEG:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |
| <b>2035</b><br><div style="display: flex; justify-content: space-between;"> <span>9,000</span> </div> <div style="display: flex; justify-content: space-between;"> <span>N</span> </div> <div style="display: flex; justify-content: space-between;"> <span>49,000 W</span> <span>LEG</span> <span>E</span> <span>50,000</span> </div> <div style="display: flex; justify-content: space-between;"> <span>S</span> </div> <div style="display: flex; justify-content: space-between;"> <span>9,000</span> </div>                                                                                                                                                                                                                                                                                                                                                              |  | <b>2035</b><br><div style="display: flex; justify-content: space-between;"> <span>9,000</span> </div> <div style="display: flex; justify-content: space-between;"> <span>N</span> </div> <div style="display: flex; justify-content: space-between;"> <span>49,000 W</span> <span>+</span> <span>E</span> <span>50,000</span> </div> <div style="display: flex; justify-content: space-between;"> <span>S</span> </div> <div style="display: flex; justify-content: space-between;"> <span>9,000</span> </div>                                                                                                                                                                                                                                                                                                                                                                  |  |

U:\Ucjobs\\_09100-09500\\_09500\09599\Post-Processing\[01 I-15 SB\_Nichols.xls]Input (1)

# Growth Calculations

Project: Nichols Mine Expansion  
Scenario: GP Buildout Post 2035 With Project

Job #: 09599  
Analyst: CHS  
Date: 6/1/2015

LOCATION: I-15 Southbound Ramps / Nichols Road

| EXISTING COUNTED INBOUND AND OUTBOUND VOLUME CALCULATION |  |  |  |  |                                            |  |  |  |  |
|----------------------------------------------------------|--|--|--|--|--------------------------------------------|--|--|--|--|
| AM                                                       |  |  |  |  | PM                                         |  |  |  |  |
| EXISTING COUNT YEAR:                                     |  |  |  |  | EXISTING COUNT YEAR:                       |  |  |  |  |
| 2015                                                     |  |  |  |  | 2015                                       |  |  |  |  |
| 241 0                                                    |  |  |  |  | 207 0                                      |  |  |  |  |
| v ^                                                      |  |  |  |  | v ^                                        |  |  |  |  |
| 233 < IN = 949 < 233                                     |  |  |  |  | 496 < IN = 1042 < 373                      |  |  |  |  |
| 475 > OUT = 949 > 393                                    |  |  |  |  | 462 > OUT = 1042 > 278                     |  |  |  |  |
| v ^                                                      |  |  |  |  | v ^                                        |  |  |  |  |
| 323 0                                                    |  |  |  |  | 268 0                                      |  |  |  |  |
| GROWTH CALCULATION DECISION RULE                         |  |  |  |  | GROWTH CALCULATION DECISION RULE           |  |  |  |  |
| MIN = Minimum Count Growth Approach                      |  |  |  |  | MIN = Minimum Count Growth Approach        |  |  |  |  |
| ADD = Additive (Growth Increment) Approach               |  |  |  |  | ADD = Additive (Growth Increment) Approach |  |  |  |  |
| MUL = Multiplicative (Ratio) Approach                    |  |  |  |  | MUL = Multiplicative (Ratio) Approach      |  |  |  |  |
| ADD < ADD                                                |  |  |  |  | MUL < MUL                                  |  |  |  |  |
| ADD > ADD                                                |  |  |  |  | ADD > MUL                                  |  |  |  |  |
| v ^                                                      |  |  |  |  | v ^                                        |  |  |  |  |
| ADD MUL                                                  |  |  |  |  | ADD MUL                                    |  |  |  |  |
| MINIMUM GROWTH %s 2008 TO 2035                           |  |  |  |  | MINIMUM GROWTH %s 2008 TO 2035             |  |  |  |  |
| 0% 0%                                                    |  |  |  |  | 0% 0%                                      |  |  |  |  |
| v ^                                                      |  |  |  |  | v ^                                        |  |  |  |  |
| 0% < 0%                                                  |  |  |  |  | 0% < 0%                                    |  |  |  |  |
| 0% > 0%                                                  |  |  |  |  | 0% > 0%                                    |  |  |  |  |
| v ^                                                      |  |  |  |  | v ^                                        |  |  |  |  |
| 0% 0%                                                    |  |  |  |  | 0% 0%                                      |  |  |  |  |
| REFINED GROWTH: 2008 TO 2035                             |  |  |  |  | ADJUSTED GROWTH: 2008 TO 2035              |  |  |  |  |
| 420 0                                                    |  |  |  |  | 283 0                                      |  |  |  |  |
| v ^                                                      |  |  |  |  | v ^                                        |  |  |  |  |
| 1240 < 1220                                              |  |  |  |  | 1144 < 957                                 |  |  |  |  |
| 1490 > 1450                                              |  |  |  |  | 2040 > 1712                                |  |  |  |  |
| v ^                                                      |  |  |  |  | v ^                                        |  |  |  |  |
| 440 0                                                    |  |  |  |  | 420 0                                      |  |  |  |  |
| PRORATED GROWTH: 2015 TO 2035                            |  |  |  |  | PRORATED GROWTH: 2015 TO 2035              |  |  |  |  |
| 20 YEARS                                                 |  |  |  |  | 20 YEARS                                   |  |  |  |  |
| 310 0                                                    |  |  |  |  | 210 0                                      |  |  |  |  |
| v ^                                                      |  |  |  |  | v ^                                        |  |  |  |  |
| 920 < 900                                                |  |  |  |  | 850 < 710                                  |  |  |  |  |
| 1100 > 1070                                              |  |  |  |  | 1510 > 1270                                |  |  |  |  |
| v ^                                                      |  |  |  |  | v ^                                        |  |  |  |  |
| 330 0                                                    |  |  |  |  | 310 0                                      |  |  |  |  |
| NEW PROJECTED VOLUMES: 2035                              |  |  |  |  | NEW PROJECTED VOLUMES: 2035                |  |  |  |  |
| 550 0                                                    |  |  |  |  | 420 0                                      |  |  |  |  |
| v ^                                                      |  |  |  |  | v ^                                        |  |  |  |  |
| 1150 < IN = 3260 < 1130                                  |  |  |  |  | 1350 < IN = 3470 < 1080                    |  |  |  |  |
| 1580 > OUT = 3260 > 1460                                 |  |  |  |  | 1970 > OUT = 3480 > 1550                   |  |  |  |  |
| v ^ *                                                    |  |  |  |  | v ^ *                                      |  |  |  |  |
| 650 0                                                    |  |  |  |  | 580 0                                      |  |  |  |  |

\* NOTE: Outbound future volume may be factored (increased) to match inbound if inbound is greater than outbound.

U:\UcJobs\09100-09500\09500\09599\Post-Processing\01 I-15 SB\_Nichols.xls Growth Summary (2)



Project: Nichols Mine Expansion  
Scenario: GP Buildout Post 2035 With Project

Job #: 09599  
Analyst: CHS  
Date: 6/1/2015

LOCATION: I-15 Southbound Ramps / Nichols Road  
FORECAST YEAR: 2035

| INDIVIDUAL TURN VOLUME GROWTH REVIEW |                  |                         |               |             |          |                         |               |             |          |
|--------------------------------------|------------------|-------------------------|---------------|-------------|----------|-------------------------|---------------|-------------|----------|
| APPROACH                             | TURNING MOVEMENT | AM PEAK HOUR INPUT DATA |               |             |          | PM PEAK HOUR INPUT DATA |               |             |          |
|                                      |                  | EXISTING COUNT          | FUTURE VOLUME | DIFF-ERENCE | % CHANGE | EXISTING COUNT          | FUTURE VOLUME | DIFF-ERENCE | % CHANGE |
| NORTH BOUND                          | Left             | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
|                                      | Through          | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
|                                      | Right            | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
|                                      | NB Total         | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
| SOUTH BOUND                          | Left             | 165                     | 374           | 209         | 127%     | 65                      | 150           | 85          | 131%     |
|                                      | Through          | 8                       | 8             | 0           | 0%       | 3                       | 2             | -1          | -33%     |
|                                      | Right            | 68                      | 169           | 101         | 149%     | 139                     | 271           | 132         | 95%      |
|                                      | SB Total         | 241                     | 551           | 310         | 129%     | 207                     | 423           | 216         | 104%     |
| EAST BOUND                           | Left             | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
|                                      | Through          | 228                     | 1,086         | 858         | 376%     | 213                     | 1,400         | 1,187       | 557%     |
|                                      | Right            | 247                     | 489           | 242         | 98%      | 249                     | 558           | 309         | 124%     |
|                                      | EB Total         | 475                     | 1,575         | 1,100       | 232%     | 462                     | 1,958         | 1,496       | 324%     |
| WEST BOUND                           | Left             | 68                      | 153           | 85          | 125%     | 16                      | 19            | 3           | 19%      |
|                                      | Through          | 165                     | 981           | 816         | 495%     | 357                     | 1,079         | 722         | 202%     |
|                                      | Right            | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
|                                      | WB Total         | 233                     | 1,134         | 901         | 387%     | 373                     | 1,098         | 725         | 194%     |
| TOTAL ENTERING VOLUME                |                  | 949                     | 3,260         | 2311        | 244%     | 1,042                   | 3,479         | 2437        | 234%     |

| FORECAST PEAK HOUR TO ADT COMPARISON |              |              |              |                |
|--------------------------------------|--------------|--------------|--------------|----------------|
|                                      |              | VOLUMES      |              | ADT            |
|                                      |              | AM           | PM           |                |
| North Leg                            | Inbound      | 551          | 423          |                |
| North Leg                            | Outbound     | 0            | 0            |                |
| <b>North Leg</b>                     | <b>TOTAL</b> | <b>551</b>   | <b>423</b>   | <b>9,000</b>   |
|                                      |              |              |              |                |
| South Leg                            | Inbound      | 0            | 0            |                |
| South Leg                            | Outbound     | 650          | 579          |                |
| <b>South Leg</b>                     | <b>TOTAL</b> | <b>650</b>   | <b>579</b>   | <b>9,000</b>   |
|                                      |              |              |              |                |
| East Leg                             | Inbound      | 1,134        | 1,098        |                |
| East Leg                             | Outbound     | 1,460        | 1,550        |                |
| <b>East Leg</b>                      | <b>TOTAL</b> | <b>2,594</b> | <b>2,648</b> | <b>50,000</b>  |
|                                      |              |              |              |                |
| West Leg                             | Inbound      | 1,575        | 1,958        |                |
| West Leg                             | Outbound     | 1,150        | 1,350        |                |
| <b>West Leg</b>                      | <b>TOTAL</b> | <b>2,725</b> | <b>3,308</b> | <b>49,000</b>  |
|                                      |              |              |              |                |
| <b>OVERALL TOTAL</b>                 |              | <b>6,520</b> | <b>6,958</b> | <b>117,000</b> |

U:\UcJobs\\_09100-09500\\_09500\09599\Post-Processing\[01 I-15 SB\_Nichols.xls]Output (3)

# INPUT DATA

Project: =====> Nichols Mine Expansion <=== Job #: 09599  
 Scenario: =====> GP Buildout Post 2035 With Project <=== Analyst: CHS  
 Existing Conditions Model Run ID: ==> RivTAM for MV-Existing Base Model <=== Date: 6/1/2015  
 Future Conditions Model Run ID: ==> RivTAM-Lake Elsinore GP <===

| LOCATION:                                                                                                                                                                                                                                                                                                                                     |  | I-15 Northbound Ramps / Nichols Road                                                                                                                                                                                                                                                                                                          |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| AM PEAK HOUR                                                                                                                                                                                                                                                                                                                                  |  | PM PEAK HOUR                                                                                                                                                                                                                                                                                                                                  |  |
| EXISTING TURNING MOVEMENT VOLUMES:                                                                                                                                                                                                                                                                                                            |  | EXISTING TURNING MOVEMENT VOLUMES:                                                                                                                                                                                                                                                                                                            |  |
| <b>2015</b><br><div style="text-align: center;">           0    0    0<br/>           &lt;    v    &gt;<br/>           65 ^                      ^ 92<br/>           328 &gt;            Total =    846 &lt;    138<br/>           0 v                      v 0<br/>           &lt;    ^    &gt;<br/>           95    1    127         </div> |  | <b>2015</b><br><div style="text-align: center;">           0    0    0<br/>           &lt;    v    &gt;<br/>           135 ^                      ^ 28<br/>           142 &gt;            Total =    713 &lt;    84<br/>           0 v                      v 0<br/>           &lt;    ^    &gt;<br/>           288    3    33         </div> |  |
| EXISTING MODEL YEAR:                                                                                                                                                                                                                                                                                                                          |  | EXISTING MODEL YEAR:                                                                                                                                                                                                                                                                                                                          |  |
| <b>2008</b><br><div style="text-align: center;">           0    281<br/>           v    ^<br/>           116 &lt;    IN =    926 &lt;    116<br/>           361 &gt;    OUT =    925 &gt;    528<br/>           v    ^<br/>           0    449         </div>                                                                                 |  | <b>2008</b><br><div style="text-align: center;">           0    162<br/>           v    ^<br/>           610 &lt;    IN =    1186 &lt;    425<br/>           320 &gt;    OUT =    913 &gt;    141<br/>           v    ^<br/>           0    441         </div>                                                                                |  |
| FUTURE MODEL YEAR:                                                                                                                                                                                                                                                                                                                            |  | FUTURE MODEL YEAR:                                                                                                                                                                                                                                                                                                                            |  |
| <b>2035</b><br><div style="text-align: center;">           0    883<br/>           v    ^<br/>           1339 &lt;    IN =    4069 &lt;    1762<br/>           1810 &gt;    OUT =    4069 &gt;    1847<br/>           v    ^<br/>           0    497         </div>                                                                           |  | <b>2035</b><br><div style="text-align: center;">           0    1131<br/>           v    ^<br/>           2182 &lt;    IN =    5565 &lt;    2741<br/>           2286 &gt;    OUT =    5565 &gt;    2252<br/>           v    ^<br/>           0    538         </div>                                                                          |  |
| EXISTING (COUNTED) ADTs BY LEG:                                                                                                                                                                                                                                                                                                               |  | EXISTING (COUNTED) ADTs BY LEG:                                                                                                                                                                                                                                                                                                               |  |
| <b>2015</b><br><div style="text-align: center;">           2,174<br/>           N<br/>           8,499    W    LEG    E    3,719<br/>           S<br/>           4,236         </div>                                                                                                                                                         |  | <b>2015</b><br><div style="text-align: center;">           2,174<br/>           N<br/>           8,499    W    +    E    3,719<br/>           S<br/>           4,236         </div>                                                                                                                                                           |  |
| REFINED FUTURE ADT'S BY LEG:                                                                                                                                                                                                                                                                                                                  |  | REFINED FUTURE ADT'S BY LEG:                                                                                                                                                                                                                                                                                                                  |  |
| <b>2035</b><br><div style="text-align: center;">           15,000<br/>           N<br/>           50,000    W    LEG    E    59,000<br/>           S<br/>           8,000         </div>                                                                                                                                                      |  | <b>2035</b><br><div style="text-align: center;">           15,000<br/>           N<br/>           50,000    W    +    E    59,000<br/>           S<br/>           8,000         </div>                                                                                                                                                        |  |

U:\Ucjobs\\_09100-09500\\_09500\09599\Post-Processing\[02 I-15 NB\_Nichols.xls]Input (1)

Growth Calculations

Project: Nichols Mine Expansion  
Scenario: GP Buildout Post 2035 With Project

Job #: 09599  
Analyst: CHS  
Date: 6/1/2015

LOCATION: I-15 Northbound Ramps / Nichols Road

| EXISTING COUNTED INBOUND AND OUTBOUND VOLUME CALCULATION |       |        |      |        |                                            |       |        |      |        |
|----------------------------------------------------------|-------|--------|------|--------|--------------------------------------------|-------|--------|------|--------|
| AM                                                       |       |        |      |        | PM                                         |       |        |      |        |
| EXISTING COUNT YEAR:<br>2015                             |       |        |      |        | EXISTING COUNT YEAR:<br>2015               |       |        |      |        |
|                                                          |       | 0      | 158  |        |                                            |       | 0      | 166  |        |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
| 233 <                                                    | IN =  | 846 <  | 230  |        | 372 <                                      | IN =  | 713 <  | 112  |        |
| 393 >                                                    | OUT = | 846 >  | 455  |        | 277 >                                      | OUT = | 713 >  | 175  |        |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
|                                                          |       | 0      | 223  |        |                                            |       | 0      | 324  |        |
| GROWTH CALCULATION DECISION RULE                         |       |        |      |        | GROWTH CALCULATION DECISION RULE           |       |        |      |        |
| MIN = Minimum Count Growth Approach                      |       |        |      |        | MIN = Minimum Count Growth Approach        |       |        |      |        |
| ADD = Additive (Growth Increment) Approach               |       |        |      |        | ADD = Additive (Growth Increment) Approach |       |        |      |        |
| MUL = Multiplicative (Ratio) Approach                    |       |        |      |        | MUL = Multiplicative (Ratio) Approach      |       |        |      |        |
|                                                          |       | MUL    | MUL  |        |                                            |       | MUL    | ADD  |        |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
| ADD <                                                    |       |        |      | < ADD  |                                            |       |        |      | < MUL  |
| ADD >                                                    |       |        |      | > MUL  |                                            |       |        |      | > ADD  |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
|                                                          |       | MUL    | MUL  |        |                                            |       | MUL    | MUL  |        |
| MINIMUM GROWTH %s 2008 TO 2035                           |       |        |      |        | MINIMUM GROWTH %s 2008 TO 2035             |       |        |      |        |
|                                                          |       | 0%     | 0%   |        |                                            |       | 0%     | 0%   |        |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
| 0% <                                                     |       |        |      | < 0%   | 0% <                                       |       |        |      | < 0%   |
| 0% >                                                     |       |        |      | > 0%   | 0% >                                       |       |        |      | > 0%   |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
|                                                          |       | 0%     | 0%   |        |                                            |       | 0%     | 0%   |        |
| REFINED GROWTH: 2008 TO 2035                             |       |        |      |        | ADJUSTED GROWTH: 2008 TO 2035              |       |        |      |        |
|                                                          |       | 0      | 342  |        |                                            |       | 0      | 970  |        |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
| 1220 <                                                   |       |        |      | < 1650 | 958 <                                      |       |        |      | < 608  |
| 1450 >                                                   |       |        |      | > 1135 | 1703 >                                     |       |        |      | > 2110 |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
|                                                          |       | 0      | 27   |        |                                            |       | 0      | 76   |        |
| PRORATED GROWTH: 2015 TO 2035                            |       |        |      |        | PRORATED GROWTH: 2015 TO 2035              |       |        |      |        |
| 20 YEARS                                                 |       | 0      | 250  |        | 20 YEARS                                   |       | 0      | 720  |        |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
| 900 <                                                    |       |        |      | < 1220 | 710 <                                      |       |        |      | < 450  |
| 1070 >                                                   |       |        |      | > 840  | 1260 >                                     |       |        |      | > 1560 |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
|                                                          |       | 0      | 20   |        |                                            |       | 0      | 60   |        |
| NEW PROJECTED VOLUMES: 2035                              |       |        |      |        | NEW PROJECTED VOLUMES: 2035                |       |        |      |        |
|                                                          |       | 0      | 455  |        |                                            |       | 0      | 890  |        |
|                                                          |       | v      | ^    |        |                                            |       | v      | ^    |        |
| 1253 <                                                   | IN =  | 3150 < | 1450 |        | 1080 <                                     | IN =  | 2480 < | 560  |        |
| 1460 >                                                   | OUT = | 3150 > | 1442 |        | 1540 >                                     | OUT = | 3710 > | 1740 |        |
|                                                          |       | v      | ^ *  |        |                                            |       | v      | ^ *  |        |
|                                                          |       | 0      | 240  |        |                                            |       | 0      | 380  |        |

\* NOTE: Outbound future volume may be factored (increased) to match inbound if inbound is greater than outbound.

U:\UcJobs\09100-09500\09500\09599\Post-Processing\02 I-15 NB\_Nichols.xls] Growth Summary (2)

Project: Nichols Mine Expansion  
Scenario: GP Buildout Post 2035 With Project

Job #: 09599  
Analyst: CHS  
Date: 6/1/2015

LOCATION: I-15 Northbound Ramps / Nichols Road  
FORECAST YEAR: 2035

| INDIVIDUAL TURN VOLUME GROWTH REVIEW |                  |                         |               |             |          |                         |               |             |          |
|--------------------------------------|------------------|-------------------------|---------------|-------------|----------|-------------------------|---------------|-------------|----------|
| APPROACH                             | TURNING MOVEMENT | AM PEAK HOUR INPUT DATA |               |             |          | PM PEAK HOUR INPUT DATA |               |             |          |
|                                      |                  | EXISTING COUNT          | FUTURE VOLUME | DIFF-ERENCE | % CHANGE | EXISTING COUNT          | FUTURE VOLUME | DIFF-ERENCE | % CHANGE |
| NORTH BOUND                          | Left             | 95                      | 117           | 22          | 23%      | 288                     | 449           | 161         | 56%      |
|                                      | Through          | 1                       | 1             | 0           | 0%       | 3                       | 4             | 1           | 33%      |
|                                      | Right            | 127                     | 123           | -4          | -3%      | 33                      | 109           | 76          | 230%     |
|                                      | NB Total         | 223                     | 241           | 18          | 8%       | 324                     | 562           | 238         | 73%      |
| SOUTH BOUND                          | Left             | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
|                                      | Through          | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
|                                      | Right            | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
|                                      | SB Total         | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
| EAST BOUND                           | Left             | 65                      | 138           | 73          | 112%     | 135                     | 688           | 553         | 410%     |
|                                      | Through          | 328                     | 1,319         | 991         | 302%     | 142                     | 1,631         | 1,489       | 1049%    |
|                                      | Right            | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
|                                      | EB Total         | 393                     | 1,457         | 1,064       | 271%     | 277                     | 2,319         | 2,042       | 737%     |
| WEST BOUND                           | Left             | 0                       | 0             | 0           | #DIV/0!  | 0                       | 0             | 0           | #DIV/0!  |
|                                      | Through          | 138                     | 1,137         | 999         | 724%     | 84                      | 631           | 547         | 651%     |
|                                      | Right            | 92                      | 316           | 224         | 243%     | 28                      | 198           | 170         | 607%     |
|                                      | WB Total         | 230                     | 1,453         | 1,223       | 532%     | 112                     | 829           | 717         | 640%     |
| TOTAL ENTERING VOLUME                |                  | 846                     | 3,151         | 2305        | 272%     | 713                     | 3,710         | 2997        | 420%     |

| FORECAST PEAK HOUR TO ADT COMPARISON |              |              |              |                |
|--------------------------------------|--------------|--------------|--------------|----------------|
|                                      |              | VOLUMES      |              | ADT            |
|                                      |              | AM           | PM           |                |
| North Leg                            | Inbound      | 0            | 0            |                |
| North Leg                            | Outbound     | 455          | 890          |                |
| <b>North Leg</b>                     | <b>TOTAL</b> | <b>455</b>   | <b>890</b>   | <b>15,000</b>  |
|                                      |              |              |              |                |
| South Leg                            | Inbound      | 241          | 562          |                |
| South Leg                            | Outbound     | 0            | 0            |                |
| <b>South Leg</b>                     | <b>TOTAL</b> | <b>241</b>   | <b>562</b>   | <b>8,000</b>   |
|                                      |              |              |              |                |
| East Leg                             | Inbound      | 1,453        | 829          |                |
| East Leg                             | Outbound     | 1,442        | 1,740        |                |
| <b>East Leg</b>                      | <b>TOTAL</b> | <b>2,895</b> | <b>2,569</b> | <b>59,000</b>  |
|                                      |              |              |              |                |
| West Leg                             | Inbound      | 1,457        | 2,319        |                |
| West Leg                             | Outbound     | 1,254        | 1,080        |                |
| <b>West Leg</b>                      | <b>TOTAL</b> | <b>2,711</b> | <b>3,399</b> | <b>50,000</b>  |
|                                      |              |              |              |                |
| <b>OVERALL TOTAL</b>                 |              | <b>6,302</b> | <b>7,420</b> | <b>132,000</b> |

U:\UcJobs\\_09100-09500\\_09500\09599\Post-Processing\[02 I-15 NB\_Nichols.xls]Output (3)

## **APPENDIX 5.1:**

### **E+P CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| Intersection              |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Intersection Delay, s/veh | 12.2 |      |      |      |      |      |      |      |      |      |      |      |
| Intersection LOS          | B    |      |      |      |      |      |      |      |      |      |      |      |
| Movement                  | EBU  | EBL  | EBT  | EBR  | WBU  | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
| Vol, veh/h                | 0    | 0    | 232  | 247  | 0    | 82   | 169  | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor          | 0.92 | 0.89 | 0.89 | 0.89 | 0.92 | 0.89 | 0.89 | 0.89 | 0.92 | 0.89 | 0.89 | 0.89 |
| Heavy Vehicles, %         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                 | 0    | 0    | 261  | 278  | 0    | 92   | 190  | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes           | 0    | 0    | 1    | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |

| Approach                   |  |  | EB   | WB   |
|----------------------------|--|--|------|------|
| Opposing Approach          |  |  | WB   | EB   |
| Opposing Lanes             |  |  | 2    | 2    |
| Conflicting Approach Left  |  |  | SB   |      |
| Conflicting Lanes Left     |  |  | 1    | 0    |
| Conflicting Approach Right |  |  |      | SB   |
| Conflicting Lanes Right    |  |  | 0    | 1    |
| HCM Control Delay          |  |  | 11.9 | 11.3 |
| HCM LOS                    |  |  | B    | B    |

| Lane                   | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |
|------------------------|-------|-------|-------|-------|-------|
| Vol Left, %            | 0%    | 0%    | 100%  | 0%    | 70%   |
| Vol Thru, %            | 100%  | 0%    | 0%    | 100%  | 3%    |
| Vol Right, %           | 0%    | 100%  | 0%    | 0%    | 27%   |
| Sign Control           | Stop  | Stop  | Stop  | Stop  | Stop  |
| Traffic Vol by Lane    | 232   | 247   | 82    | 169   | 255   |
| LT Vol                 | 0     | 0     | 82    | 0     | 179   |
| Through Vol            | 232   | 0     | 0     | 169   | 8     |
| RT Vol                 | 0     | 247   | 0     | 0     | 68    |
| Lane Flow Rate         | 261   | 278   | 92    | 190   | 287   |
| Geometry Grp           | 7     | 7     | 7     | 7     | 2     |
| Degree of Util (X)     | 0.42  | 0.392 | 0.168 | 0.32  | 0.457 |
| Departure Headway (Hd) | 5.797 | 5.087 | 6.566 | 6.058 | 5.737 |
| Convergence, Y/N       | Yes   | Yes   | Yes   | Yes   | Yes   |
| Cap                    | 620   | 708   | 546   | 592   | 627   |
| Service Time           | 3.53  | 2.82  | 4.306 | 3.797 | 3.773 |
| HCM Lane V/C Ratio     | 0.421 | 0.393 | 0.168 | 0.321 | 0.458 |
| HCM Control Delay      | 12.7  | 11.1  | 10.6  | 11.6  | 13.5  |
| HCM Lane LOS           | B     | B     | B     | B     | B     |
| HCM 95th-tile Q        | 2.1   | 1.9   | 0.6   | 1.4   | 2.4   |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 179  | 8    | 68   |
| Peak Hour Factor  | 0.92 | 0.89 | 0.89 | 0.89 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 201  | 9    | 76   |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 13.5

HCM LOS B

Lane



| Intersection             |        |       |      |        |      |      |        |      |      |      |      |      |
|--------------------------|--------|-------|------|--------|------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 6      |       |      |        |      |      |        |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT   | EBR  | WBL    | WBT  | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Vol, veh/h               | 65     | 346   | 0    | 0      | 156  | 104  | 95     | 1    | 143  | 0    | 0    | 0    |
| Conflicting Peds, #/hr   | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free   | Free  | Free | Free   | Free | Free | Stop   | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -      | -     | None | -      | -    | None | -      | -    | None | -    | -    | None |
| Storage Length           | 230    | -     | -    | -      | -    | -    | -      | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 75     | 75    | 75   | 75     | 75   | 75   | 75     | 75   | 75   | 75   | 75   | 75   |
| Heavy Vehicles, %        | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 87     | 461   | 0    | 0      | 208  | 139  | 127    | 1    | 191  | 0    | 0    | 0    |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Major/Minor              | Major1 |       |      | Major2 |      |      | Minor1 |      |      |      |      |      |
| Conflicting Flow All     | 347    | 0     | 0    | 461    | 0    | 0    | 912    | 982  | 461  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 635    | 635  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 277    | 347  | -    |      |      |      |
| Critical Hdwy            | 4.1    | -     | -    | 4.1    | -    | -    | 5      | 5    | 5    |      |      |      |
| Critical Hdwy Stg 1      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Critical Hdwy Stg 2      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Follow-up Hdwy           | 2.2    | -     | -    | 2.2    | -    | -    | 3.5    | 4    | 3.3  |      |      |      |
| Pot Cap-1 Maneuver       | 1223   | -     | -    | 1111   | -    | -    | 437    | 378  | 705  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 532    | 476  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 774    | 638  | -    |      |      |      |
| Platoon blocked, %       |        | -     | -    |        | -    | -    |        |      |      |      |      |      |
| Mov Cap-1 Maneuver       | 1223   | -     | -    | 1111   | -    | -    | 406    | 0    | 705  |      |      |      |
| Mov Cap-2 Maneuver       | -      | -     | -    | -      | -    | -    | 406    | 0    | -    |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 494    | 0    | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 774    | 0    | -    |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Approach                 | EB     |       |      | WB     |      |      | NB     |      |      |      |      |      |
| HCM Control Delay, s     | 1.3    |       |      | 0      |      |      | 20.5   |      |      |      |      |      |
| HCM LOS                  |        |       |      |        |      |      | C      |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBLn1  | EBL   | EBT  | EBR    | WBL  | WBT  | WBR    |      |      |      |      |      |
| Capacity (veh/h)         | 545    | 1223  | -    | -      | 1111 | -    | -      |      |      |      |      |      |
| HCM Lane V/C Ratio       | 0.585  | 0.071 | -    | -      | -    | -    | -      |      |      |      |      |      |
| HCM Control Delay (s)    | 20.5   | 8.2   | -    | -      | 0    | -    | -      |      |      |      |      |      |
| HCM Lane LOS             | C      | A     | -    | -      | A    | -    | -      |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | 3.7    | 0.2   | -    | -      | 0    | -    | -      |      |      |      |      |      |

| Intersection             |        |      |        |      |        |       |
|--------------------------|--------|------|--------|------|--------|-------|
| Int Delay, s/veh         | 1      |      |        |      |        |       |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR   |
| Vol, veh/h               | 0      | 489  | 187    | 0    | 0      | 72    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0     |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop  |
| RT Channelized           | -      | None | -      | None | -      | Yield |
| Storage Length           | -      | -    | -      | -    | -      | 0     |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -     |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -     |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67    |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0     |
| Mvmt Flow                | 0      | 730  | 279    | 0    | 0      | 107   |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |       |
| Conflicting Flow All     | 279    | 0    | -      | 0    | 1009   | 279   |
| Stage 1                  | -      | -    | -      | -    | 279    | -     |
| Stage 2                  | -      | -    | -      | -    | 730    | -     |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2   |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -     |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -     |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3   |
| Pot Cap-1 Maneuver       | 1295   | -    | -      | -    | 269    | 765   |
| Stage 1                  | -      | -    | -      | -    | 773    | -     |
| Stage 2                  | -      | -    | -      | -    | 481    | -     |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -     |
| Mov Cap-1 Maneuver       | 1295   | -    | -      | -    | 269    | 765   |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 269    | -     |
| Stage 1                  | -      | -    | -      | -    | 773    | -     |
| Stage 2                  | -      | -    | -      | -    | 481    | -     |
| Approach                 | EB     |      | WB     |      | SB     |       |
| HCM Control Delay, s     | 0      |      | 0      |      | 10.5   |       |
| HCM LOS                  |        |      |        |      | B      |       |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |       |
| Capacity (veh/h)         | 1295   | -    | -      | -    | 765    |       |
| HCM Lane V/C Ratio       | -      | -    | -      | -    | 0.14   |       |
| HCM Control Delay (s)    | 0      | -    | -      | -    | 10.5   |       |
| HCM Lane LOS             | A      | -    | -      | -    | B      |       |
| HCM 95th %tile Q(veh)    | 0      | -    | -      | -    | 0.5    |       |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.9    |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 81     | 408  | 187    | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 121    | 609  | 279    | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 279    | 0    | -      | 0    | 1130   | 279  |
| Stage 1                  | -      | -    | -      | -    | 279    | -    |
| Stage 2                  | -      | -    | -      | -    | 851    | -    |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -    |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3  |
| Pot Cap-1 Maneuver       | 1295   | -    | -      | -    | 227    | 765  |
| Stage 1                  | -      | -    | -      | -    | 773    | -    |
| Stage 2                  | -      | -    | -      | -    | 422    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 1295   | -    | -      | -    | 206    | 765  |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 206    | -    |
| Stage 1                  | -      | -    | -      | -    | 773    | -    |
| Stage 2                  | -      | -    | -      | -    | 383    | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 1.3    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 1295   | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.093  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 8.1    | -    | -      | -    | 0      |      |
| HCM Lane LOS             | A      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0.3    | -    | -      | -    | -      |      |

| Intersection               |       |       |       |       |       |      |      |      |      |      |      |      |
|----------------------------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|
| Intersection Delay, s/veh  | 13.2  |       |       |       |       |      |      |      |      |      |      |      |
| Intersection LOS           | B     |       |       |       |       |      |      |      |      |      |      |      |
| Movement                   | EBU   | EBL   | EBT   | EBR   | WBU   | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
| Vol, veh/h                 | 0     | 0     | 216   | 249   | 0     | 29   | 360  | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor           | 0.92  | 0.95  | 0.95  | 0.95  | 0.92  | 0.95 | 0.95 | 0.95 | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, %          | 0     | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                  | 0     | 0     | 227   | 262   | 0     | 31   | 379  | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes            | 0     | 0     | 1     | 1     | 0     | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| Approach                   |       |       | EB    |       | WB    |      |      |      |      |      |      |      |
| Opposing Approach          |       |       | WB    |       | EB    |      |      |      |      |      |      |      |
| Opposing Lanes             |       |       | 2     |       | 2     |      |      |      |      |      |      |      |
| Conflicting Approach Left  |       |       | SB    |       |       |      |      |      |      |      |      |      |
| Conflicting Lanes Left     |       |       | 1     |       | 0     |      |      |      |      |      |      |      |
| Conflicting Approach Right |       |       |       |       | SB    |      |      |      |      |      |      |      |
| Conflicting Lanes Right    |       |       | 0     |       | 1     |      |      |      |      |      |      |      |
| HCM Control Delay          |       |       | 11.1  |       | 16.4  |      |      |      |      |      |      |      |
| HCM LOS                    |       |       | B     |       | C     |      |      |      |      |      |      |      |
| Lane                       | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |      |      |      |      |      |      |      |
| Vol Left, %                | 0%    | 0%    | 100%  | 0%    | 35%   |      |      |      |      |      |      |      |
| Vol Thru, %                | 100%  | 0%    | 0%    | 100%  | 1%    |      |      |      |      |      |      |      |
| Vol Right, %               | 0%    | 100%  | 0%    | 0%    | 64%   |      |      |      |      |      |      |      |
| Sign Control               | Stop  | Stop  | Stop  | Stop  | Stop  |      |      |      |      |      |      |      |
| Traffic Vol by Lane        | 216   | 249   | 29    | 360   | 217   |      |      |      |      |      |      |      |
| LT Vol                     | 0     | 0     | 29    | 0     | 75    |      |      |      |      |      |      |      |
| Through Vol                | 216   | 0     | 0     | 360   | 3     |      |      |      |      |      |      |      |
| RT Vol                     | 0     | 249   | 0     | 0     | 139   |      |      |      |      |      |      |      |
| Lane Flow Rate             | 227   | 262   | 31    | 379   | 228   |      |      |      |      |      |      |      |
| Geometry Grp               | 7     | 7     | 7     | 7     | 2     |      |      |      |      |      |      |      |
| Degree of Util (X)         | 0.361 | 0.364 | 0.053 | 0.607 | 0.358 |      |      |      |      |      |      |      |
| Departure Headway (Hd)     | 5.709 | 4.999 | 6.27  | 5.764 | 5.646 |      |      |      |      |      |      |      |
| Convergence, Y/N           | Yes   | Yes   | Yes   | Yes   | Yes   |      |      |      |      |      |      |      |
| Cap                        | 630   | 721   | 572   | 625   | 637   |      |      |      |      |      |      |      |
| Service Time               | 3.44  | 2.731 | 4.003 | 3.497 | 3.685 |      |      |      |      |      |      |      |
| HCM Lane V/C Ratio         | 0.36  | 0.363 | 0.054 | 0.606 | 0.358 |      |      |      |      |      |      |      |
| HCM Control Delay          | 11.6  | 10.6  | 9.4   | 17    | 11.8  |      |      |      |      |      |      |      |
| HCM Lane LOS               | B     | B     | A     | C     | B     |      |      |      |      |      |      |      |
| HCM 95th-tile Q            | 1.6   | 1.7   | 0.2   | 4.1   | 1.6   |      |      |      |      |      |      |      |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 75   | 3    | 139  |
| Peak Hour Factor  | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 79   | 3    | 146  |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 11.8

HCM LOS B

Lane

| Intersection             |        |       |      |        |      |      |        |      |      |      |      |      |
|--------------------------|--------|-------|------|--------|------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 11.6   |       |      |        |      |      |        |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT   | EBR  | WBL    | WBT  | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Vol, veh/h               | 135    | 156   | 0    | 0      | 100  | 39   | 288    | 3    | 45   | 0    | 0    | 0    |
| Conflicting Peds, #/hr   | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free   | Free  | Free | Free   | Free | Free | Stop   | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -      | -     | None | -      | -    | None | -      | -    | None | -    | -    | None |
| Storage Length           | 230    | -     | -    | -      | -    | -    | -      | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 90     | 90    | 90   | 90     | 90   | 90   | 90     | 90   | 90   | 90   | 90   | 90   |
| Heavy Vehicles, %        | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 150    | 173   | 0    | 0      | 111  | 43   | 320    | 3    | 50   | 0    | 0    | 0    |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Major/Minor              | Major1 |       |      | Major2 |      |      | Minor1 |      |      |      |      |      |
| Conflicting Flow All     | 154    | 0     | 0    | 173    | 0    | 0    | 606    | 627  | 173  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 473    | 473  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 133    | 154  | -    |      |      |      |
| Critical Hdwy            | 4.1    | -     | -    | 4.1    | -    | -    | 5      | 5    | 5    |      |      |      |
| Critical Hdwy Stg 1      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Critical Hdwy Stg 2      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Follow-up Hdwy           | 2.2    | -     | -    | 2.2    | -    | -    | 3.5    | 4    | 3.3  |      |      |      |
| Pot Cap-1 Maneuver       | 1439   | -     | -    | 1416   | -    | -    | 587    | 523  | 928  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 631    | 562  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 898    | 774  | -    |      |      |      |
| Platoon blocked, %       |        | -     | -    |        | -    | -    |        |      |      |      |      |      |
| Mov Cap-1 Maneuver       | 1439   | -     | -    | 1416   | -    | -    | 526    | 0    | 928  |      |      |      |
| Mov Cap-2 Maneuver       | -      | -     | -    | -      | -    | -    | 526    | 0    | -    |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 565    | 0    | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 898    | 0    | -    |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Approach                 | EB     |       |      | WB     |      |      | NB     |      |      |      |      |      |
| HCM Control Delay, s     | 3.6    |       |      | 0      |      |      | 23.4   |      |      |      |      |      |
| HCM LOS                  |        |       |      |        |      |      | C      |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBLn1  | EBL   | EBT  | EBR    | WBL  | WBT  | WBR    |      |      |      |      |      |
| Capacity (veh/h)         | 559    | 1439  | -    | -      | 1416 | -    | -      |      |      |      |      |      |
| HCM Lane V/C Ratio       | 0.668  | 0.104 | -    | -      | -    | -    | -      |      |      |      |      |      |
| HCM Control Delay (s)    | 23.4   | 7.8   | -    | -      | 0    | -    | -      |      |      |      |      |      |
| HCM Lane LOS             | C      | A     | -    | -      | A    | -    | -      |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | 5      | 0.3   | -    | -      | 0    | -    | -      |      |      |      |      |      |

Intersection

Int Delay, s/veh 0.8

| Movement                 | EBL  | EBT  | WBT  | WBR  | SBL  | SBR   |
|--------------------------|------|------|------|------|------|-------|
| Vol, veh/h               | 0    | 201  | 107  | 0    | 0    | 32    |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0     |
| Sign Control             | Free | Free | Free | Free | Stop | Stop  |
| RT Channelized           | -    | None | -    | None | -    | Yield |
| Storage Length           | -    | -    | -    | -    | -    | 0     |
| Veh in Median Storage, # | -    | 0    | 0    | -    | 0    | -     |
| Grade, %                 | -    | 0    | 0    | -    | 0    | -     |
| Peak Hour Factor         | 88   | 88   | 88   | 88   | 88   | 88    |
| Heavy Vehicles, %        | 0    | 0    | 0    | 0    | 0    | 0     |
| Mvmt Flow                | 0    | 228  | 122  | 0    | 0    | 36    |

| Major/Minor          | Major1 | Major2 | Minor2 |
|----------------------|--------|--------|--------|
| Conflicting Flow All | 122    | 0      | 350    |
| Stage 1              | -      | -      | 122    |
| Stage 2              | -      | -      | 228    |
| Critical Hdwy        | 4.1    | -      | 6.4    |
| Critical Hdwy Stg 1  | -      | -      | 5.4    |
| Critical Hdwy Stg 2  | -      | -      | 5.4    |
| Follow-up Hdwy       | 2.2    | -      | 3.5    |
| Pot Cap-1 Maneuver   | 1478   | -      | 651    |
| Stage 1              | -      | -      | 908    |
| Stage 2              | -      | -      | 815    |
| Platoon blocked, %   | -      | -      | -      |
| Mov Cap-1 Maneuver   | 1478   | -      | 651    |
| Mov Cap-2 Maneuver   | -      | -      | 651    |
| Stage 1              | -      | -      | 908    |
| Stage 2              | -      | -      | 815    |

| Approach             | EB | WB | SB |
|----------------------|----|----|----|
| HCM Control Delay, s | 0  | 0  | 9  |
| HCM LOS              |    |    | A  |

| Minor Lane/Major Mvmt | EBL  | EBT | WBT | WBR | SBLn1 |
|-----------------------|------|-----|-----|-----|-------|
| Capacity (veh/h)      | 1478 | -   | -   | -   | 935   |
| HCM Lane V/C Ratio    | -    | -   | -   | -   | 0.039 |
| HCM Control Delay (s) | 0    | -   | -   | -   | 9     |
| HCM Lane LOS          | A    | -   | -   | -   | A     |
| HCM 95th %tile Q(veh) | 0    | -   | -   | -   | 0.1   |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.7    |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 30     | 171  | 107    | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 84     | 84   | 84     | 84   | 84     | 84   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 36     | 204  | 127    | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 127    | 0    | -      | 0    | 402    | 127  |
| Stage 1                  | -      | -    | -      | -    | 127    | -    |
| Stage 2                  | -      | -    | -      | -    | 275    | -    |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -    |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3  |
| Pot Cap-1 Maneuver       | 1472   | -    | -      | -    | 608    | 929  |
| Stage 1                  | -      | -    | -      | -    | 904    | -    |
| Stage 2                  | -      | -    | -      | -    | 776    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 1472   | -    | -      | -    | 593    | 929  |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 593    | -    |
| Stage 1                  | -      | -    | -      | -    | 904    | -    |
| Stage 2                  | -      | -    | -      | -    | 757    | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 1.1    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 1472   | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.024  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 7.5    | -    | -      | -    | 0      |      |
| HCM Lane LOS             | A      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0.1    | -    | -      | -    | -      |      |



## **APPENDIX 5.2:**

### **E+P CONDITIONS TRAFFIC SIGNAL WARRANT ANALYSIS WORKSHEETS**

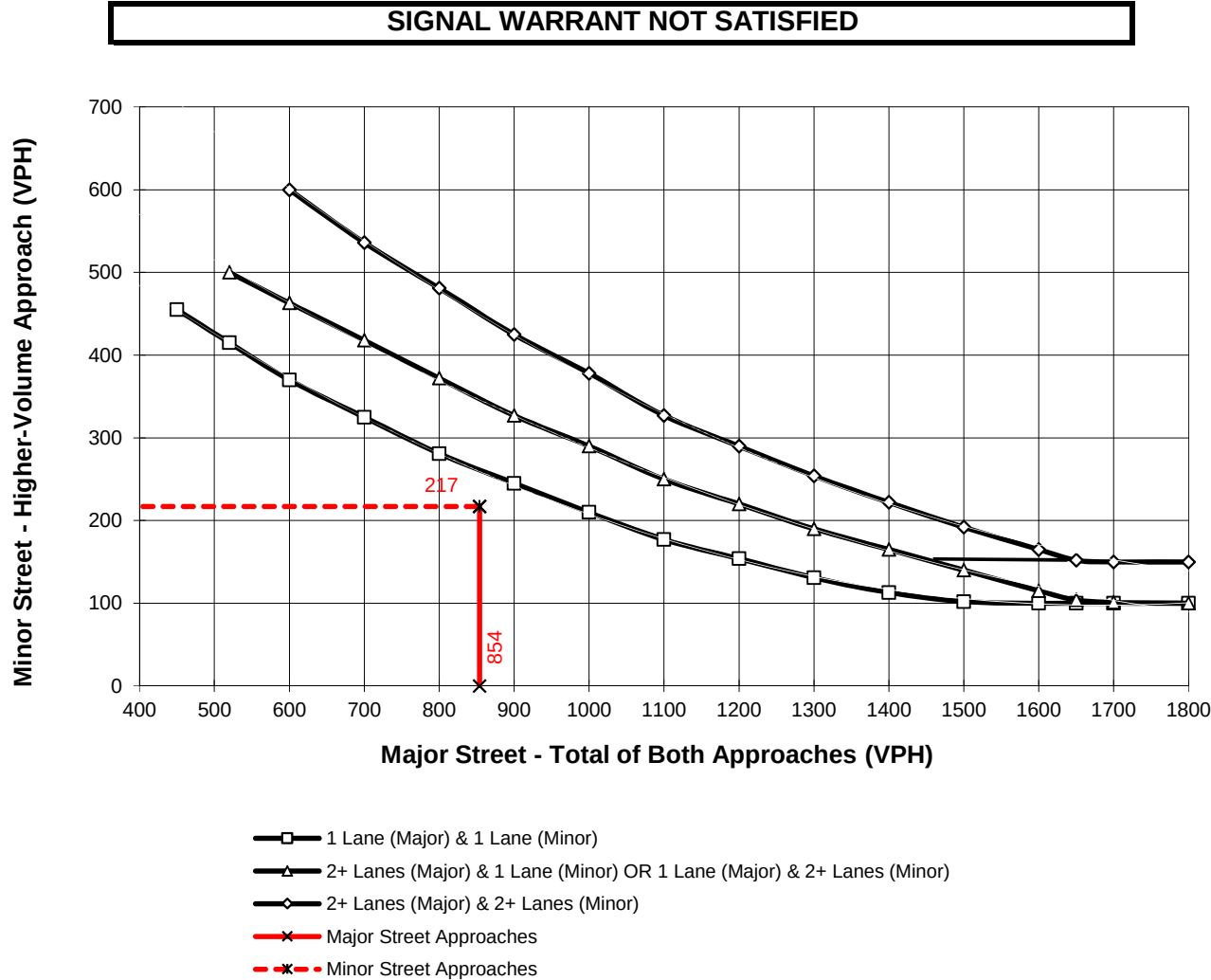
This Page Intentionally Left Blank

Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = Existing plus Project Conditions - Weekday PM Peak Hour

Major Street Name = Nichols Road  
Total of Both Approaches (VPH) = 854  
Number of Approach Lanes on Major Street = 1

Minor Street Name = I-15 Southbound Ramps  
High Volume Approach (VPH) = 217  
Number of Approach Lanes On Minor Street = 1



\*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold for a minor-street approach with one lane

**Figure 4C-3. Warrant 3, Peak Hour**

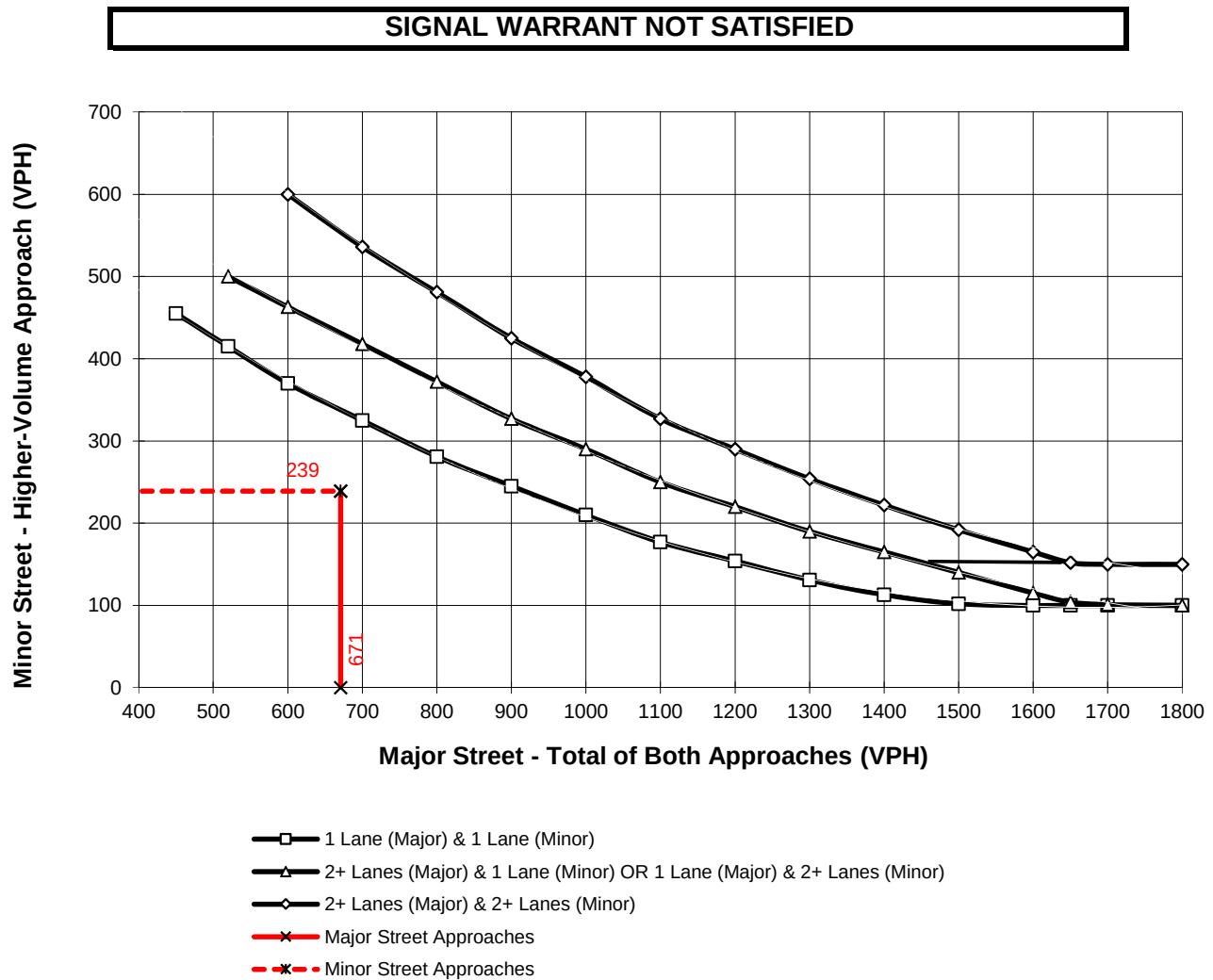
Traffic Conditions = **Existing plus Project Conditions - Weekday AM Peak Hour**

Major Street Name = **Nichols Road**

Total of Both Approaches (VPH) = **671**  
Number of Approach Lanes on Major Street = **1**

Minor Street Name = **I-15 Northbound Ramps**

High Volume Approach (VPH) = **239**  
Number of Approach Lanes On Minor Street = **1**



\*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes  
and 100 vph applies as the lower threshold for a minor-street approach with one lane

## **APPENDIX 5.3:**

### **E+P CONDITIONS BASIC FREEWAY SEGMENT ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |  |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|--|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |  |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |  |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |  |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |  |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year Existing plus Project                                                               |                                        |  |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |  |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |  |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |  |
| Volume, V                                                   | 2864                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |  |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 2                                      |  |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |  |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |  |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |  |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |  |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |  |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |  |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.990                                  |  |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |  |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |  |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |  |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |  |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |  |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0 mph                               |  |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |  |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |  |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |  |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |  |
|                                                             | 1048                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |  |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |  |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |  |
| D = v <sub>p</sub> / S                                      | 15.0                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |  |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |  |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |  |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |  |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |  |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |  |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |  |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |  |

| BASIC FREEWAY SEGMENTS WORKSHEET                                 |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                       |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                          | CHS                         |                                  | Highway/Direction of Travel <i>I-15 Southbound</i>                                                |                                        |     |
| Agency or Company                                                | Urban Crossroads, Inc.      |                                  | From/To <i>S of Nichols Road</i>                                                                  |                                        |     |
| Date Performed                                                   | 6/3/2015                    |                                  | Jurisdiction <i>Caltrans</i>                                                                      |                                        |     |
| Analysis Time Period                                             | AM Peak Hour                |                                  | Analysis Year <i>Existing plus Project</i>                                                        |                                        |     |
| Project Description <i>Nichols Mine Expansion TIA (JN 09599)</i> |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                   |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                               |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                        | 2924                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                             |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 2                                      |     |
| Peak-Hr Prop. of AADT, K                                         |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                        |                             |                                  | General Terrain:                                                                                  | <i>Level</i>                           |     |
| DDHV = AADT x K x D                                              |                             | veh/h                            | Grade % Length                                                                                    | <i>mi</i>                              |     |
|                                                                  |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                                |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                   | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                   | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.990                                  |     |
| <b>Speed Inputs</b>                                              |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                       |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                           |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                               | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                          |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                                   | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                       |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                              |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                         |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )      |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                                  | 1070                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                               |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                                | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                           | 15.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                              | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                  |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                              | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                       | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                           | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                            |                             |                                  |                                                                                                   |                                        |     |



| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year Existing plus Project                                                               |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3480                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1267                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 69.9                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 18.1                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year Existing plus Project                                                               |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3519                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 2                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.990                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1288                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 69.9                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 18.4                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year Existing plus Project                                                               |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4257                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1550                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 68.6                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 22.6                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year Existing plus Project                                                               |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4321                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1573                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 68.4                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 23.0                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year Existing plus Project                                                               |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3265                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1189                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 17.0                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year Existing plus Project                                                               |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3429                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1249                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 17.8                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

## **APPENDIX 5.4:**

### **E+P CONDITIONS FREEWAY MERGE/DIVERGE ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank



| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------------|----------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                    |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                        |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |               | CHS                                |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | I-15 Southbound                                                                                                                                                                                                        |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |               | Urban Crossroads, Inc.             |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Nichols Off-Ramp                                                                                                                                                                                                       |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |               | 6/3/2015                           |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Caltrans                                                                                                                                                                                                               |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |               | AM Peak Hour                       |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Existing plus Project                                                                                                                                                                                                  |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |               |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |               | Freeway Number of Lanes, N      3  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 291 veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | Ramp Number of Lanes, N      1     |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | Acceleration Lane Length, $L_A$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | Deceleration Lane Length $L_D$ 220 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | Freeway Volume, $V_F$ 2864         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | Ramp Volume, $V_R$ 231             |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
| Freeway Free-Flow Speed, $S_{FF}$ 70.0                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
| Ramp Free-Flow Speed, $S_{FR}$ 45.0                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |               |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | V<br>(Veh/hr) | PHF                                | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | $f_{HV}$                                                                                                                                                                                                               | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2864          | 0.92                               | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.990                                                                                                                                                                                                                  | 1.00          | 3144                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 231           | 0.92                               | Level                | 8                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.962                                                                                                                                                                                                                  | 1.00          | 261                                  |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 291           | 0.92                               | Level                | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.952                                                                                                                                                                                                                  | 1.00          | 332                                  |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                    |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                        |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                    |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                        |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |               |                                    |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.669 using Equation (Exhibit 13-7)<br>$V_{12} =$ 2191 pc/h<br>$V_3$ or $V_{av34}$ 953 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                                        |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                    |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual        | Capacity                           |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual                                                                                                                                                                                                                 | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |               | Exhibit 13-8                       |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3144                                                                                                                                                                                                                   | Exhibit 13-8  | 7200                                 | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |                                    | $V_{FO} = V_F - V_R$ | 2883                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7200                                                                                                                                                                                                                   | No            |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |                                    | $V_R$                | 261                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2100                                                                                                                                                                                                                   | No            |                                      |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                    |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual        | Max Desirable                      |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual                                                                                                                                                                                                                 | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | Exhibit 13-8                       |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2191                                                                                                                                                                                                                   | Exhibit 13-8  | 4400:All                             | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                    |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                        |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |               |                                    |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 21.1 (pc/mi/ln)<br>LOS =      C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                        |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                    |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                        |               |                                      |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |               |                                    |                      |                       | $D_S =$ 0.321 (Exhibit 13-12)<br>$S_R =$ 61.0 mph (Exhibit 13-12)<br>$S_0 =$ 76.8 mph (Exhibit 13-12)<br>$S =$ 65.1 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                        |               |                                      |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Southbound       |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp       |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans              |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 | AM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Existing plus Project |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2075$ ft<br><br>$V_u = 231$ veh/h                                                                                                                                                                                                                                                                                             |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                     |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1                     |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 230                   |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2633                  |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 291                   |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$              | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2633            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995                 | 1.00          | 2876                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 291             | 0.92                            | Level    | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.952                 | 1.00          | 332                                                                                                                                                                                                |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 231             | 0.92                            | Level    | 8                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.962                 | 1.00          | 261                                                                                                                                                                                                |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 740.03$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.584$ using Equation (Exhibit 13-6)<br>$V_{12} = 1679$ pc/h<br>$V_3$ or $V_{av34} = 1197$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 1679$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                       |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                       |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual                | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3208            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                       |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual                | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2011            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 19.6$ (pc/mi/ln)<br>LOS = B (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                       |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                       |               |                                                                                                                                                                                                    |            |
| $M_S = 0.329$ (Exhibit 13-11)<br>$S_R = 60.8$ mph (Exhibit 13-11)<br>$S_0 = 67.5$ mph (Exhibit 13-11)<br>$S = 63.1$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                       |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Northbound       |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp       |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans              |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | AM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Existing plus Project |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2130$ ft<br><br>$V_u = 189$ veh/h                                                                                                                                                                                                                                                                                              |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                     |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1                     |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 800                   |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3330                  |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 150                   |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$              | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3330            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995                 | 1.00          | 3638                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 150             | 0.92                            | Level    | 9                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.957                 | 1.00          | 170                                                                                                                                                                                                |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 189             | 0.92                            | Level    | 14                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.935                 | 1.00          | 220                                                                                                                                                                                                |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                       |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 1121.51$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.600$ using Equation (Exhibit 13-6)<br>$V_{12} = 2182$ pc/h<br>$V_3$ or $V_{av34} = 1456$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 2182$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                       |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                       |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual                | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3808            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                       |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual                | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2352            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 18.7$ (pc/mi/ln)<br>LOS = B (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                       |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                       |               |                                                                                                                                                                                                    |            |
| $M_S = 0.290$ (Exhibit 13-11)<br>$S_R = 61.9$ mph (Exhibit 13-11)<br>$S_0 = 66.6$ mph (Exhibit 13-11)<br>$S = 63.6$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                       |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound       |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp      |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans              |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Existing plus Project |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                     |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 150 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                     |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 225                   |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3519                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 189                   |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$              | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3519            | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990                 | 1.00          | 3863                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 189             | 0.92                            | Level                | 14                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.935                 | 1.00          | 220                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 150             | 0.92                            | Level                | 9                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.957                 | 1.00          | 170                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                       |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                       |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.653 using Equation (Exhibit 13-7)<br>$V_{12} =$ 2600 pc/h<br>$V_3$ or $V_{av34}$ 1263 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                       |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3863                  | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 3643                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200                  | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 220                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100                  | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2600                  | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                       |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 24.6 (pc/mi/ln)<br>LOS =      C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                       |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                       |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.318 (Exhibit 13-12)<br>$S_R =$ 61.1 mph (Exhibit 13-12)<br>$S_0 =$ 75.8 mph (Exhibit 13-12)<br>$S =$ 65.2 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                       |               |                                                                                                                                                                                                                        |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------|---------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                    |         |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                        |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                                |         | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound                                                                                                                                                                                                        |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.             |         | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp                                                                                                                                                                                                       |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                           |         | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                                                                                                                                                                                                               |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                       |         | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Existing plus Project                                                                                                                                                                                                  |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      3  |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 267 veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N      1     |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$ 220 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$ 4257         |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$ 203             |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
| Freeway Free-Flow Speed, $S_{FF}$ 70.0                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
| Ramp Free-Flow Speed, $S_{FR}$ 45.0                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                                | Terrain | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                                                                                                                                                                                                               | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4257            | 0.92                               | Level   | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                                                                                                                                                                                                                  | 1.00          | 4650                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 203             | 0.92                               | Level   | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.980                                                                                                                                                                                                                  | 1.00          | 225                                  |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                        |               |                                      |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 267             | 0.92                               | Level   | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.980                                                                                                                                                                                                                  | 1.00          | 296                                  |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                    |         |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                        |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                    |         |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                        |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                    |         |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.633 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3028 pc/h<br>$V_3$ or $V_{av34}$ 1622 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                                        |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                    |         |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                           |         | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                 | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                       |         |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4650                                                                                                                                                                                                                   | Exhibit 13-8  | 7200                                 | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |         | $V_{FO} = V_F - V_R$  | 4425                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-8                                                                                                                                                                                                           | 7200          | No                                   |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |         | $V_R$                 | 225                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Exhibit 13-10                                                                                                                                                                                                          | 2100          | No                                   |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                    |         |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                        |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                      |         | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                 | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                       |         |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3028                                                                                                                                                                                                                   | Exhibit 13-8  | 4400:All                             | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                    |         |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                        |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                    |         |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 28.3 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                        |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                    |         |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                        |               |                                      |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                    |         |                       | $D_S =$ 0.318 (Exhibit 13-12)<br>$S_R =$ 61.1 mph (Exhibit 13-12)<br>$S_0 =$ 74.4 mph (Exhibit 13-12)<br>$S =$ 65.1 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                        |               |                                      |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                |                                                                                                                                                                                                            |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                       |                |                                                                                                                                                                                                            |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            | CHS                                      |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Southbound       |                |                                                                                                                                                                                                            |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | Urban Crossroads, Inc.                   |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp       |                |                                                                                                                                                                                                            |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            | 6/3/2015                                 |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans              |                |                                                                                                                                                                                                            |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | PM Peak Hour                             |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Existing plus Project |                |                                                                                                                                                                                                            |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                |                                                                                                                                                                                                            |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                |                                                                                                                                                                                                            |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2075 ft<br>V <sub>u</sub> = 203 veh/h                                                                                                                                                                                                                                                                                                                                                                                                   |            | Freeway Number of Lanes, N               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                     |                | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Number of Lanes, N                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                     |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Acceleration Lane Length, L <sub>A</sub> |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 230                   |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Deceleration Lane Length L <sub>D</sub>  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Freeway Volume, V <sub>F</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4054                  |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Volume, V <sub>R</sub>              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 267                   |                |                                                                                                                                                                                                            |            |
| Freeway Free-Flow Speed, S <sub>FF</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                                          |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                |                                                                                                                                                                                                            |            |
| Ramp Free-Flow Speed, S <sub>FR</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                          |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                |                                                                                                                                                                                                            |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                |                                                                                                                                                                                                            |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | V (Veh/hr) | PHF                                      | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub>       | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub>                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4054       | 0.92                                     | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.995                 | 1.00           | 4429                                                                                                                                                                                                       |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 267        | 0.92                                     | Level    | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.980                 | 1.00           | 296                                                                                                                                                                                                        |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 203        | 0.92                                     | Level    | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.980                 | 1.00           | 225                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |                |                                                                                                                                                                                                            |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                       |                |                                                                                                                                                                                                            |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |                |                                                                                                                                                                                                            |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 1064.67 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.584 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 2586 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 1843 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 2586 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                          |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                       |                |                                                                                                                                                                                                            |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                          |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                       |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Capacity                                 |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                | Capacity       |                                                                                                                                                                                                            | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4725       | Exhibit 13-8                             |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                       | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                       | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                       | Exhibit 13-10  |                                                                                                                                                                                                            |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Max Desirable                            |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                | Max Desirable  |                                                                                                                                                                                                            | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2882       | Exhibit 13-8                             | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       | Exhibit 13-8   |                                                                                                                                                                                                            |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                       |                |                                                                                                                                                                                                            |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 26.4 (pc/mi/ln)<br>LOS = C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                       |                |                                                                                                                                                                                                            |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |                |                                                                                                                                                                                                            |            |
| M <sub>S</sub> = 0.370 (Exhibit 13-11)<br>S <sub>R</sub> = 59.6 mph (Exhibit 13-11)<br>S <sub>0</sub> = 65.2 mph (Exhibit 13-11)<br>S = 61.7 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |                |                                                                                                                                                                                                            |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------|----------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                     |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                    |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | CHS                                 |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | I-15 Northbound                                                                                                                                                                                    |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Urban Crossroads, Inc.              |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Nichols On-Ramp                                                                                                                                                                                    |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | 6/3/2015                            |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Caltrans                                                                                                                                                                                           |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 | PM Peak Hour                        |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Existing plus Project                                                                                                                                                                              |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} =$ 2130 ft<br><br>$V_u =$ 326 veh/h                                                                                                                                                                                                                                                                                            |                 | Freeway Number of Lanes, $N$ 3      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Ramp Number of Lanes, $N$ 1         |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Acceleration Lane Length, $L_A$ 800 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Deceleration Lane Length $L_D$      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Freeway Volume, $V_F$ 3103          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Ramp Volume, $V_R$ 162              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| Freeway Free-Flow Speed, $S_{FF}$ 70.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| Ramp Free-Flow Speed, $S_{FR}$ 45.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $V$<br>(Veh/hr) | PHF                                 | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | $f_{HV}$                                                                                                                                                                                           | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3103            | 0.92                                | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.995                                                                                                                                                                                              | 1.00          | 3390                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 162             | 0.92                                | Level    | 6                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.971                                                                                                                                                                                              | 1.00          | 181                                  |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 326             | 0.92                                | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.990                                                                                                                                                                                              | 1.00          | 358                                  |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                     |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                     |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                    |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ 1070.79 (Equation 13-6 or 13-7)<br>$P_{FM} =$ 0.600 using Equation (Exhibit 13-6)<br>$V_{12} =$ 2034 pc/h<br>$V_3$ or $V_{av34}$ 1356 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ 2034 pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                     |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                    |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                     |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual          | Capacity                            |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual                                                                                                                                                                                             | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3571            | Exhibit 13-8                        |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                    | Exhibit 13-8  |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                     |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    | Exhibit 13-8  |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                     |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                    | Exhibit 13-10 |                                      |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                     |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual          | Max Desirable                       |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual                                                                                                                                                                                             | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2215            | Exhibit 13-8                        | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                    | Exhibit 13-8  |                                      |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                     |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                    |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ 17.7 (pc/mi/ln)<br>LOS = B (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                     |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                    |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                     |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                    |               |                                      |            |
| $M_S =$ 0.285 (Exhibit 13-11)<br>$S_R =$ 62.0 mph (Exhibit 13-11)<br>$S_0 =$ 66.9 mph (Exhibit 13-11)<br>$S =$ 63.8 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                       |                 |                                     |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                    |               |                                      |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|---------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |         |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                       |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |         | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound       |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |         | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp      |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |         | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans              |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |         | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Existing plus Project |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                     |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 162 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                     |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 225                   |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3429                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 326                   |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |         | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |         | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$              | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3429            | 0.92                            | Level   | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                 | 1.00          | 3746                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 326             | 0.92                            | Level   | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990                 | 1.00          | 358                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                       |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 162             | 0.92                            | Level   | 6                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.971                 | 1.00          | 181                                                                                                                                                                                                                    |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                 |         |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                       |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |         |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                       |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |         |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.650 using Equation (Exhibit 13-7)<br>$V_{12} =$ 2560 pc/h<br>$V_3$ or $V_{av34}$ 1186 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                       |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |         |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                       |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |         | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |         |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3746                  | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         | $V_{FO} = V_F - V_R$  | 3388                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-8          | 7200          | No                                                                                                                                                                                                                     |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         | $V_R$                 | 358                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Exhibit 13-10         | 2100          | No                                                                                                                                                                                                                     |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |         |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                       |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |         | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |         |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2560                  | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |         |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                       |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |         |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 24.2 (pc/mi/ln)<br>LOS =      C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                       |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |         |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                       |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |         |                       | $D_S =$ 0.330 (Exhibit 13-12)<br>$S_R =$ 60.8 mph (Exhibit 13-12)<br>$S_0 =$ 76.1 mph (Exhibit 13-12)<br>$S =$ 64.9 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                       |               |                                                                                                                                                                                                                        |            |



## **APPENDIX 6.1:**

### **EAP (2016) CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| Intersection              |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Intersection Delay, s/veh | 12.4 |      |      |      |      |      |      |      |      |      |      |      |
| Intersection LOS          | B    |      |      |      |      |      |      |      |      |      |      |      |
| Movement                  | EBU  | EBL  | EBT  | EBR  | WBU  | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
| Vol, veh/h                | 0    | 0    | 236  | 252  | 0    | 83   | 172  | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor          | 0.92 | 0.89 | 0.89 | 0.89 | 0.92 | 0.89 | 0.89 | 0.89 | 0.92 | 0.89 | 0.89 | 0.89 |
| Heavy Vehicles, %         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                 | 0    | 0    | 265  | 283  | 0    | 93   | 193  | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes           | 0    | 0    | 1    | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |

| Approach                   |  | EB   | WB   |
|----------------------------|--|------|------|
| Opposing Approach          |  | WB   | EB   |
| Opposing Lanes             |  | 2    | 2    |
| Conflicting Approach Left  |  | SB   |      |
| Conflicting Lanes Left     |  | 1    | 0    |
| Conflicting Approach Right |  |      | SB   |
| Conflicting Lanes Right    |  | 0    | 1    |
| HCM Control Delay          |  | 12.1 | 11.4 |
| HCM LOS                    |  | B    | B    |

| Lane                   | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |
|------------------------|-------|-------|-------|-------|-------|
| Vol Left, %            | 0%    | 0%    | 100%  | 0%    | 70%   |
| Vol Thru, %            | 100%  | 0%    | 0%    | 100%  | 3%    |
| Vol Right, %           | 0%    | 100%  | 0%    | 0%    | 27%   |
| Sign Control           | Stop  | Stop  | Stop  | Stop  | Stop  |
| Traffic Vol by Lane    | 236   | 252   | 83    | 172   | 259   |
| LT Vol                 | 0     | 0     | 83    | 0     | 182   |
| Through Vol            | 236   | 0     | 0     | 172   | 8     |
| RT Vol                 | 0     | 252   | 0     | 0     | 69    |
| Lane Flow Rate         | 265   | 283   | 93    | 193   | 291   |
| Geometry Grp           | 7     | 7     | 7     | 7     | 2     |
| Degree of Util (X)     | 0.429 | 0.402 | 0.171 | 0.327 | 0.466 |
| Departure Headway (Hd) | 5.825 | 5.115 | 6.603 | 6.094 | 5.769 |
| Convergence, Y/N       | Yes   | Yes   | Yes   | Yes   | Yes   |
| Cap                    | 618   | 702   | 544   | 589   | 626   |
| Service Time           | 3.559 | 2.849 | 4.342 | 3.834 | 3.803 |
| HCM Lane V/C Ratio     | 0.429 | 0.403 | 0.171 | 0.328 | 0.465 |
| HCM Control Delay      | 12.9  | 11.3  | 10.7  | 11.8  | 13.8  |
| HCM Lane LOS           | B     | B     | B     | B     | B     |
| HCM 95th-tile Q        | 2.1   | 1.9   | 0.6   | 1.4   | 2.5   |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 182  | 8    | 69   |
| Peak Hour Factor  | 0.92 | 0.89 | 0.89 | 0.89 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 204  | 9    | 78   |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 13.8

HCM LOS B

Lane

| Intersection             |        |       |      |        |      |      |        |      |      |      |      |      |
|--------------------------|--------|-------|------|--------|------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 6.2    |       |      |        |      |      |        |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT   | EBR  | WBL    | WBT  | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Vol, veh/h               | 66     | 352   | 0    | 0      | 158  | 105  | 96     | 1    | 146  | 0    | 0    | 0    |
| Conflicting Peds, #/hr   | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free   | Free  | Free | Free   | Free | Free | Stop   | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -      | -     | None | -      | -    | None | -      | -    | None | -    | -    | None |
| Storage Length           | 230    | -     | -    | -      | -    | -    | -      | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 75     | 75    | 75   | 75     | 75   | 75   | 75     | 75   | 75   | 75   | 75   | 75   |
| Heavy Vehicles, %        | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 88     | 469   | 0    | 0      | 211  | 140  | 128    | 1    | 195  | 0    | 0    | 0    |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Major/Minor              | Major1 |       |      | Major2 |      |      | Minor1 |      |      |      |      |      |
| Conflicting Flow All     | 351    | 0     | 0    | 469    | 0    | 0    | 926    | 996  | 469  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 645    | 645  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 281    | 351  | -    |      |      |      |
| Critical Hdwy            | 4.1    | -     | -    | 4.1    | -    | -    | 5      | 5    | 5    |      |      |      |
| Critical Hdwy Stg 1      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Critical Hdwy Stg 2      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Follow-up Hdwy           | 2.2    | -     | -    | 2.2    | -    | -    | 3.5    | 4    | 3.3  |      |      |      |
| Pot Cap-1 Maneuver       | 1219   | -     | -    | 1103   | -    | -    | 431    | 373  | 700  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 526    | 471  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 771    | 636  | -    |      |      |      |
| Platoon blocked, %       |        | -     | -    |        | -    | -    |        |      |      |      |      |      |
| Mov Cap-1 Maneuver       | 1219   | -     | -    | 1103   | -    | -    | 400    | 0    | 700  |      |      |      |
| Mov Cap-2 Maneuver       | -      | -     | -    | -      | -    | -    | 400    | 0    | -    |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 488    | 0    | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 771    | 0    | -    |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Approach                 | EB     |       |      | WB     |      |      | NB     |      |      |      |      |      |
| HCM Control Delay, s     | 1.3    |       |      | 0      |      |      | 21.2   |      |      |      |      |      |
| HCM LOS                  |        |       |      |        |      |      | C      |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBLn1  | EBL   | EBT  | EBR    | WBL  | WBT  | WBR    |      |      |      |      |      |
| Capacity (veh/h)         | 539    | 1219  | -    | -      | 1103 | -    | -      |      |      |      |      |      |
| HCM Lane V/C Ratio       | 0.601  | 0.072 | -    | -      | -    | -    | -      |      |      |      |      |      |
| HCM Control Delay (s)    | 21.2   | 8.2   | -    | -      | 0    | -    | -      |      |      |      |      |      |
| HCM Lane LOS             | C      | A     | -    | -      | A    | -    | -      |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | 3.9    | 0.2   | -    | -      | 0    | -    | -      |      |      |      |      |      |

| Intersection             |        |      |        |      |        |       |
|--------------------------|--------|------|--------|------|--------|-------|
| Int Delay, s/veh         | 1      |      |        |      |        |       |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR   |
| Vol, veh/h               | 0      | 498  | 191    | 0    | 0      | 73    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0     |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop  |
| RT Channelized           | -      | None | -      | None | -      | Yield |
| Storage Length           | -      | -    | -      | -    | -      | 0     |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -     |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -     |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67    |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0     |
| Mvmt Flow                | 0      | 743  | 285    | 0    | 0      | 109   |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |       |
| Conflicting Flow All     | 285    | 0    | -      | 0    | 1028   | 285   |
| Stage 1                  | -      | -    | -      | -    | 285    | -     |
| Stage 2                  | -      | -    | -      | -    | 743    | -     |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2   |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -     |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -     |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3   |
| Pot Cap-1 Maneuver       | 1289   | -    | -      | -    | 262    | 759   |
| Stage 1                  | -      | -    | -      | -    | 768    | -     |
| Stage 2                  | -      | -    | -      | -    | 474    | -     |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -     |
| Mov Cap-1 Maneuver       | 1289   | -    | -      | -    | 262    | 759   |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 262    | -     |
| Stage 1                  | -      | -    | -      | -    | 768    | -     |
| Stage 2                  | -      | -    | -      | -    | 474    | -     |
| Approach                 | EB     |      | WB     |      | SB     |       |
| HCM Control Delay, s     | 0      |      | 0      |      | 10.5   |       |
| HCM LOS                  |        |      |        |      | B      |       |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |       |
| Capacity (veh/h)         | 1289   | -    | -      | -    | 759    |       |
| HCM Lane V/C Ratio       | -      | -    | -      | -    | 0.144  |       |
| HCM Control Delay (s)    | 0      | -    | -      | -    | 10.5   |       |
| HCM Lane LOS             | A      | -    | -      | -    | B      |       |
| HCM 95th %tile Q(veh)    | 0      | -    | -      | -    | 0.5    |       |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.9    |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 82     | 416  | 191    | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 122    | 621  | 285    | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 285    | 0    | -      | 0    | 1151   | 285  |
| Stage 1                  | -      | -    | -      | -    | 285    | -    |
| Stage 2                  | -      | -    | -      | -    | 866    | -    |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -    |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3  |
| Pot Cap-1 Maneuver       | 1289   | -    | -      | -    | 221    | 759  |
| Stage 1                  | -      | -    | -      | -    | 768    | -    |
| Stage 2                  | -      | -    | -      | -    | 415    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 1289   | -    | -      | -    | 200    | 759  |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 200    | -    |
| Stage 1                  | -      | -    | -      | -    | 768    | -    |
| Stage 2                  | -      | -    | -      | -    | 376    | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 1.3    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 1289   | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.095  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 8.1    | -    | -      | -    | 0      |      |
| HCM Lane LOS             | A      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0.3    | -    | -      | -    | -      |      |

| Intersection               |       |       |       |       |       |      |      |      |      |      |      |      |
|----------------------------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|
| Intersection Delay, s/veh  | 13.5  |       |       |       |       |      |      |      |      |      |      |      |
| Intersection LOS           | B     |       |       |       |       |      |      |      |      |      |      |      |
| Movement                   | EBU   | EBL   | EBT   | EBR   | WBU   | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
| Vol, veh/h                 | 0     | 0     | 220   | 253   | 0     | 29   | 367  | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor           | 0.92  | 0.95  | 0.95  | 0.95  | 0.92  | 0.95 | 0.95 | 0.95 | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, %          | 0     | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                  | 0     | 0     | 232   | 266   | 0     | 31   | 386  | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes            | 0     | 0     | 1     | 1     | 0     | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| Approach                   |       |       | EB    |       | WB    |      |      |      |      |      |      |      |
| Opposing Approach          |       |       | WB    |       | EB    |      |      |      |      |      |      |      |
| Opposing Lanes             |       |       | 2     |       | 2     |      |      |      |      |      |      |      |
| Conflicting Approach Left  |       |       | SB    |       |       |      |      |      |      |      |      |      |
| Conflicting Lanes Left     |       |       | 1     |       | 0     |      |      |      |      |      |      |      |
| Conflicting Approach Right |       |       |       |       | SB    |      |      |      |      |      |      |      |
| Conflicting Lanes Right    |       |       | 0     |       | 1     |      |      |      |      |      |      |      |
| HCM Control Delay          |       |       | 11.2  |       | 17    |      |      |      |      |      |      |      |
| HCM LOS                    |       |       | B     |       | C     |      |      |      |      |      |      |      |
| Lane                       | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |      |      |      |      |      |      |      |
| Vol Left, %                | 0%    | 0%    | 100%  | 0%    | 35%   |      |      |      |      |      |      |      |
| Vol Thru, %                | 100%  | 0%    | 0%    | 100%  | 1%    |      |      |      |      |      |      |      |
| Vol Right, %               | 0%    | 100%  | 0%    | 0%    | 64%   |      |      |      |      |      |      |      |
| Sign Control               | Stop  | Stop  | Stop  | Stop  | Stop  |      |      |      |      |      |      |      |
| Traffic Vol by Lane        | 220   | 253   | 29    | 367   | 220   |      |      |      |      |      |      |      |
| LT Vol                     | 0     | 0     | 29    | 0     | 76    |      |      |      |      |      |      |      |
| Through Vol                | 220   | 0     | 0     | 367   | 3     |      |      |      |      |      |      |      |
| RT Vol                     | 0     | 253   | 0     | 0     | 141   |      |      |      |      |      |      |      |
| Lane Flow Rate             | 232   | 266   | 31    | 386   | 232   |      |      |      |      |      |      |      |
| Geometry Grp               | 7     | 7     | 7     | 7     | 2     |      |      |      |      |      |      |      |
| Degree of Util (X)         | 0.369 | 0.372 | 0.053 | 0.622 | 0.365 |      |      |      |      |      |      |      |
| Departure Headway (Hd)     | 5.736 | 5.027 | 6.299 | 5.792 | 5.68  |      |      |      |      |      |      |      |
| Convergence, Y/N           | Yes   | Yes   | Yes   | Yes   | Yes   |      |      |      |      |      |      |      |
| Cap                        | 628   | 716   | 569   | 622   | 632   |      |      |      |      |      |      |      |
| Service Time               | 3.469 | 2.759 | 4.033 | 3.526 | 3.722 |      |      |      |      |      |      |      |
| HCM Lane V/C Ratio         | 0.369 | 0.372 | 0.054 | 0.621 | 0.367 |      |      |      |      |      |      |      |
| HCM Control Delay          | 11.8  | 10.7  | 9.4   | 17.6  | 12    |      |      |      |      |      |      |      |
| HCM Lane LOS               | B     | B     | A     | C     | B     |      |      |      |      |      |      |      |
| HCM 95th-tile Q            | 1.7   | 1.7   | 0.2   | 4.3   | 1.7   |      |      |      |      |      |      |      |



Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 76   | 3    | 141  |
| Peak Hour Factor  | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 80   | 3    | 148  |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 12

HCM LOS B

Lane

| Intersection             |        |       |      |        |      |      |        |      |      |      |      |      |
|--------------------------|--------|-------|------|--------|------|------|--------|------|------|------|------|------|
| Int Delay, s/veh         | 12.3   |       |      |        |      |      |        |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Movement                 | EBL    | EBT   | EBR  | WBL    | WBT  | WBR  | NBL    | NBT  | NBR  | SBL  | SBT  | SBR  |
| Vol, veh/h               | 138    | 159   | 0    | 0      | 102  | 40   | 294    | 3    | 45   | 0    | 0    | 0    |
| Conflicting Peds, #/hr   | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free   | Free  | Free | Free   | Free | Free | Stop   | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -      | -     | None | -      | -    | None | -      | -    | None | -    | -    | None |
| Storage Length           | 230    | -     | -    | -      | -    | -    | -      | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Grade, %                 | -      | 0     | -    | -      | 0    | -    | -      | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 90     | 90    | 90   | 90     | 90   | 90   | 90     | 90   | 90   | 90   | 90   | 90   |
| Heavy Vehicles, %        | 0      | 0     | 0    | 0      | 0    | 0    | 0      | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 153    | 177   | 0    | 0      | 113  | 44   | 327    | 3    | 50   | 0    | 0    | 0    |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Major/Minor              | Major1 |       |      | Major2 |      |      | Minor1 |      |      |      |      |      |
| Conflicting Flow All     | 158    | 0     | 0    | 177    | 0    | 0    | 619    | 641  | 177  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 483    | 483  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 136    | 158  | -    |      |      |      |
| Critical Hdwy            | 4.1    | -     | -    | 4.1    | -    | -    | 5      | 5    | 5    |      |      |      |
| Critical Hdwy Stg 1      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Critical Hdwy Stg 2      | -      | -     | -    | -      | -    | -    | 5.4    | 5.5  | -    |      |      |      |
| Follow-up Hdwy           | 2.2    | -     | -    | 2.2    | -    | -    | 3.5    | 4    | 3.3  |      |      |      |
| Pot Cap-1 Maneuver       | 1434   | -     | -    | 1411   | -    | -    | 579    | 517  | 924  |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 625    | 556  | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 895    | 771  | -    |      |      |      |
| Platoon blocked, %       |        | -     | -    |        | -    | -    |        |      |      |      |      |      |
| Mov Cap-1 Maneuver       | 1434   | -     | -    | 1411   | -    | -    | 517    | 0    | 924  |      |      |      |
| Mov Cap-2 Maneuver       | -      | -     | -    | -      | -    | -    | 517    | 0    | -    |      |      |      |
| Stage 1                  | -      | -     | -    | -      | -    | -    | 558    | 0    | -    |      |      |      |
| Stage 2                  | -      | -     | -    | -      | -    | -    | 895    | 0    | -    |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Approach                 | EB     |       |      | WB     |      |      | NB     |      |      |      |      |      |
| HCM Control Delay, s     | 3.6    |       |      | 0      |      |      | 25     |      |      |      |      |      |
| HCM LOS                  |        |       |      |        |      |      | D      |      |      |      |      |      |
|                          |        |       |      |        |      |      |        |      |      |      |      |      |
| Minor Lane/Major Mvmt    | NBLn1  | EBL   | EBT  | EBR    | WBL  | WBT  | WBR    |      |      |      |      |      |
| Capacity (veh/h)         | 549    | 1434  | -    | -      | 1411 | -    | -      |      |      |      |      |      |
| HCM Lane V/C Ratio       | 0.692  | 0.107 | -    | -      | -    | -    | -      |      |      |      |      |      |
| HCM Control Delay (s)    | 25     | 7.8   | -    | -      | 0    | -    | -      |      |      |      |      |      |
| HCM Lane LOS             | D      | A     | -    | -      | A    | -    | -      |      |      |      |      |      |
| HCM 95th %tile Q(veh)    | 5.4    | 0.4   | -    | -      | 0    | -    | -      |      |      |      |      |      |

| Intersection             |        |      |        |      |        |       |
|--------------------------|--------|------|--------|------|--------|-------|
| Int Delay, s/veh         | 0.8    |      |        |      |        |       |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR   |
| Vol, veh/h               | 0      | 204  | 109    | 0    | 0      | 32    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0     |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop  |
| RT Channelized           | -      | None | -      | None | -      | Yield |
| Storage Length           | -      | -    | -      | -    | -      | 0     |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -     |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -     |
| Peak Hour Factor         | 88     | 88   | 88     | 88   | 88     | 88    |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0     |
| Mvmt Flow                | 0      | 232  | 124    | 0    | 0      | 36    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |       |
| Conflicting Flow All     | 124    | 0    | -      | 0    | 356    | 124   |
| Stage 1                  | -      | -    | -      | -    | 124    | -     |
| Stage 2                  | -      | -    | -      | -    | 232    | -     |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2   |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -     |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -     |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3   |
| Pot Cap-1 Maneuver       | 1475   | -    | -      | -    | 646    | 932   |
| Stage 1                  | -      | -    | -      | -    | 907    | -     |
| Stage 2                  | -      | -    | -      | -    | 811    | -     |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -     |
| Mov Cap-1 Maneuver       | 1475   | -    | -      | -    | 646    | 932   |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 646    | -     |
| Stage 1                  | -      | -    | -      | -    | 907    | -     |
| Stage 2                  | -      | -    | -      | -    | 811    | -     |
| Approach                 | EB     |      | WB     |      | SB     |       |
| HCM Control Delay, s     | 0      |      | 0      |      | 9      |       |
| HCM LOS                  |        |      |        |      | A      |       |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |       |
| Capacity (veh/h)         | 1475   | -    | -      | -    | 932    |       |
| HCM Lane V/C Ratio       | -      | -    | -      | -    | 0.039  |       |
| HCM Control Delay (s)    | 0      | -    | -      | -    | 9      |       |
| HCM Lane LOS             | A      | -    | -      | -    | A      |       |
| HCM 95th %tile Q(veh)    | 0      | -    | -      | -    | 0.1    |       |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.7    |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 30     | 174  | 109    | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 84     | 84   | 84     | 84   | 84     | 84   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 36     | 207  | 130    | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 130    | 0    | -      | 0    | 409    | 130  |
| Stage 1                  | -      | -    | -      | -    | 130    | -    |
| Stage 2                  | -      | -    | -      | -    | 279    | -    |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -    |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3  |
| Pot Cap-1 Maneuver       | 1468   | -    | -      | -    | 602    | 925  |
| Stage 1                  | -      | -    | -      | -    | 901    | -    |
| Stage 2                  | -      | -    | -      | -    | 773    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 1468   | -    | -      | -    | 587    | 925  |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 587    | -    |
| Stage 1                  | -      | -    | -      | -    | 901    | -    |
| Stage 2                  | -      | -    | -      | -    | 754    | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 1.1    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 1468   | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.024  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 7.5    | -    | -      | -    | 0      |      |
| HCM Lane LOS             | A      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0.1    | -    | -      | -    | -      |      |

## **APPENDIX 6.2:**

### **EAP (2016) CONDITIONS TRAFFIC SIGNAL WARRANT ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

### Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **EAP (2016) Conditions - Weekday PM Peak Hour**

Major Street Name = **Nichols Road**

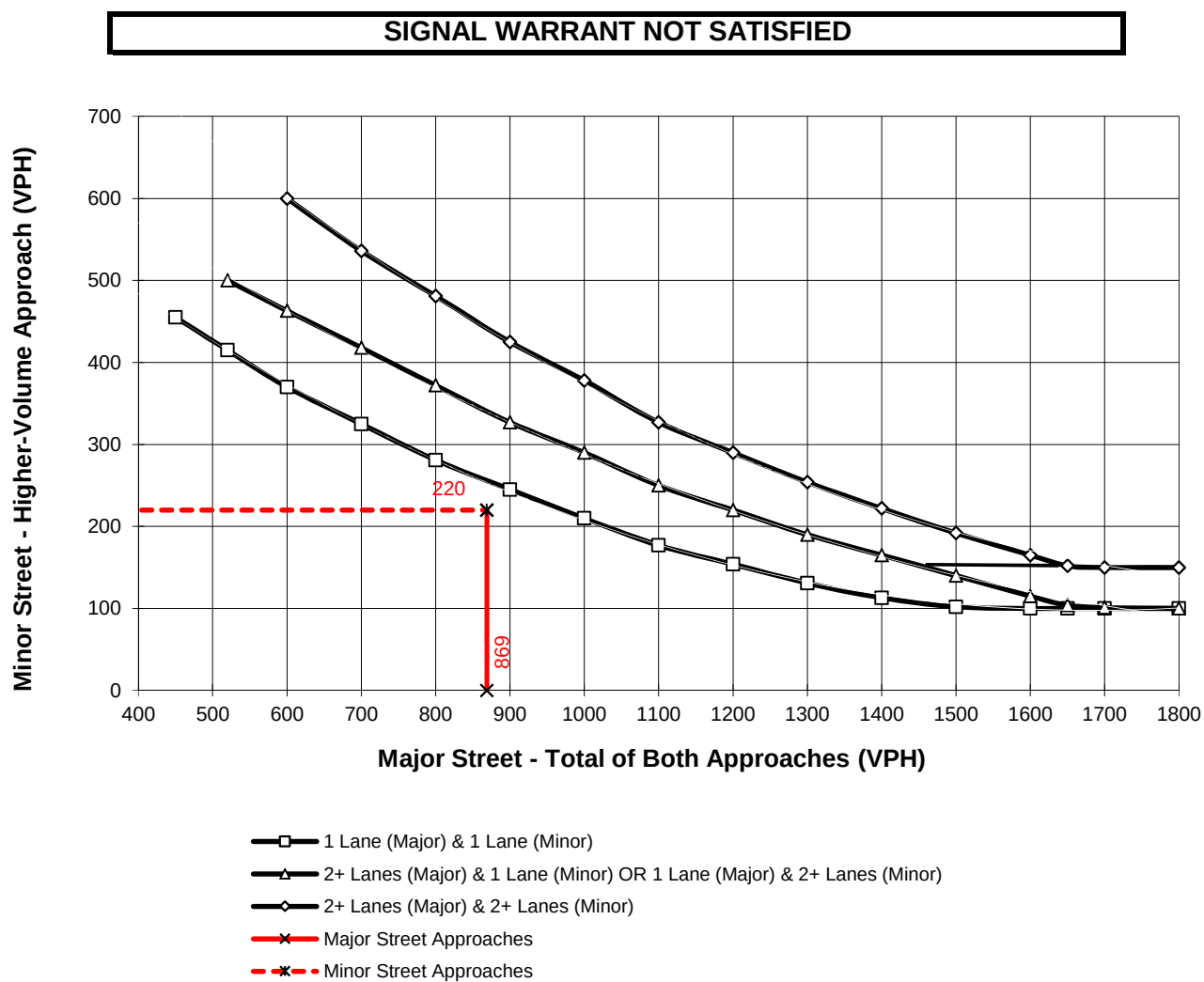
Total of Both Approaches (VPH) = **869**

Number of Approach Lanes on Major Street = **1**

Minor Street Name = **I-15 Southbound Ramps**

High Volume Approach (VPH) = **220**

Number of Approach Lanes On Minor Street = **1**



\*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes  
and 100 vph applies as the lower threshold for a minor-street approach with one lane

### Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **EAP (2016) Conditions - Weekday AM Peak Hour**

Major Street Name = **Nichols Road**

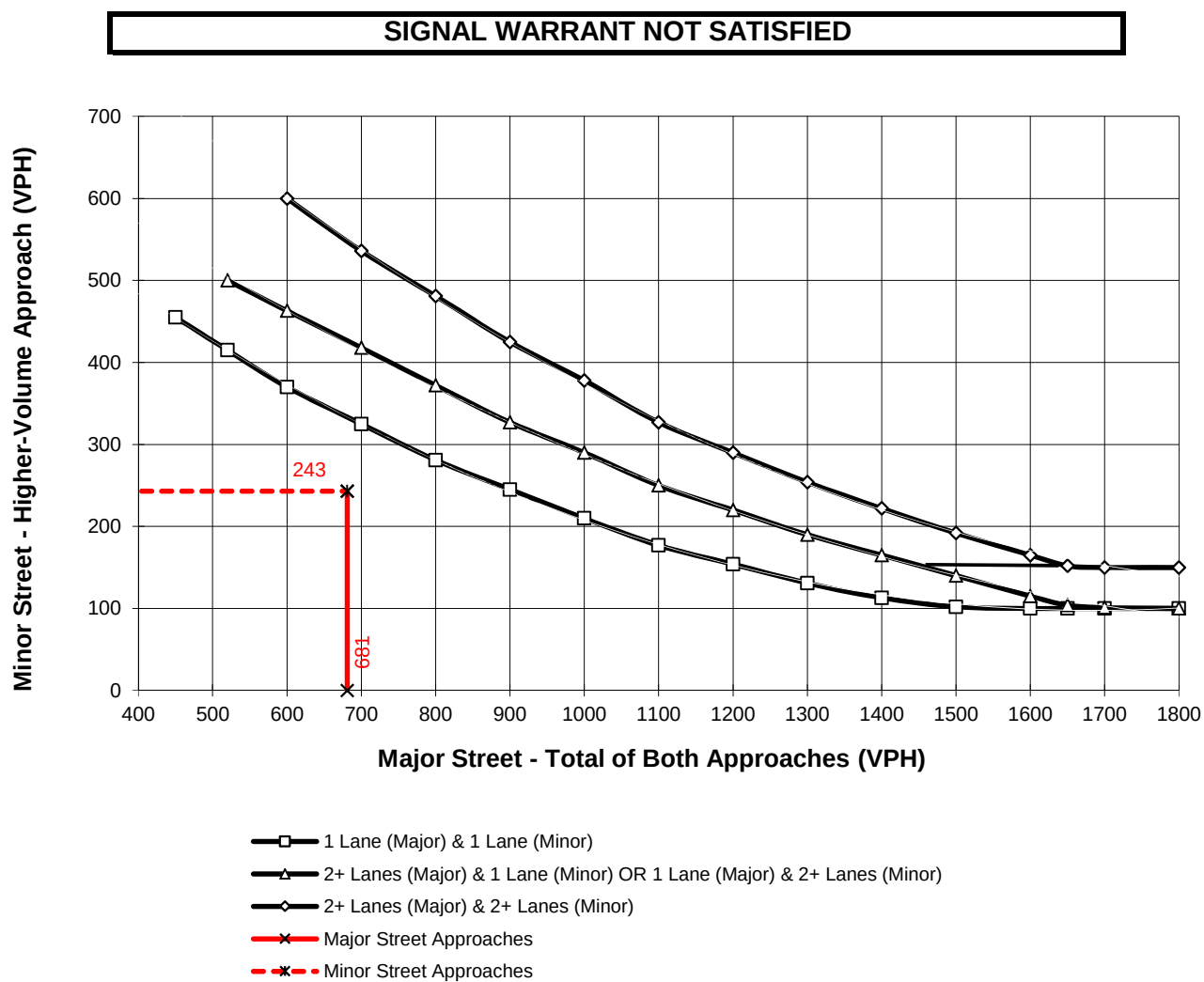
Total of Both Approaches (VPH) = **681**

Number of Approach Lanes on Major Street = **1**

Minor Street Name = **I-15 Northbound Ramps**

High Volume Approach (VPH) = **243**

Number of Approach Lanes On Minor Street = **1**



\*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes  
and 100 vph applies as the lower threshold for a minor-street approach with one lane



## **APPENDIX 6.3:**

### **EAP (2016) CONDITIONS BASIC FREEWAY SEGMENT ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year EAP 2016                                                                            |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 2921                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 2                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.990                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   |                                        | mph |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   |                                        | mph |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    |                                        | mph |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1069                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 15.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year EAP 2016                                                                            |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 2982                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 2                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.990                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1091                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 15.6                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year EAP 2016                                                                            |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3550                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1293                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 69.9                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 18.5                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year EAP 2016                                                                            |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3589                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 2                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.990                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1313                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 69.9                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 18.8                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year EAP 2016                                                                            |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4342                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1581                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 68.3                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 23.1                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year EAP 2016                                                                            |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4407                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1605                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 68.1                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 23.6                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |



| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year EAP 2016                                                                            |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3330                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1213                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 17.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year EAP 2016                                                                            |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3498                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 1                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.995                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1274                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 69.9                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 18.2                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

## **APPENDIX 6.4:**

### **EAP (2016) CONDITIONS FREEWAY MERGE/DIVERGE ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | I-15 Southbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | EAP 2016         |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 297 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 220              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2921             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 236              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2921            | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.990            | 1.00          | 3207                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 236             | 0.92                            | Level                | 8                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.962            | 1.00          | 267                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 297             | 0.92                            | Level                | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.952            | 1.00          | 339                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.668 using Equation (Exhibit 13-7)<br>$V_{12} =$ 2230 pc/h<br>$V_3$ or $V_{av34}$ 977 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3207             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 2940                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7200             | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 267                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2100             | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2230             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 21.5 (pc/mi/ln)<br>LOS =      C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                     |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.322 (Exhibit 13-12)<br>$S_R =$ 61.0 mph (Exhibit 13-12)<br>$S_0 =$ 76.8 mph (Exhibit 13-12)<br>$S =$ 65.1 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Southbound |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans        |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 | AM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | EAP 2016        |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2075$ ft<br><br>$V_u = 236$ veh/h                                                                                                                                                                                                                                                                                             |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3               |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1               |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 230             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2686            |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 297             |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$        | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2686            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995           | 1.00          | 2934                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 297             | 0.92                            | Level    | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.952           | 1.00          | 339                                                                                                                                                                                                |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 236             | 0.92                            | Level    | 8                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.962           | 1.00          | 267                                                                                                                                                                                                |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 753.94$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.584$ using Equation (Exhibit 13-6)<br>$V_{12} = 1713$ pc/h<br>$V_3$ or $V_{av34} = 1221$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 1713$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3273            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2052            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 19.9$ (pc/mi/ln)<br>LOS = B (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |               |                                                                                                                                                                                                    |            |
| $M_S = 0.331$ (Exhibit 13-11)<br>$S_R = 60.7$ mph (Exhibit 13-11)<br>$S_0 = 67.4$ mph (Exhibit 13-11)<br>$S = 63.1$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                 |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Northbound |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans        |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | AM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | EAP 2016        |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2130$ ft<br><br>$V_u = 193$ veh/h                                                                                                                                                                                                                                                                                              |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3               |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1               |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 800             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3397            |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 153             |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$        | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3397            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995           | 1.00          | 3711                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 153             | 0.92                            | Level    | 9                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.957           | 1.00          | 174                                                                                                                                                                                                |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 193             | 0.92                            | Level    | 14                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.935           | 1.00          | 224                                                                                                                                                                                                |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 1137.99$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.600$ using Equation (Exhibit 13-6)<br>$V_{12} = 2226$ pc/h<br>$V_3$ or $V_{av34} = 1485$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 2226$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3885            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2400            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 19.1$ (pc/mi/ln)<br>LOS = B (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |               |                                                                                                                                                                                                    |            |
| $M_S = 0.292$ (Exhibit 13-11)<br>$S_R = 61.8$ mph (Exhibit 13-11)<br>$S_0 = 66.5$ mph (Exhibit 13-11)<br>$S = 63.5$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                 |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | EAP 2016         |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 153 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 225              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3589             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 193              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3589            | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990            | 1.00          | 3940                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 193             | 0.92                            | Level                | 14                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.935            | 1.00          | 224                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 153             | 0.92                            | Level                | 9                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.957            | 1.00          | 174                                                                                                                                                                                                                    |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                 |                      |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.651 using Equation (Exhibit 13-7)<br>$V_{12} =$ 2644 pc/h<br>$V_3$ or $V_{av34}$ 1296 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3940             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 3716                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200             | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 224                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100             | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2644             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 25.0 (pc/mi/ln)<br>LOS =      C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.318 (Exhibit 13-12)<br>$S_R =$ 61.1 mph (Exhibit 13-12)<br>$S_0 =$ 75.6 mph (Exhibit 13-12)<br>$S =$ 65.2 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |



| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | EAP 2016         |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 272 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 220              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4342             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 207              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4342            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995            | 1.00          | 4743                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 207             | 0.92                            | Level                | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.980            | 1.00          | 229                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 272             | 0.92                            | Level                | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.980            | 1.00          | 302                                                                                                                                                                                                                    |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                 |                      |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.631 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3077 pc/h<br>$V_3$ or $V_{av34}$ 1666 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4743             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 4514                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200             | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 229                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100             | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3077             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 28.7 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.319 (Exhibit 13-12)<br>$S_R =$ 61.1 mph (Exhibit 13-12)<br>$S_0 =$ 74.2 mph (Exhibit 13-12)<br>$S =$ 65.1 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Southbound |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans        |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | PM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | EAP 2016        |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2075$ ft<br><br>$V_u = 207$ veh/h                                                                                                                                                                                                                                                                                              |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3               |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1               |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 230             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 4135            |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 272             |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$        | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4135            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995           | 1.00          | 4517                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 272             | 0.92                            | Level    | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.980           | 1.00          | 302                                                                                                                                                                                                |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 207             | 0.92                            | Level    | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.980           | 1.00          | 229                                                                                                                                                                                                |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 1084.79$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.584$ using Equation (Exhibit 13-6)<br>$V_{12} = 2638$ pc/h<br>$V_3$ or $V_{av34} = 1879$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 2638$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4819            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2940            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 26.8$ (pc/mi/ln)<br>LOS = C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |               |                                                                                                                                                                                                    |            |
| $M_S = 0.374$ (Exhibit 13-11)<br>$S_R = 59.5$ mph (Exhibit 13-11)<br>$S_0 = 65.0$ mph (Exhibit 13-11)<br>$S = 61.6$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                 |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Northbound |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans        |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | PM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | EAP 2016        |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2130$ ft<br><br>$V_u = 332$ veh/h                                                                                                                                                                                                                                                                                              |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3               |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1               |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 800             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3165            |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 165             |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$        | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3165            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995           | 1.00          | 3457                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 165             | 0.92                            | Level    | 6                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.971           | 1.00          | 185                                                                                                                                                                                                |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 332             | 0.92                            | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.990           | 1.00          | 364                                                                                                                                                                                                |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 1085.99$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.600$ using Equation (Exhibit 13-6)<br>$V_{12} = 2074$ pc/h<br>$V_3$ or $V_{av34} = 1383$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 2074$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 3642            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 2259            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 18.0$ (pc/mi/ln)<br>LOS = B (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |               |                                                                                                                                                                                                    |            |
| $M_S = 0.286$ (Exhibit 13-11)<br>$S_R = 62.0$ mph (Exhibit 13-11)<br>$S_0 = 66.8$ mph (Exhibit 13-11)<br>$S = 63.7$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                 |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | EAP 2016         |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 165 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 225              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3498             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 332              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3498            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995            | 1.00          | 3821                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 332             | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990            | 1.00          | 364                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 165             | 0.92                            | Level                | 6                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.971            | 1.00          | 185                                                                                                                                                                                                                    |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                 |                      |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.648 using Equation (Exhibit 13-7)<br>$V_{12} =$ 2603 pc/h<br>$V_3$ or $V_{av34}$ 1218 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3821             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 3457                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200             | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 364                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100             | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2603             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 24.6 (pc/mi/ln)<br>LOS =      C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.331 (Exhibit 13-12)<br>$S_R =$ 60.7 mph (Exhibit 13-12)<br>$S_0 =$ 75.9 mph (Exhibit 13-12)<br>$S =$ 64.9 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |

## **APPENDIX 7.1:**

### **EAPC (2016) CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| Intersection              |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Intersection Delay, s/veh | 62.7 |      |      |      |      |      |      |      |      |      |      |      |
| Intersection LOS          | F    |      |      |      |      |      |      |      |      |      |      |      |
| Movement                  | EBU  | EBL  | EBT  | EBR  | WBU  | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
| Vol, veh/h                | 0    | 0    | 546  | 479  | 0    | 127  | 402  | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor          | 0.92 | 0.89 | 0.89 | 0.89 | 0.92 | 0.89 | 0.89 | 0.89 | 0.92 | 0.89 | 0.89 | 0.89 |
| Heavy Vehicles, %         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                 | 0    | 0    | 613  | 538  | 0    | 143  | 452  | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes           | 0    | 0    | 1    | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |

| Approach                   |  | EB   | WB   |
|----------------------------|--|------|------|
| Opposing Approach          |  | WB   | EB   |
| Opposing Lanes             |  | 2    | 2    |
| Conflicting Approach Left  |  | SB   |      |
| Conflicting Lanes Left     |  | 1    | 0    |
| Conflicting Approach Right |  |      | SB   |
| Conflicting Lanes Right    |  | 0    | 1    |
| HCM Control Delay          |  | 67.3 | 51.1 |
| HCM LOS                    |  | F    | F    |

| Lane                   | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |
|------------------------|-------|-------|-------|-------|-------|
| Vol Left, %            | 0%    | 0%    | 100%  | 0%    | 65%   |
| Vol Thru, %            | 100%  | 0%    | 0%    | 100%  | 2%    |
| Vol Right, %           | 0%    | 100%  | 0%    | 0%    | 33%   |
| Sign Control           | Stop  | Stop  | Stop  | Stop  | Stop  |
| Traffic Vol by Lane    | 546   | 479   | 127   | 402   | 520   |
| LT Vol                 | 0     | 0     | 127   | 0     | 339   |
| Through Vol            | 546   | 0     | 0     | 402   | 8     |
| RT Vol                 | 0     | 479   | 0     | 0     | 173   |
| Lane Flow Rate         | 613   | 538   | 143   | 452   | 584   |
| Geometry Grp           | 7     | 7     | 7     | 7     | 2     |
| Degree of Util (X)     | 1     | 1     | 0.326 | 0.97  | 1     |
| Departure Headway (Hd) | 7.567 | 6.843 | 8.231 | 7.729 | 6.902 |
| Convergence, Y/N       | Yes   | Yes   | Yes   | Yes   | Yes   |
| Cap                    | 479   | 527   | 437   | 470   | 532   |
| Service Time           | 5.334 | 4.634 | 5.997 | 5.497 | 4.902 |
| HCM Lane V/C Ratio     | 1.28  | 1.021 | 0.327 | 0.962 | 1.098 |
| HCM Control Delay      | 68.9  | 65.5  | 15    | 62.5  | 65.6  |
| HCM Lane LOS           | F     | F     | B     | F     | F     |
| HCM 95th-tile Q        | 13.3  | 14    | 1.4   | 12.1  | 14    |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 339  | 8    | 173  |
| Peak Hour Factor  | 0.92 | 0.89 | 0.89 | 0.89 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 381  | 9    | 194  |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 65.6

HCM LOS F

Lane



**Intersection**

Int Delay, s/veh 94.7

| Movement                 | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Vol, veh/h               | 165  | 721  | 0    | 0    | 309  | 214  | 220  | 1    | 282  | 0    | 0    | 0    |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -    | -    | None | -    | -    | None | -    | -    | None | -    | -    | None |
| Storage Length           | 230  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Grade, %                 | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   | 75   |
| Heavy Vehicles, %        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 220  | 961  | 0    | 0    | 412  | 285  | 293  | 1    | 376  | 0    | 0    | 0    |

| Major/Minor          | Major1 |   |   | Major2 |   |   | Minor1 |      |     |
|----------------------|--------|---|---|--------|---|---|--------|------|-----|
| Conflicting Flow All | 697    | 0 | 0 | 961    | 0 | 0 | 1956   | 2098 | 961 |
| Stage 1              | -      | - | - | -      | - | - | 1401   | 1401 | -   |
| Stage 2              | -      | - | - | -      | - | - | 555    | 697  | -   |
| Critical Hdwy        | 4.1    | - | - | 4.1    | - | - | 3.5    | 3.5  | 3.5 |
| Critical Hdwy Stg 1  | -      | - | - | -      | - | - | 5.4    | 5.5  | -   |
| Critical Hdwy Stg 2  | -      | - | - | -      | - | - | 5.4    | 5.5  | -   |
| Follow-up Hdwy       | 2.2    | - | - | 2.2    | - | - | 3.5    | 4    | 3.3 |
| Pot Cap-1 Maneuver   | 909    | - | - | 724    | - | - | 343    | 302  | 645 |
| Stage 1              | -      | - | - | -      | - | - | ~ 230  | 209  | -   |
| Stage 2              | -      | - | - | -      | - | - | 579    | 446  | -   |
| Platoon blocked, %   | -      | - | - | -      | - | - | -      | -    | -   |
| Mov Cap-1 Maneuver   | 909    | - | - | 724    | - | - | ~ 260  | 0    | 645 |
| Mov Cap-2 Maneuver   | -      | - | - | -      | - | - | ~ 260  | 0    | -   |
| Stage 1              | -      | - | - | -      | - | - | ~ 174  | 0    | -   |
| Stage 2              | -      | - | - | -      | - | - | 579    | 0    | -   |

| Approach             | EB  | WB | NB       |
|----------------------|-----|----|----------|
| HCM Control Delay, s | 1.9 | 0  | \$ 356.8 |
| HCM LOS              |     |    | F        |

| Minor Lane/Major Mvmt | NBLn1    | EBL   | EBT | EBR | WBL | WBT | WBR |
|-----------------------|----------|-------|-----|-----|-----|-----|-----|
| Capacity (veh/h)      | 391      | 909   | -   | -   | 724 | -   | -   |
| HCM Lane V/C Ratio    | 1.715    | 0.242 | -   | -   | -   | -   | -   |
| HCM Control Delay (s) | \$ 356.8 | 10.2  | -   | -   | 0   | -   | -   |
| HCM Lane LOS          | F        | B     | -   | -   | A   | -   | -   |
| HCM 95th %tile Q(veh) | 41.1     | 0.9   | -   | -   | 0   | -   | -   |

**Notes**

~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

| Intersection             |        |      |        |      |        |       |
|--------------------------|--------|------|--------|------|--------|-------|
| Int Delay, s/veh         | 0.7    |      |        |      |        |       |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR   |
| Vol, veh/h               | 0      | 1003 | 450    | 0    | 0      | 73    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0     |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop  |
| RT Channelized           | -      | None | -      | None | -      | Yield |
| Storage Length           | -      | -    | -      | -    | -      | 0     |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -     |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -     |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67    |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0     |
| Mvmt Flow                | 0      | 1497 | 672    | 0    | 0      | 109   |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |       |
| Conflicting Flow All     | 672    | 0    | -      | 0    | 2169   | 672   |
| Stage 1                  | -      | -    | -      | -    | 672    | -     |
| Stage 2                  | -      | -    | -      | -    | 1497   | -     |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2   |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -     |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -     |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3   |
| Pot Cap-1 Maneuver       | 928    | -    | -      | -    | 52     | 459   |
| Stage 1                  | -      | -    | -      | -    | 511    | -     |
| Stage 2                  | -      | -    | -      | -    | 207    | -     |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -     |
| Mov Cap-1 Maneuver       | 928    | -    | -      | -    | 52     | 459   |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 52     | -     |
| Stage 1                  | -      | -    | -      | -    | 511    | -     |
| Stage 2                  | -      | -    | -      | -    | 207    | -     |
| Approach                 | EB     |      | WB     |      | SB     |       |
| HCM Control Delay, s     | 0      |      | 0      |      | 15.3   |       |
| HCM LOS                  |        |      |        |      | C      |       |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |       |
| Capacity (veh/h)         | 928    | -    | -      | -    | 459    |       |
| HCM Lane V/C Ratio       | -      | -    | -      | -    | 0.237  |       |
| HCM Control Delay (s)    | 0      | -    | -      | -    | 15.3   |       |
| HCM Lane LOS             | A      | -    | -      | -    | C      |       |
| HCM 95th %tile Q(veh)    | 0      | -    | -      | -    | 0.9    |       |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.6    |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 82     | 921  | 450    | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 122    | 1375 | 672    | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 672    | 0    | -      | 0    | 2291   | 672  |
| Stage 1                  | -      | -    | -      | -    | 672    | -    |
| Stage 2                  | -      | -    | -      | -    | 1619   | -    |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -    |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3  |
| Pot Cap-1 Maneuver       | 928    | -    | -      | -    | 44     | 459  |
| Stage 1                  | -      | -    | -      | -    | 511    | -    |
| Stage 2                  | -      | -    | -      | -    | 180    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 928    | -    | -      | -    | 38     | 459  |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 38     | -    |
| Stage 1                  | -      | -    | -      | -    | 511    | -    |
| Stage 2                  | -      | -    | -      | -    | 156    | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 0.8    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 928    | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.132  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 9.5    | -    | -      | -    | 0      |      |
| HCM Lane LOS             | A      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0.5    | -    | -      | -    | -      |      |

**Intersection**

Intersection Delay, s/veh 61

Intersection LOS F

| Movement          | EBU  | EBL  | EBT  | EBR  | WBU  | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
|-------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Vol, veh/h        | 0    | 0    | 499  | 534  | 0    | 66   | 720  | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor  | 0.92 | 0.95 | 0.95 | 0.95 | 0.92 | 0.95 | 0.95 | 0.95 | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 0    | 525  | 562  | 0    | 69   | 758  | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes   | 0    | 0    | 1    | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |

**Approach**

EB

WB

Opposing Approach

WB

EB

Opposing Lanes

2

2

Conflicting Approach Left

SB

Conflicting Lanes Left

1

0

Conflicting Approach Right

SB

Conflicting Lanes Right

0

1

HCM Control Delay

66.1

64.3

HCM LOS

F

F

| Lane                   | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |
|------------------------|-------|-------|-------|-------|-------|
| Vol Left, %            | 0%    | 0%    | 100%  | 0%    | 26%   |
| Vol Thru, %            | 100%  | 0%    | 0%    | 100%  | 1%    |
| Vol Right, %           | 0%    | 100%  | 0%    | 0%    | 73%   |
| Sign Control           | Stop  | Stop  | Stop  | Stop  | Stop  |
| Traffic Vol by Lane    | 499   | 534   | 66    | 720   | 470   |
| LT Vol                 | 0     | 0     | 66    | 0     | 124   |
| Through Vol            | 499   | 0     | 0     | 720   | 3     |
| RT Vol                 | 0     | 534   | 0     | 0     | 343   |
| Lane Flow Rate         | 525   | 562   | 69    | 758   | 495   |
| Geometry Grp           | 7     | 7     | 7     | 7     | 2     |
| Degree of Util (X)     | 1     | 1     | 0.157 | 1     | 0.904 |
| Departure Headway (Hd) | 7.418 | 6.715 | 8.16  | 7.659 | 6.58  |
| Convergence, Y/N       | Yes   | Yes   | Yes   | Yes   | Yes   |
| Cap                    | 494   | 545   | 443   | 485   | 554   |
| Service Time           | 5.119 | 4.416 | 5.86  | 5.359 | 4.609 |
| HCM Lane V/C Ratio     | 1.063 | 1.031 | 0.156 | 1.563 | 0.894 |
| HCM Control Delay      | 67.9  | 64.4  | 12.4  | 69.1  | 44.2  |
| HCM Lane LOS           | F     | F     | B     | F     | E     |
| HCM 95th-tile Q        | 13.5  | 14.2  | 0.6   | 13.3  | 10.7  |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 124  | 3    | 343  |
| Peak Hour Factor  | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 131  | 3    | 361  |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 44.2

HCM LOS E

Lane

| Intersection               |          |                        |      |                            |      |      |                                |      |      |      |      |      |
|----------------------------|----------|------------------------|------|----------------------------|------|------|--------------------------------|------|------|------|------|------|
| Int Delay, s/veh           |          | 174.7                  |      |                            |      |      |                                |      |      |      |      |      |
|                            |          |                        |      |                            |      |      |                                |      |      |      |      |      |
| Movement                   | EBL      | EBT                    | EBR  | WBL                        | WBT  | WBR  | NBL                            | NBT  | NBR  | SBL  | SBT  | SBR  |
| Vol, veh/h                 | 324      | 301                    | 0    | 0                          | 225  | 65   | 561                            | 3    | 79   | 0    | 0    | 0    |
| Conflicting Peds, #/hr     | 0        | 0                      | 0    | 0                          | 0    | 0    | 0                              | 0    | 0    | 0    | 0    | 0    |
| Sign Control               | Free     | Free                   | Free | Free                       | Free | Free | Stop                           | Stop | Stop | Stop | Stop | Stop |
| RT Channelized             | -        | -                      | None | -                          | -    | None | -                              | -    | None | -    | -    | None |
| Storage Length             | 230      | -                      | -    | -                          | -    | -    | -                              | -    | -    | -    | -    | -    |
| Veh in Median Storage, #   | -        | 0                      | -    | -                          | 0    | -    | -                              | 0    | -    | -    | 0    | -    |
| Grade, %                   | -        | 0                      | -    | -                          | 0    | -    | -                              | 0    | -    | -    | 0    | -    |
| Peak Hour Factor           | 90       | 90                     | 90   | 90                         | 90   | 90   | 90                             | 90   | 90   | 90   | 90   | 90   |
| Heavy Vehicles, %          | 0        | 0                      | 0    | 0                          | 0    | 0    | 0                              | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                  | 360      | 334                    | 0    | 0                          | 250  | 72   | 623                            | 3    | 88   | 0    | 0    | 0    |
|                            |          |                        |      |                            |      |      |                                |      |      |      |      |      |
| Major/Minor                | Major1   |                        |      | Major2                     |      |      | Minor1                         |      |      |      |      |      |
| Conflicting Flow All       | 322      | 0                      | 0    | 334                        | 0    | 0    | 1340                           | 1376 | 334  |      |      |      |
| Stage 1                    | -        | -                      | -    | -                          | -    | -    | 1054                           | 1054 | -    |      |      |      |
| Stage 2                    | -        | -                      | -    | -                          | -    | -    | 286                            | 322  | -    |      |      |      |
| Critical Hdwy              | 4.1      | -                      | -    | 4.1                        | -    | -    | 3.5                            | 3.5  | 3.5  |      |      |      |
| Critical Hdwy Stg 1        | -        | -                      | -    | -                          | -    | -    | 5.4                            | 5.5  | -    |      |      |      |
| Critical Hdwy Stg 2        | -        | -                      | -    | -                          | -    | -    | 5.4                            | 5.5  | -    |      |      |      |
| Follow-up Hdwy             | 2.2      | -                      | -    | 2.2                        | -    | -    | 3.5                            | 4    | 3.3  |      |      |      |
| Pot Cap-1 Maneuver         | 1249     | -                      | -    | 1237                       | -    | -    | ~ 500                          | 461  | 915  |      |      |      |
| Stage 1                    | -        | -                      | -    | -                          | -    | -    | ~ 338                          | 305  | -    |      |      |      |
| Stage 2                    | -        | -                      | -    | -                          | -    | -    | 767                            | 655  | -    |      |      |      |
| Platoon blocked, %         |          | -                      | -    |                            | -    | -    |                                |      |      |      |      |      |
| Mov Cap-1 Maneuver         | 1249     | -                      | -    | 1237                       | -    | -    | ~ 356                          | 0    | 915  |      |      |      |
| Mov Cap-2 Maneuver         | -        | -                      | -    | -                          | -    | -    | ~ 356                          | 0    | -    |      |      |      |
| Stage 1                    | -        | -                      | -    | -                          | -    | -    | ~ 241                          | 0    | -    |      |      |      |
| Stage 2                    | -        | -                      | -    | -                          | -    | -    | 767                            | 0    | -    |      |      |      |
|                            |          |                        |      |                            |      |      |                                |      |      |      |      |      |
| Approach                   | EB       |                        |      | WB                         |      |      | NB                             |      |      |      |      |      |
| HCM Control Delay, s       | 4.7      |                        |      | 0                          |      |      | \$ 418.7                       |      |      |      |      |      |
| HCM LOS                    |          |                        |      |                            |      |      | F                              |      |      |      |      |      |
|                            |          |                        |      |                            |      |      |                                |      |      |      |      |      |
| Minor Lane/Major Mvmt      | NBLn1    | EBL                    | EBT  | EBR                        | WBL  | WBT  | WBR                            |      |      |      |      |      |
| Capacity (veh/h)           | 385      | 1249                   | -    | -                          | 1237 | -    | -                              |      |      |      |      |      |
| HCM Lane V/C Ratio         | 1.856    | 0.288                  | -    | -                          | -    | -    | -                              |      |      |      |      |      |
| HCM Control Delay (s)      | \$ 418.7 | 9                      | -    | -                          | 0    | -    | -                              |      |      |      |      |      |
| HCM Lane LOS               | F        | A                      | -    | -                          | A    | -    | -                              |      |      |      |      |      |
| HCM 95th %tile Q(veh)      | 46.9     | 1.2                    | -    | -                          | 0    | -    | -                              |      |      |      |      |      |
| Notes                      |          |                        |      |                            |      |      |                                |      |      |      |      |      |
| ~: Volume exceeds capacity |          | \$: Delay exceeds 300s |      | +: Computation Not Defined |      |      | *: All major volume in platoon |      |      |      |      |      |

| Intersection             |        |      |        |      |        |       |
|--------------------------|--------|------|--------|------|--------|-------|
| Int Delay, s/veh         | 0.5    |      |        |      |        |       |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR   |
| Vol, veh/h               | 0      | 380  | 259    | 0    | 0      | 32    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0     |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop  |
| RT Channelized           | -      | None | -      | None | -      | Yield |
| Storage Length           | -      | -    | -      | -    | -      | 0     |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -     |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -     |
| Peak Hour Factor         | 88     | 88   | 88     | 88   | 88     | 88    |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0     |
| Mvmt Flow                | 0      | 432  | 294    | 0    | 0      | 36    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |       |
| Conflicting Flow All     | 294    | 0    | -      | 0    | 726    | 294   |
| Stage 1                  | -      | -    | -      | -    | 294    | -     |
| Stage 2                  | -      | -    | -      | -    | 432    | -     |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2   |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -     |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -     |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3   |
| Pot Cap-1 Maneuver       | 1279   | -    | -      | -    | 394    | 750   |
| Stage 1                  | -      | -    | -      | -    | 761    | -     |
| Stage 2                  | -      | -    | -      | -    | 659    | -     |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -     |
| Mov Cap-1 Maneuver       | 1279   | -    | -      | -    | 394    | 750   |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 394    | -     |
| Stage 1                  | -      | -    | -      | -    | 761    | -     |
| Stage 2                  | -      | -    | -      | -    | 659    | -     |
| Approach                 | EB     |      | WB     |      | SB     |       |
| HCM Control Delay, s     | 0      |      | 0      |      | 10     |       |
| HCM LOS                  |        |      |        |      | B      |       |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |       |
| Capacity (veh/h)         | 1279   | -    | -      | -    | 750    |       |
| HCM Lane V/C Ratio       | -      | -    | -      | -    | 0.048  |       |
| HCM Control Delay (s)    | 0      | -    | -      | -    | 10     |       |
| HCM Lane LOS             | A      | -    | -      | -    | B      |       |
| HCM 95th %tile Q(veh)    | 0      | -    | -      | -    | 0.2    |       |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.4    |      |        |      |        |      |
|                          |        |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 30     | 349  | 259    | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 84     | 84   | 84     | 84   | 84     | 84   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 36     | 415  | 308    | 0    | 0      | 0    |
|                          |        |      |        |      |        |      |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 308    | 0    | -      | 0    | 795    | 308  |
| Stage 1                  | -      | -    | -      | -    | 308    | -    |
| Stage 2                  | -      | -    | -      | -    | 487    | -    |
| Critical Hdwy            | 4.1    | -    | -      | -    | 6.4    | 6.2  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 5.4    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 5.4    | -    |
| Follow-up Hdwy           | 2.2    | -    | -      | -    | 3.5    | 3.3  |
| Pot Cap-1 Maneuver       | 1264   | -    | -      | -    | 359    | 737  |
| Stage 1                  | -      | -    | -      | -    | 750    | -    |
| Stage 2                  | -      | -    | -      | -    | 622    | -    |
| Platoon blocked, %       |        | -    | -      | -    |        |      |
| Mov Cap-1 Maneuver       | 1264   | -    | -      | -    | 349    | 737  |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 349    | -    |
| Stage 1                  | -      | -    | -      | -    | 750    | -    |
| Stage 2                  | -      | -    | -      | -    | 604    | -    |
|                          |        |      |        |      |        |      |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 0.6    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
|                          |        |      |        |      |        |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 1264   | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.028  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 7.9    | -    | -      | -    | 0      |      |
| HCM Lane LOS             | A      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0.1    | -    | -      | -    | -      |      |



## **APPENDIX 7.2:**

### **EAPC (2016) CONDITIONS TRAFFIC SIGNAL WARRANT ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

### Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **EAPC (2016) Conditions - Weekday PM Peak Hour**

Major Street Name = **Nichols Road**

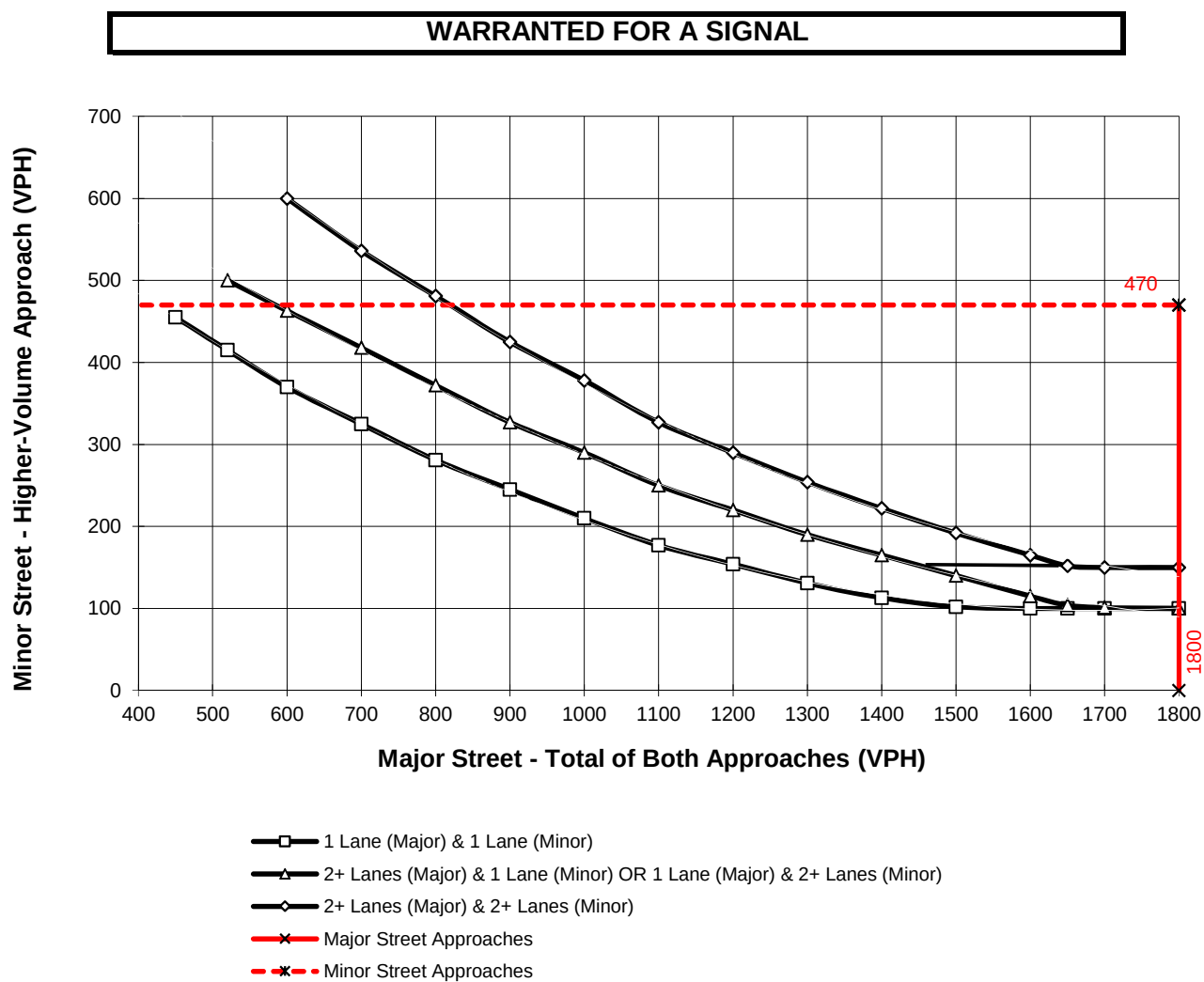
Total of Both Approaches (VPH) = **1819**

Number of Approach Lanes on Major Street = **1**

Minor Street Name = **I-15 Southbound Ramps**

High Volume Approach (VPH) = **470**

Number of Approach Lanes On Minor Street = **1**



\*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes  
and 100 vph applies as the lower threshold for a minor-street approach with one lane

### Figure 4C-3. Warrant 3, Peak Hour

Traffic Conditions = **EAPC (2016) Conditions - Weekday AM Peak Hour**

Major Street Name = **Nichols Road**

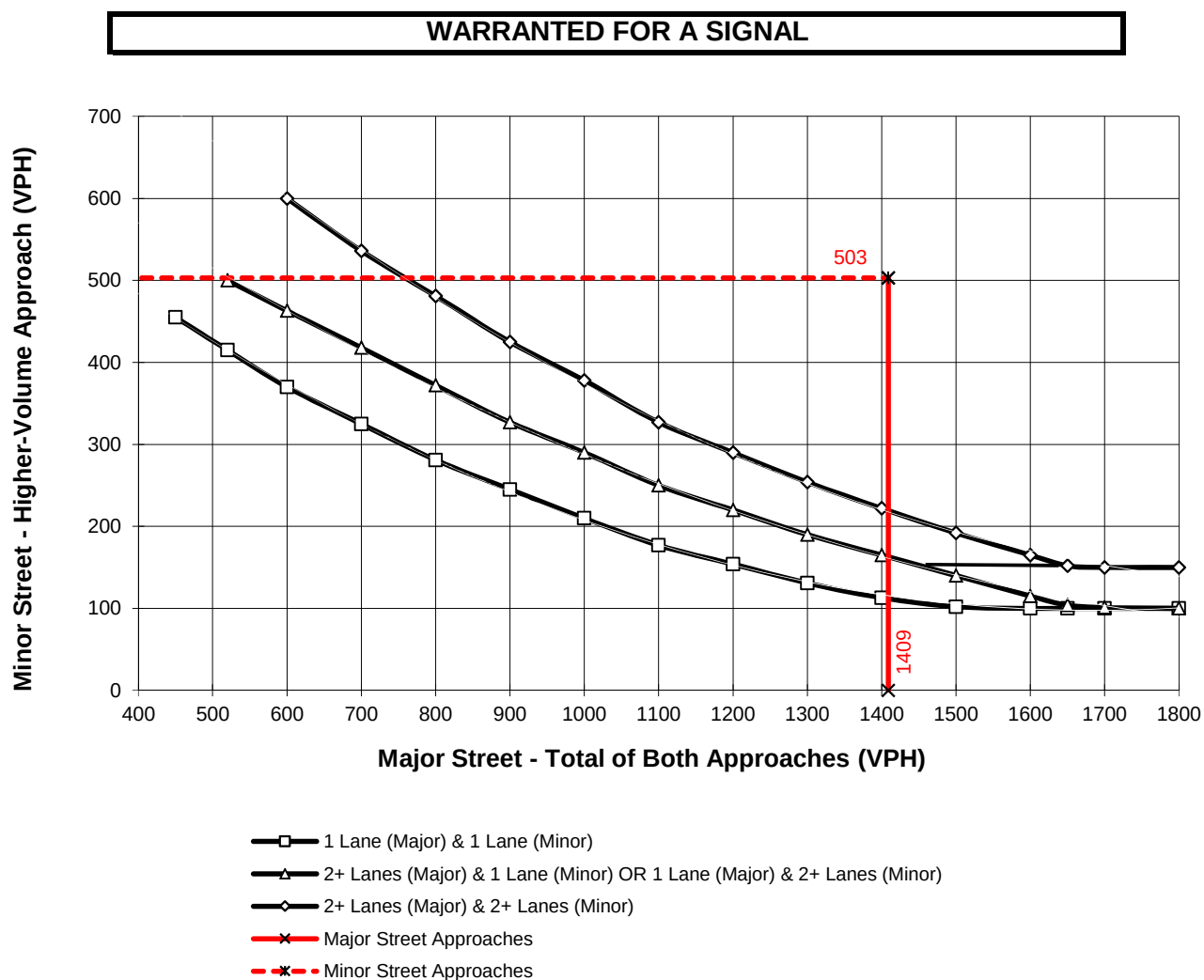
Total of Both Approaches (VPH) = **1409**

Number of Approach Lanes on Major Street = **1**

Minor Street Name = **I-15 Northbound Ramps**

High Volume Approach (VPH) = **503**

Number of Approach Lanes On Minor Street = **1**



\*Note: 150 vph applies as the lower threshold for a minor-street approach with two or more lanes  
and 100 vph applies as the lower threshold for a minor-street approach with one lane

**APPENDIX 7.3:**

**EAPC (2016) CONDITIONS BASIC FREEWAY SEGMENT ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/11/2015                   |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year EAPC 2016                                                                           |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3056                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1163                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 16.6                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/11/2015                   |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year EAPC 2016                                                                           |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3150                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1204                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 70.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 17.2                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | B                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |



| BASIC FREEWAY SEGMENTS WORKSHEET                                                                                       |                             |          |                                                                                                   |                                |     |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------|---------------------------------------------------------------------------------------------------|--------------------------------|-----|
| <b>General Information</b>                                                                                             |                             |          | <b>Site Information</b>                                                                           |                                |     |
| Analyst                                                                                                                | CHS                         |          | Highway/Direction of Travel <i>I-15 Northbound</i>                                                |                                |     |
| Agency or Company                                                                                                      | Urban Crossroads, Inc.      |          | From/To <i>North of Nichols Road</i>                                                              |                                |     |
| Date Performed                                                                                                         | 6/11/2015                   |          | Jurisdiction <i>Caltrans</i>                                                                      |                                |     |
| Analysis Time Period                                                                                                   | AM Peak Hour                |          | Analysis Year <i>EAPC 2016</i>                                                                    |                                |     |
| Project Description <i>Nichols Mine Expansion TIA (JN 09599)</i>                                                       |                             |          |                                                                                                   |                                |     |
| <input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data |                             |          |                                                                                                   |                                |     |
| <b>Flow Inputs</b>                                                                                                     |                             |          |                                                                                                   |                                |     |
| Volume, V                                                                                                              | 4727                        | veh/h    | Peak-Hour Factor, PHF                                                                             | 0.92                           |     |
| AADT                                                                                                                   |                             | veh/day  | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                             |     |
| Peak-Hr Prop. of AADT, K                                                                                               |                             |          | %RVs, P <sub>R</sub>                                                                              | 0                              |     |
| Peak-Hr Direction Prop, D                                                                                              |                             |          | General Terrain:                                                                                  | Level                          |     |
| DDHV = AADT x K x D                                                                                                    |                             | veh/h    | Grade % Length                                                                                    | mi                             |     |
| Up/Down %                                                                                                              |                             |          |                                                                                                   |                                |     |
| <b>Calculate Flow Adjustments</b>                                                                                      |                             |          |                                                                                                   |                                |     |
| f <sub>p</sub>                                                                                                         | 1.00                        |          | E <sub>R</sub>                                                                                    | 1.2                            |     |
| E <sub>T</sub>                                                                                                         | 1.5                         |          | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                          |     |
| <b>Speed Inputs</b>                                                                                                    |                             |          | <b>Calc Speed Adj and FFS</b>                                                                     |                                |     |
| Lane Width                                                                                                             |                             | ft       |                                                                                                   |                                |     |
| Rt-Side Lat. Clearance                                                                                                 |                             | ft       | f <sub>LW</sub>                                                                                   | mph                            |     |
| Number of Lanes, N                                                                                                     | 3                           |          | f <sub>LC</sub>                                                                                   | mph                            |     |
| Total Ramp Density, TRD                                                                                                |                             | ramps/mi | TRD Adjustment                                                                                    | mph                            |     |
| FFS (measured)                                                                                                         | 70.0                        | mph      | FFS                                                                                               | 70.0                           | mph |
| Base free-flow Speed, BFFS                                                                                             |                             | mph      |                                                                                                   |                                |     |
| <b>LOS and Performance Measures</b>                                                                                    |                             |          | <b>Design (N)</b>                                                                                 |                                |     |
| <u>Operational (LOS)</u>                                                                                               |                             |          | <u>Design (N)</u>                                                                                 |                                |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                                            |                             |          | Design LOS                                                                                        |                                |     |
|                                                                                                                        | 1807                        | pc/h/ln  | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                |     |
| x f <sub>p</sub> )                                                                                                     |                             |          | x f <sub>p</sub> )                                                                                |                                |     |
| S                                                                                                                      | 65.7                        | mph      | S                                                                                                 |                                |     |
| D = v <sub>p</sub> / S                                                                                                 | 27.5                        | pc/mi/ln | D = v <sub>p</sub> / S                                                                            |                                |     |
| LOS                                                                                                                    | D                           |          | Required Number of Lanes, N                                                                       |                                |     |
| <b>Glossary</b>                                                                                                        |                             |          | <b>Factor Location</b>                                                                            |                                |     |
| N - Number of lanes                                                                                                    | S - Speed                   |          | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8 |     |
| V - Hourly volume                                                                                                      | D - Density                 |          | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9 |     |
| v <sub>p</sub> - Flow rate                                                                                             | FFS - Free-flow speed       |          | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11               |     |
| LOS - Level of service                                                                                                 | BFFS - Base free-flow speed |          | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                |     |
| DDHV - Directional design hour volume                                                                                  |                             |          |                                                                                                   |                                |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/11/2015                   |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year EAPC 2016                                                                           |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4850                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1854                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 65.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 28.5                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | D                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/11/2015                   |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year EAPC 2016                                                                           |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4466                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1699                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 67.1                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 25.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/11/2015                   |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year EAPC 2016                                                                           |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4599                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1750                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 66.5                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 26.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | D                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/11/2015                   |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year EAPC 2016                                                                           |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4886                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1868                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 64.8                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 28.8                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | D                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/11/2015                   |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year EAPC 2016                                                                           |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 5137                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1954                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 63.4                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 30.8                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | D                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

**APPENDIX 7.4:**

**EAPC (2016) CONDITIONS FREEWAY MERGE/DIVERGE ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank



| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/11/2015                       |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | EAPC 2016        |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 614 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 220              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3056             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 520              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3056            | 0.92                            | Level                | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.952            | 1.00          | 3488                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 520             | 0.92                            | Level                | 7                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.966            | 1.00          | 585                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 614             | 0.92                            | Level                | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.948            | 1.00          | 704                                                                                                                                                                                                                    |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                 |                      |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.646 using Equation (Exhibit 13-7)<br>$V_{12} =$ 2460 pc/h<br>$V_3$ or $V_{av34}$ 1028 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 3488             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 2903                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200             | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 585                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100             | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2460             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 23.4 (pc/mi/ln)<br>LOS =      C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.351 (Exhibit 13-12)<br>$S_R =$ 60.2 mph (Exhibit 13-12)<br>$S_0 =$ 76.7 mph (Exhibit 13-12)<br>$S =$ 64.3 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Southbound |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | 6/11/2015                       |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans        |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 | AM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | EAPC 2016       |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2075$ ft<br><br>$V_u = 520$ veh/h                                                                                                                                                                                                                                                                                             |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3               |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1               |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 230             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2536            |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 614             |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$        | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 2536            | 0.92                            | Level    | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.948           | 1.00          | 2908                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 614             | 0.92                            | Level    | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.948           | 1.00          | 704                                                                                                                                                                                                |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 520             | 0.92                            | Level    | 7                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.966           | 1.00          | 585                                                                                                                                                                                                |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 826.49$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.584$ using Equation (Exhibit 13-6)<br>$V_{12} = 1698$ pc/h<br>$V_3$ or $V_{av34} = 1210$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 1698$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3612            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual          | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 2402            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 22.4$ (pc/mi/ln)<br>LOS = C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                 |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |               |                                                                                                                                                                                                    |            |
| $M_S = 0.343$ (Exhibit 13-11)<br>$S_R = 60.4$ mph (Exhibit 13-11)<br>$S_0 = 67.4$ mph (Exhibit 13-11)<br>$S = 62.6$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                 |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                              |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                            |                |                                              |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            | CHS                                          |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Northbound                                                                                                                                                                                            |                |                                              |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | Urban Crossroads, Inc.                       |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp                                                                                                                                                                                            |                |                                              |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            | 6/11/2015                                    |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans                                                                                                                                                                                                   |                |                                              |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | AM Peak Hour                                 |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | EAPC 2016                                                                                                                                                                                                  |                |                                              |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2130 ft<br>V <sub>u</sub> = 503 veh/h                                                                                                                                                                                                                                                                                                                                                                                                   |            | Freeway Number of Lanes, N 3                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Number of Lanes, N 1                    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Acceleration Lane Length, L <sub>A</sub> 800 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Deceleration Lane Length L <sub>D</sub>      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Freeway Volume, V <sub>F</sub> 4347          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Volume, V <sub>R</sub> 380              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| Freeway Free-Flow Speed, S <sub>FF</sub> 70.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| Ramp Free-Flow Speed, S <sub>FR</sub> 45.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | V (Veh/hr) | PHF                                          | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub>                                                                                                                                                                                            | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub> |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4347       | 0.92                                         | Level    | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.948                                                                                                                                                                                                      | 1.00           | 4985                                         |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 380        | 0.92                                         | Level    | 7                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.966                                                                                                                                                                                                      | 1.00           | 427                                          |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 503        | 0.92                                         | Level    | 13                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.939                                                                                                                                                                                                      | 1.00           | 582                                          |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                              |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |                |                                              |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                              |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                            |                |                                              |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 1464.77 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.600 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 2991 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 1994 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 2991 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                              |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                            |                |                                              |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                              |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Capacity                                     |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                                                                                                                                                                                                     | Capacity       |                                              | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 5412       | Exhibit 13-8                                 |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                            | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                              |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                            | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                              |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                            | Exhibit 13-10  |                                              |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                              |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Max Desirable                                |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                                                                                                                                                                                                     | Max Desirable  |                                              | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3418       | Exhibit 13-8                                 | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            | Exhibit 13-8   |                                              |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                              |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                            |                |                                              |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 26.9 (pc/mi/ln)<br>LOS = C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                              |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                            |                |                                              |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                              |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                            |                |                                              |            |
| M <sub>S</sub> = 0.368 (Exhibit 13-11)<br>S <sub>R</sub> = 59.7 mph (Exhibit 13-11)<br>S <sub>0</sub> = 64.6 mph (Exhibit 13-11)<br>S = 61.4 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                              |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                            |                |                                              |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/11/2015                       |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | EAPC 2016        |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 380 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 225              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4850             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 503              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4850            | 0.92                            | Level                | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.948            | 1.00          | 5562                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 503             | 0.92                            | Level                | 13                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.939            | 1.00          | 582                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 380             | 0.92                            | Level                | 7                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.966            | 1.00          | 427                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.594 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3541 pc/h<br>$V_3$ or $V_{av34}$ 2021 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5562             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 4980                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200             | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 582                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100             | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3541             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 32.7 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.350 (Exhibit 13-12)<br>$S_R =$ 60.2 mph (Exhibit 13-12)<br>$S_0 =$ 72.8 mph (Exhibit 13-12)<br>$S =$ 64.2 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/11/2015                       |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | EAPC 2016        |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 603 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 220              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4466             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 470              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4466            | 0.92                            | Level                | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.952            | 1.00          | 5097                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 470             | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990            | 1.00          | 516                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 603             | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990            | 1.00          | 662                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.609 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3305 pc/h<br>$V_3$ or $V_{av34}$ 1792 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5097             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 4581                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200             | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 516                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100             | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3305             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 30.7 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.344 (Exhibit 13-12)<br>$S_R =$ 60.4 mph (Exhibit 13-12)<br>$S_0 =$ 73.7 mph (Exhibit 13-12)<br>$S =$ 64.5 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                |                                                                                                                                                                                                            |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            | CHS                                      |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Southbound |                |                                                                                                                                                                                                            |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | Urban Crossroads, Inc.                   |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp |                |                                                                                                                                                                                                            |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            | 6/11/2015                                |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans        |                |                                                                                                                                                                                                            |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | PM Peak Hour                             |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | EAPC 2016       |                |                                                                                                                                                                                                            |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2075 ft<br>V <sub>u</sub> = 470 veh/h                                                                                                                                                                                                                                                                                                                                                                                                   |            | Freeway Number of Lanes, N               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3               |                | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Number of Lanes, N                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1               |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Acceleration Lane Length, L <sub>A</sub> |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 230             |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Deceleration Lane Length L <sub>D</sub>  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Freeway Volume, V <sub>F</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3996            |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Volume, V <sub>R</sub>              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 603             |                |                                                                                                                                                                                                            |            |
| Freeway Free-Flow Speed, S <sub>FF</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                                          |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| Ramp Free-Flow Speed, S <sub>FR</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                          |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | V (Veh/hr) | PHF                                      | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub> | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub>                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3996       | 0.92                                     | Level    | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.948           | 1.00           | 4582                                                                                                                                                                                                       |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 603        | 0.92                                     | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.990           | 1.00           | 662                                                                                                                                                                                                        |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 470        | 0.92                                     | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.990           | 1.00           | 516                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                |                                                                                                                                                                                                            |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                |                                                                                                                                                                                                            |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 1175.74 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.584 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 2676 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 1906 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 2676 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                          |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                 |                |                                                                                                                                                                                                            |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                          |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Capacity                                 |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual          | Capacity       |                                                                                                                                                                                                            | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 5244       | Exhibit 13-8                             |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Exhibit 13-10  |                                                                                                                                                                                                            |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Max Desirable                            |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual          | Max Desirable  |                                                                                                                                                                                                            | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3338       | Exhibit 13-8                             | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8   |                                                                                                                                                                                                            |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                |                                                                                                                                                                                                            |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 29.8 (pc/mi/ln)<br>LOS = D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                                                                                                                                                                                                            |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                |                                                                                                                                                                                                            |            |
| M <sub>S</sub> = 0.410 (Exhibit 13-11)<br>S <sub>R</sub> = 58.5 mph (Exhibit 13-11)<br>S <sub>0</sub> = 64.9 mph (Exhibit 13-11)<br>S = 60.7 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                |                                                                                                                                                                                                            |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                |                                                                                                                                                                                                            |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            | CHS                                      |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Northbound |                |                                                                                                                                                                                                            |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | Urban Crossroads, Inc.                   |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp |                |                                                                                                                                                                                                            |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            | 6/11/2015                                |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans        |                |                                                                                                                                                                                                            |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | PM Peak Hour                             |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | EAPC 2016       |                |                                                                                                                                                                                                            |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2130 ft<br>V <sub>u</sub> = 643 veh/h                                                                                                                                                                                                                                                                                                                                                                                                   |            | Freeway Number of Lanes, N               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3               |                | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Number of Lanes, N                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1               |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Acceleration Lane Length, L <sub>A</sub> |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 800             |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Deceleration Lane Length L <sub>D</sub>  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Freeway Volume, V <sub>F</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4494            |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Volume, V <sub>R</sub>              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 392             |                |                                                                                                                                                                                                            |            |
| Freeway Free-Flow Speed, S <sub>FF</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                                          |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| Ramp Free-Flow Speed, S <sub>FR</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                          |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | V (Veh/hr) | PHF                                      | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub> | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub>                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4494       | 0.92                                     | Level    | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.948           | 1.00           | 5153                                                                                                                                                                                                       |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 392        | 0.92                                     | Level    | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.980           | 1.00           | 435                                                                                                                                                                                                        |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 643        | 0.92                                     | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.995           | 1.00           | 702                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                |                                                                                                                                                                                                            |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                |                                                                                                                                                                                                            |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                |                                                                                                                                                                                                            |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 1502.43 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.600 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 3091 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 2062 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 3091 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                          |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                 |                |                                                                                                                                                                                                            |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                          |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Capacity                                 |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual          | Capacity       |                                                                                                                                                                                                            | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 5588       | Exhibit 13-8                             |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Exhibit 13-10  |                                                                                                                                                                                                            |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Max Desirable                            |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual          | Max Desirable  |                                                                                                                                                                                                            | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3526       | Exhibit 13-8                             | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8   |                                                                                                                                                                                                            |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                |                                                                                                                                                                                                            |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 27.8 (pc/mi/ln)<br>LOS = C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                |                                                                                                                                                                                                            |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                |                                                                                                                                                                                                            |            |
| M <sub>S</sub> = 0.382 (Exhibit 13-11)<br>S <sub>R</sub> = 59.3 mph (Exhibit 13-11)<br>S <sub>0</sub> = 64.4 mph (Exhibit 13-11)<br>S = 61.1 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                |                                                                                                                                                                                                            |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|---------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound  |               |                                                                                                                                                                                                                        |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp |               |                                                                                                                                                                                                                        |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/11/2015                       |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans         |               |                                                                                                                                                                                                                        |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | EAPC 2016        |               |                                                                                                                                                                                                                        |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 392 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 225              |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5137             |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 643              |               |                                                                                                                                                                                                                        |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$         | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                   |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5137            | 0.92                            | Level                | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.952            | 1.00          | 5863                                                                                                                                                                                                                   |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 643             | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995            | 1.00          | 702                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                  |               |                                                                                                                                                                                                                        |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 392             | 0.92                            | Level                | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.980            | 1.00          | 435                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                  |               |                                                                                                                                                                                                                        |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                  |               |                                                                                                                                                                                                                        |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.581 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3701 pc/h<br>$V_3$ or $V_{av34}$ 2162 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                  |               |                                                                                                                                                                                                                        |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Capacity      |                                                                                                                                                                                                                        | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5863             | Exhibit 13-8  | 7200                                                                                                                                                                                                                   | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 5161                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200             | No            |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 702                   | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100             | No            |                                                                                                                                                                                                                        |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                  |               |                                                                                                                                                                                                                        |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual           | Max Desirable |                                                                                                                                                                                                                        | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3701             | Exhibit 13-8  | 4400:All                                                                                                                                                                                                               | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                  |               |                                                                                                                                                                                                                        |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 34.1 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                  |               |                                                                                                                                                                                                                        |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                  |               |                                                                                                                                                                                                                        |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.361 (Exhibit 13-12)<br>$S_R =$ 59.9 mph (Exhibit 13-12)<br>$S_0 =$ 72.3 mph (Exhibit 13-12)<br>$S =$ 63.9 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                  |               |                                                                                                                                                                                                                        |            |



**APPENDIX 7.5:**

**EAPC (2016) CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS  
WITH IMPROVEMENTS**

This Page Intentionally Left Blank

HCM 2010 Signalized Intersection Summary  
1: I-15 SB On-Ramp/I-15 SB Off-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                                                                                                     |  |  |  |  |  |  |  |  |  |  |  |  |
|-----------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Movement                                                                                            | EBL                                                                               | EBT                                                                               | EBR                                                                               | WBL                                                                               | WBT                                                                               | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                 | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations                                                                                 |                                                                                   |  |  |  |  |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |  |                                                                                     |
| Volume (veh/h)                                                                                      | 0                                                                                 | 546                                                                               | 479                                                                               | 127                                                                               | 402                                                                               | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   | 339                                                                                 | 8                                                                                   | 173                                                                                 |
| Number                                                                                              | 5                                                                                 | 2                                                                                 | 12                                                                                | 1                                                                                 | 6                                                                                 | 16                                                                                |                                                                                    |                                                                                     |                                                                                     | 7                                                                                   | 4                                                                                   | 14                                                                                  |
| Initial Q (Qb), veh                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Ped-Bike Adj(A_pbT)                                                                                 | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                |                                                                                     | 1.00                                                                                |
| Parking Bus, Adj                                                                                    | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 1.00                                                                                | 1.00                                                                                |
| Adj Sat Flow, veh/h/ln                                                                              | 0                                                                                 | 1900                                                                              | 1900                                                                              | 1900                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1900                                                                                | 1900                                                                                | 1900                                                                                |
| Adj Flow Rate, veh/h                                                                                | 0                                                                                 | 613                                                                               | 0                                                                                 | 143                                                                               | 452                                                                               | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 381                                                                                 | 9                                                                                   | 194                                                                                 |
| Adj No. of Lanes                                                                                    | 0                                                                                 | 1                                                                                 | 1                                                                                 | 1                                                                                 | 1                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 1                                                                                   | 0                                                                                   |
| Peak Hour Factor                                                                                    | 0.89                                                                              | 0.89                                                                              | 0.89                                                                              | 0.89                                                                              | 0.89                                                                              | 0.89                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.89                                                                                | 0.89                                                                                | 0.89                                                                                |
| Percent Heavy Veh, %                                                                                | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Cap, veh/h                                                                                          | 0                                                                                 | 768                                                                               | 653                                                                               | 188                                                                               | 1053                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 402                                                                                 | 10                                                                                  | 205                                                                                 |
| Arrive On Green                                                                                     | 0.00                                                                              | 0.40                                                                              | 0.00                                                                              | 0.21                                                                              | 1.00                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.35                                                                                | 0.35                                                                                | 0.35                                                                                |
| Sat Flow, veh/h                                                                                     | 0                                                                                 | 1900                                                                              | 1615                                                                              | 1810                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1136                                                                                | 27                                                                                  | 578                                                                                 |
| Grp Volume(v), veh/h                                                                                | 0                                                                                 | 613                                                                               | 0                                                                                 | 143                                                                               | 452                                                                               | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 584                                                                                 | 0                                                                                   | 0                                                                                   |
| Grp Sat Flow(s),veh/h/ln                                                                            | 0                                                                                 | 1900                                                                              | 1615                                                                              | 1810                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1741                                                                                | 0                                                                                   | 0                                                                                   |
| Q Serve(g_s), s                                                                                     | 0.0                                                                               | 34.1                                                                              | 0.0                                                                               | 8.9                                                                               | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 39.1                                                                                | 0.0                                                                                 | 0.0                                                                                 |
| Cycle Q Clear(g_c), s                                                                               | 0.0                                                                               | 34.1                                                                              | 0.0                                                                               | 8.9                                                                               | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 39.1                                                                                | 0.0                                                                                 | 0.0                                                                                 |
| Prop In Lane                                                                                        | 0.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.65                                                                                |                                                                                     | 0.33                                                                                |
| Lane Grp Cap(c), veh/h                                                                              | 0                                                                                 | 768                                                                               | 653                                                                               | 188                                                                               | 1053                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 617                                                                                 | 0                                                                                   | 0                                                                                   |
| V/C Ratio(X)                                                                                        | 0.00                                                                              | 0.80                                                                              | 0.00                                                                              | 0.76                                                                              | 0.43                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.95                                                                                | 0.00                                                                                | 0.00                                                                                |
| Avail Cap(c_a), veh/h                                                                               | 0                                                                                 | 768                                                                               | 653                                                                               | 204                                                                               | 1053                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 617                                                                                 | 0                                                                                   | 0                                                                                   |
| HCM Platoon Ratio                                                                                   | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 2.00                                                                              | 2.00                                                                              | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 1.00                                                                                | 1.00                                                                                |
| Upstream Filter(I)                                                                                  | 0.00                                                                              | 1.00                                                                              | 0.00                                                                              | 0.35                                                                              | 0.35                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 0.00                                                                                | 0.00                                                                                |
| Uniform Delay (d), s/veh                                                                            | 0.0                                                                               | 31.4                                                                              | 0.0                                                                               | 46.1                                                                              | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 37.7                                                                                | 0.0                                                                                 | 0.0                                                                                 |
| Incr Delay (d2), s/veh                                                                              | 0.0                                                                               | 8.5                                                                               | 0.0                                                                               | 5.3                                                                               | 0.4                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 25.3                                                                                | 0.0                                                                                 | 0.0                                                                                 |
| Initial Q Delay(d3),s/veh                                                                           | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 0.0                                                                                 | 0.0                                                                                 | 0.0                                                                                 |
| %ile BackOfQ(50%),veh/ln                                                                            | 0.0                                                                               | 19.7                                                                              | 0.0                                                                               | 4.7                                                                               | 0.1                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 23.2                                                                                | 0.0                                                                                 | 0.0                                                                                 |
| LnGrp Delay(d),s/veh                                                                                | 0.0                                                                               | 39.9                                                                              | 0.0                                                                               | 51.4                                                                              | 0.4                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 63.0                                                                                | 0.0                                                                                 | 0.0                                                                                 |
| LnGrp LOS                                                                                           |                                                                                   | D                                                                                 |                                                                                   | D                                                                                 | A                                                                                 |                                                                                   |                                                                                    |                                                                                     |                                                                                     | E                                                                                   |                                                                                     |                                                                                     |
| Approach Vol, veh/h                                                                                 |                                                                                   | 613                                                                               |                                                                                   |                                                                                   | 595                                                                               |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | 584                                                                                 |                                                                                     |
| Approach Delay, s/veh                                                                               |                                                                                   | 39.9                                                                              |                                                                                   |                                                                                   | 12.7                                                                              |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | 63.0                                                                                |                                                                                     |
| Approach LOS                                                                                        |                                                                                   | D                                                                                 |                                                                                   |                                                                                   | B                                                                                 |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | E                                                                                   |                                                                                     |
| Timer                                                                                               | 1                                                                                 | 2                                                                                 | 3                                                                                 | 4                                                                                 | 5                                                                                 | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                                                                                        | 1                                                                                 | 2                                                                                 |                                                                                   | 4                                                                                 |                                                                                   | 6                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s                                                                            | 18.0                                                                              | 54.0                                                                              |                                                                                   | 48.0                                                                              |                                                                                   | 72.0                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s                                                                             | 5.5                                                                               | * 5.5                                                                             |                                                                                   | 5.5                                                                               |                                                                                   | 5.5                                                                               |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s                                                                         | 13.5                                                                              | * 49                                                                              |                                                                                   | 42.5                                                                              |                                                                                   | 66.5                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+I1), s                                                                        | 10.9                                                                              | 36.1                                                                              |                                                                                   | 41.1                                                                              |                                                                                   | 2.0                                                                               |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s                                                                             | 0.8                                                                               | 3.2                                                                               |                                                                                   | 0.5                                                                               |                                                                                   | 3.5                                                                               |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Intersection Summary                                                                                |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay                                                                                 |                                                                                   |                                                                                   | 38.4                                                                              |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                                                                                        |                                                                                   |                                                                                   | D                                                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Notes                                                                                               |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| * HCM 2010 computational engine requires equal clearance times for the phases crossing the barrier. |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

HCM 2010 Signalized Intersection Summary  
2: I-15 NB Off-Ramp/I-15 NB On-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                              |  |  |  |  |  |  |  |  |  |  |  |  |
|------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Movement                     | EBL                                                                               | EBT                                                                               | EBR                                                                               | WBL                                                                               | WBT                                                                               | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                 | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations          |  |  |                                                                                   |                                                                                   |  |                                                                                   |                                                                                    |  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Volume (veh/h)               | 165                                                                               | 721                                                                               | 0                                                                                 | 0                                                                                 | 309                                                                               | 214                                                                               | 220                                                                                | 1                                                                                   | 282                                                                                 | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Number                       | 5                                                                                 | 2                                                                                 | 12                                                                                | 1                                                                                 | 6                                                                                 | 16                                                                                | 3                                                                                  | 8                                                                                   | 18                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| Initial Q (Qb), veh          | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Ped-Bike Adj(A_pbT)          | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                               |                                                                                     | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Parking Bus, Adj             | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Adj Sat Flow, veh/h/ln       | 1900                                                                              | 1900                                                                              | 0                                                                                 | 0                                                                                 | 1900                                                                              | 1900                                                                              | 1900                                                                               | 1900                                                                                | 1900                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Adj Flow Rate, veh/h         | 220                                                                               | 961                                                                               | 0                                                                                 | 0                                                                                 | 412                                                                               | 285                                                                               | 293                                                                                | 1                                                                                   | 376                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Adj No. of Lanes             | 1                                                                                 | 1                                                                                 | 0                                                                                 | 0                                                                                 | 1                                                                                 | 0                                                                                 | 0                                                                                  | 1                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Peak Hour Factor             | 0.75                                                                              | 0.75                                                                              | 0.75                                                                              | 0.75                                                                              | 0.75                                                                              | 0.75                                                                              | 0.75                                                                               | 0.75                                                                                | 0.75                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Percent Heavy Veh, %         | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Cap, veh/h                   | 393                                                                               | 1267                                                                              | 0                                                                                 | 0                                                                                 | 423                                                                               | 293                                                                               | 256                                                                                | 1                                                                                   | 329                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Arrive On Green              | 0.43                                                                              | 1.00                                                                              | 0.00                                                                              | 0.00                                                                              | 0.40                                                                              | 0.40                                                                              | 0.35                                                                               | 0.35                                                                                | 0.35                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Sat Flow, veh/h              | 1810                                                                              | 1900                                                                              | 0                                                                                 | 0                                                                                 | 1048                                                                              | 725                                                                               | 741                                                                                | 3                                                                                   | 951                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Grp Volume(v), veh/h         | 220                                                                               | 961                                                                               | 0                                                                                 | 0                                                                                 | 0                                                                                 | 697                                                                               | 670                                                                                | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Grp Sat Flow(s),veh/h/ln     | 1810                                                                              | 1900                                                                              | 0                                                                                 | 0                                                                                 | 0                                                                                 | 1772                                                                              | 1695                                                                               | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Q Serve(g_s), s              | 10.9                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 46.4                                                                              | 41.5                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Cycle Q Clear(g_c), s        | 10.9                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 46.4                                                                              | 41.5                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Prop In Lane                 | 1.00                                                                              |                                                                                   | 0.00                                                                              | 0.00                                                                              |                                                                                   | 0.41                                                                              | 0.44                                                                               |                                                                                     | 0.56                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Lane Grp Cap(c), veh/h       | 393                                                                               | 1267                                                                              | 0                                                                                 | 0                                                                                 | 0                                                                                 | 716                                                                               | 586                                                                                | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| V/C Ratio(X)                 | 0.56                                                                              | 0.76                                                                              | 0.00                                                                              | 0.00                                                                              | 0.00                                                                              | 0.97                                                                              | 1.14                                                                               | 0.00                                                                                | 0.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Avail Cap(c_a), veh/h        | 393                                                                               | 1267                                                                              | 0                                                                                 | 0                                                                                 | 0                                                                                 | 716                                                                               | 586                                                                                | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| HCM Platoon Ratio            | 2.00                                                                              | 2.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Upstream Filter(I)           | 0.50                                                                              | 0.50                                                                              | 0.00                                                                              | 0.00                                                                              | 0.00                                                                              | 1.00                                                                              | 1.00                                                                               | 0.00                                                                                | 0.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Uniform Delay (d), s/veh     | 29.7                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 35.1                                                                              | 39.3                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Incr Delay (d2), s/veh       | 0.9                                                                               | 2.2                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 27.7                                                                              | 83.3                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Initial Q Delay(d3),s/veh    | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                                | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| %ile BackOfQ(50%),veh/ln     | 5.5                                                                               | 0.8                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 28.2                                                                              | 32.9                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| LnGrp Delay(d),s/veh         | 30.6                                                                              | 2.2                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 62.8                                                                              | 122.5                                                                              | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| LnGrp LOS                    | C                                                                                 | A                                                                                 |                                                                                   |                                                                                   |                                                                                   | E                                                                                 | F                                                                                  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Approach Vol, veh/h          | 1181                                                                              |                                                                                   |                                                                                   | 697                                                                               |                                                                                   |                                                                                   | 670                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Approach Delay, s/veh        | 7.5                                                                               |                                                                                   |                                                                                   | 62.8                                                                              |                                                                                   |                                                                                   | 122.5                                                                              |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Approach LOS                 | A                                                                                 |                                                                                   |                                                                                   | E                                                                                 |                                                                                   |                                                                                   | F                                                                                  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Timer                        | 1                                                                                 | 2                                                                                 | 3                                                                                 | 4                                                                                 | 5                                                                                 | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                 | 2                                                                                 |                                                                                   |                                                                                   | 5                                                                                 |                                                                                   |                                                                                   | 6                                                                                  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s     | 85.6                                                                              |                                                                                   |                                                                                   | 31.6                                                                              |                                                                                   |                                                                                   | 54.0                                                                               |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s      | 5.5                                                                               |                                                                                   |                                                                                   | 5.5                                                                               |                                                                                   |                                                                                   | * 5.5                                                                              |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s  | 67.5                                                                              |                                                                                   |                                                                                   | 14.5                                                                              |                                                                                   |                                                                                   | * 49                                                                               |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+I1), s | 2.0                                                                               |                                                                                   |                                                                                   | 12.9                                                                              |                                                                                   |                                                                                   | 48.4                                                                               |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s      | 11.0                                                                              |                                                                                   |                                                                                   | 0.7                                                                               |                                                                                   |                                                                                   | 0.1                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Intersection Summary         |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay          |                                                                                   |                                                                                   | 52.9                                                                              |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                 |                                                                                   |                                                                                   | D                                                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Notes                        |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

HCM 2010 Signalized Intersection Summary  
1: I-15 SB On-Ramp/I-15 SB Off-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                              |  |      |      |      |      |      |     |     |     |      |      |      |
|------------------------------|------------------------------------------------------------------------------------|------|------|------|------|------|-----|-----|-----|------|------|------|
| Movement                     | EBL                                                                                | EBT  | EBR  | WBL  | WBT  | WBR  | NBL | NBT | NBR | SBL  | SBT  | SBR  |
| Lane Configurations          |                                                                                    | ↑    | ↑    | ↑    | ↑    |      |     |     |     |      | ↑    |      |
| Volume (veh/h)               | 0                                                                                  | 499  | 534  | 66   | 720  | 0    | 0   | 0   | 0   | 124  | 3    | 343  |
| Number                       | 5                                                                                  | 2    | 12   | 1    | 6    | 16   |     |     |     | 7    | 4    | 14   |
| Initial Q (Qb), veh          | 0                                                                                  | 0    | 0    | 0    | 0    | 0    |     |     |     | 0    | 0    | 0    |
| Ped-Bike Adj(A_pbT)          | 1.00                                                                               |      | 1.00 | 1.00 |      | 1.00 |     |     |     | 1.00 |      | 1.00 |
| Parking Bus, Adj             | 1.00                                                                               | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |     |     |     | 1.00 | 1.00 | 1.00 |
| Adj Sat Flow, veh/h/ln       | 0                                                                                  | 1900 | 1900 | 1900 | 1900 | 0    |     |     |     | 1900 | 1900 | 1900 |
| Adj Flow Rate, veh/h         | 0                                                                                  | 525  | 0    | 69   | 758  | 0    |     |     |     | 131  | 3    | 361  |
| Adj No. of Lanes             | 0                                                                                  | 1    | 1    | 1    | 1    | 0    |     |     |     | 0    | 1    | 0    |
| Peak Hour Factor             | 0.95                                                                               | 0.95 | 0.95 | 0.95 | 0.95 | 0.95 |     |     |     | 0.95 | 0.95 | 0.95 |
| Percent Heavy Veh, %         | 0                                                                                  | 0    | 0    | 0    | 0    | 0    |     |     |     | 0    | 0    | 0    |
| Cap, veh/h                   | 0                                                                                  | 894  | 760  | 90   | 1069 | 0    |     |     |     | 146  | 3    | 403  |
| Arrive On Green              | 0.00                                                                               | 0.47 | 0.00 | 0.02 | 0.19 | 0.00 |     |     |     | 0.33 | 0.33 | 0.33 |
| Sat Flow, veh/h              | 0                                                                                  | 1900 | 1615 | 1810 | 1900 | 0    |     |     |     | 440  | 10   | 1213 |
| Grp Volume(v), veh/h         | 0                                                                                  | 525  | 0    | 69   | 758  | 0    |     |     |     | 495  | 0    | 0    |
| Grp Sat Flow(s),veh/h/ln     | 0                                                                                  | 1900 | 1615 | 1810 | 1900 | 0    |     |     |     | 1664 | 0    | 0    |
| Q Serve(g_s), s              | 0.0                                                                                | 21.2 | 0.0  | 4.0  | 39.3 | 0.0  |     |     |     | 29.7 | 0.0  | 0.0  |
| Cycle Q Clear(g_c), s        | 0.0                                                                                | 21.2 | 0.0  | 4.0  | 39.3 | 0.0  |     |     |     | 29.7 | 0.0  | 0.0  |
| Prop In Lane                 | 0.00                                                                               |      | 1.00 | 1.00 |      | 0.00 |     |     |     | 0.26 |      | 0.73 |
| Lane Grp Cap(c), veh/h       | 0                                                                                  | 894  | 760  | 90   | 1069 | 0    |     |     |     | 553  | 0    | 0    |
| V/C Ratio(X)                 | 0.00                                                                               | 0.59 | 0.00 | 0.77 | 0.71 | 0.00 |     |     |     | 0.90 | 0.00 | 0.00 |
| Avail Cap(c_a), veh/h        | 0                                                                                  | 894  | 760  | 159  | 1069 | 0    |     |     |     | 553  | 0    | 0    |
| HCM Platoon Ratio            | 1.00                                                                               | 1.00 | 1.00 | 0.33 | 0.33 | 1.00 |     |     |     | 1.00 | 1.00 | 1.00 |
| Upstream Filter(I)           | 0.00                                                                               | 1.00 | 0.00 | 0.64 | 0.64 | 0.00 |     |     |     | 1.00 | 0.00 | 0.00 |
| Uniform Delay (d), s/veh     | 0.0                                                                                | 20.4 | 0.0  | 51.0 | 34.7 | 0.0  |     |     |     | 33.3 | 0.0  | 0.0  |
| Incr Delay (d2), s/veh       | 0.0                                                                                | 2.8  | 0.0  | 8.5  | 2.6  | 0.0  |     |     |     | 19.6 | 0.0  | 0.0  |
| Initial Q Delay(d3),s/veh    | 0.0                                                                                | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |     |     |     | 0.0  | 0.0  | 0.0  |
| %ile BackOfQ(50%),veh/ln     | 0.0                                                                                | 11.8 | 0.0  | 2.2  | 21.5 | 0.0  |     |     |     | 16.6 | 0.0  | 0.0  |
| LnGrp Delay(d),s/veh         | 0.0                                                                                | 23.2 | 0.0  | 59.5 | 37.2 | 0.0  |     |     |     | 52.9 | 0.0  | 0.0  |
| LnGrp LOS                    |                                                                                    | C    |      | E    | D    |      |     |     |     | D    |      |      |
| Approach Vol, veh/h          |                                                                                    | 525  |      |      | 827  |      |     |     |     |      | 495  |      |
| Approach Delay, s/veh        |                                                                                    | 23.2 |      |      | 39.1 |      |     |     |     |      | 52.9 |      |
| Approach LOS                 |                                                                                    | C    |      |      | D    |      |     |     |     |      | D    |      |
| Timer                        | 1                                                                                  | 2    | 3    | 4    | 5    | 6    | 7   | 8   |     |      |      |      |
| Assigned Phs                 | 1                                                                                  | 2    |      | 4    |      | 6    |     |     |     |      |      |      |
| Phs Duration (G+Y+Rc), s     | 9.7                                                                                | 54.9 |      | 40.4 |      | 64.6 |     |     |     |      |      |      |
| Change Period (Y+Rc), s      | 4.5                                                                                | 5.5  |      | 5.5  |      | 5.5  |     |     |     |      |      |      |
| Max Green Setting (Gmax), s  | 9.2                                                                                | 45.4 |      | 34.9 |      | 59.1 |     |     |     |      |      |      |
| Max Q Clear Time (g_c+l1), s | 6.0                                                                                | 23.2 |      | 31.7 |      | 41.3 |     |     |     |      |      |      |
| Green Ext Time (p_c), s      | 0.0                                                                                | 9.2  |      | 0.9  |      | 8.3  |     |     |     |      |      |      |
| <b>Intersection Summary</b>  |                                                                                    |      |      |      |      |      |     |     |     |      |      |      |
| HCM 2010 Ctrl Delay          |                                                                                    |      | 38.3 |      |      |      |     |     |     |      |      |      |
| HCM 2010 LOS                 |                                                                                    |      | D    |      |      |      |     |     |     |      |      |      |

HCM 2010 Signalized Intersection Summary  
 2: I-15 NB Off-Ramp/I-15 NB On-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                              |  |  |  |  |  |  |  |  |  |  |  |  |
|------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Movement                     | EBL                                                                               | EBT                                                                               | EBR                                                                               | WBL                                                                               | WBT                                                                               | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                 | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations          |  |  |                                                                                   |                                                                                   |  |                                                                                   |                                                                                    |  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Volume (veh/h)               | 324                                                                               | 301                                                                               | 0                                                                                 | 0                                                                                 | 225                                                                               | 65                                                                                | 561                                                                                | 3                                                                                   | 79                                                                                  | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Number                       | 5                                                                                 | 2                                                                                 | 12                                                                                | 1                                                                                 | 6                                                                                 | 16                                                                                | 3                                                                                  | 8                                                                                   | 18                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| Initial Q (Qb), veh          | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Ped-Bike Adj(A_pbT)          | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                               |                                                                                     | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Parking Bus, Adj             | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Adj Sat Flow, veh/h/ln       | 1900                                                                              | 1900                                                                              | 0                                                                                 | 0                                                                                 | 1900                                                                              | 1900                                                                              | 1900                                                                               | 1900                                                                                | 1900                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Adj Flow Rate, veh/h         | 360                                                                               | 334                                                                               | 0                                                                                 | 0                                                                                 | 250                                                                               | 72                                                                                | 623                                                                                | 3                                                                                   | 88                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| Adj No. of Lanes             | 1                                                                                 | 1                                                                                 | 0                                                                                 | 0                                                                                 | 1                                                                                 | 0                                                                                 | 0                                                                                  | 1                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Peak Hour Factor             | 0.90                                                                              | 0.90                                                                              | 0.90                                                                              | 0.90                                                                              | 0.90                                                                              | 0.90                                                                              | 0.90                                                                               | 0.90                                                                                | 0.90                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Percent Heavy Veh, %         | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Cap, veh/h                   | 394                                                                               | 932                                                                               | 0                                                                                 | 0                                                                                 | 326                                                                               | 94                                                                                | 630                                                                                | 3                                                                                   | 89                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| Arrive On Green              | 0.07                                                                              | 0.16                                                                              | 0.00                                                                              | 0.00                                                                              | 0.23                                                                              | 0.23                                                                              | 0.40                                                                               | 0.40                                                                                | 0.40                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Sat Flow, veh/h              | 1810                                                                              | 1900                                                                              | 0                                                                                 | 0                                                                                 | 1419                                                                              | 409                                                                               | 1556                                                                               | 7                                                                                   | 220                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Grp Volume(v), veh/h         | 360                                                                               | 334                                                                               | 0                                                                                 | 0                                                                                 | 0                                                                                 | 322                                                                               | 714                                                                                | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Grp Sat Flow(s),veh/h/ln     | 1810                                                                              | 1900                                                                              | 0                                                                                 | 0                                                                                 | 0                                                                                 | 1828                                                                              | 1783                                                                               | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Q Serve(g_s), s              | 20.8                                                                              | 16.4                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 17.3                                                                              | 41.7                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Cycle Q Clear(g_c), s        | 20.8                                                                              | 16.4                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 17.3                                                                              | 41.7                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Prop In Lane                 | 1.00                                                                              |                                                                                   | 0.00                                                                              | 0.00                                                                              |                                                                                   | 0.22                                                                              | 0.87                                                                               |                                                                                     | 0.12                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Lane Grp Cap(c), veh/h       | 394                                                                               | 932                                                                               | 0                                                                                 | 0                                                                                 | 0                                                                                 | 420                                                                               | 722                                                                                | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| V/C Ratio(X)                 | 0.91                                                                              | 0.36                                                                              | 0.00                                                                              | 0.00                                                                              | 0.00                                                                              | 0.77                                                                              | 0.99                                                                               | 0.00                                                                                | 0.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Avail Cap(c_a), veh/h        | 405                                                                               | 932                                                                               | 0                                                                                 | 0                                                                                 | 0                                                                                 | 420                                                                               | 722                                                                                | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| HCM Platoon Ratio            | 0.33                                                                              | 0.33                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Upstream Filter(I)           | 0.77                                                                              | 0.77                                                                              | 0.00                                                                              | 0.00                                                                              | 0.00                                                                              | 1.00                                                                              | 1.00                                                                               | 0.00                                                                                | 0.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Uniform Delay (d), s/veh     | 47.8                                                                              | 29.3                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 37.8                                                                              | 31.0                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Incr Delay (d2), s/veh       | 20.3                                                                              | 0.8                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 12.5                                                                              | 31.0                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Initial Q Delay(d3),s/veh    | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                                | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| %ile BackOfQ(50%),veh/ln     | 12.6                                                                              | 8.9                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 10.1                                                                              | 26.6                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| LnGrp Delay(d),s/veh         | 68.0                                                                              | 30.1                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 50.3                                                                              | 62.0                                                                               | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| LnGrp LOS                    | E                                                                                 | C                                                                                 |                                                                                   |                                                                                   |                                                                                   | D                                                                                 | E                                                                                  |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Approach Vol, veh/h          |                                                                                   | 694                                                                               |                                                                                   |                                                                                   | 322                                                                               |                                                                                   |                                                                                    | 714                                                                                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Approach Delay, s/veh        |                                                                                   | 49.8                                                                              |                                                                                   |                                                                                   | 50.3                                                                              |                                                                                   |                                                                                    | 62.0                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Approach LOS                 |                                                                                   | D                                                                                 |                                                                                   |                                                                                   | D                                                                                 |                                                                                   |                                                                                    | E                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Timer                        | 1                                                                                 | 2                                                                                 | 3                                                                                 | 4                                                                                 | 5                                                                                 | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                 |                                                                                   | 2                                                                                 |                                                                                   |                                                                                   | 5                                                                                 | 6                                                                                 |                                                                                    | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s     |                                                                                   | 57.0                                                                              |                                                                                   |                                                                                   | 27.4                                                                              | 29.6                                                                              |                                                                                    | 48.0                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s      |                                                                                   | 5.5                                                                               |                                                                                   |                                                                                   | 4.5                                                                               | 5.5                                                                               |                                                                                    | 5.5                                                                                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s  |                                                                                   | 51.5                                                                              |                                                                                   |                                                                                   | 23.5                                                                              | 23.5                                                                              |                                                                                    | 42.5                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+l1), s |                                                                                   | 18.4                                                                              |                                                                                   |                                                                                   | 22.8                                                                              | 19.3                                                                              |                                                                                    | 43.7                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s      |                                                                                   | 4.3                                                                               |                                                                                   |                                                                                   | 0.1                                                                               | 1.5                                                                               |                                                                                    | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| <b>Intersection Summary</b>  |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay          |                                                                                   |                                                                                   | 54.9                                                                              |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                 |                                                                                   |                                                                                   | D                                                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

## **APPENDIX 8.1:**

### **HORIZON YEAR (2035) WITHOUT PROJECT CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank



| Intersection              |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Intersection Delay, s/veh | 68.5 |      |      |      |      |      |      |      |      |      |      |      |
| Intersection LOS          | F    |      |      |      |      |      |      |      |      |      |      |      |
| Movement                  | EBU  | EBL  | EBT  | EBR  | WBU  | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
| Vol, veh/h                | 0    | 0    | 1604 | 489  | 0    | 625  | 1139 | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor          | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles, %         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                 | 0    | 0    | 1743 | 532  | 0    | 679  | 1238 | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes           | 0    | 0    | 1    | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |

| Approach                   |  |  | EB   | WB   |
|----------------------------|--|--|------|------|
| Opposing Approach          |  |  | WB   | EB   |
| Opposing Lanes             |  |  | 2    | 2    |
| Conflicting Approach Left  |  |  | SB   |      |
| Conflicting Lanes Left     |  |  | 1    | 0    |
| Conflicting Approach Right |  |  |      | SB   |
| Conflicting Lanes Right    |  |  | 0    | 1    |
| HCM Control Delay          |  |  | 68.9 | 70.6 |
| HCM LOS                    |  |  | F    | F    |

| Lane                   | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |
|------------------------|-------|-------|-------|-------|-------|
| Vol Left, %            | 0%    | 0%    | 100%  | 0%    | 38%   |
| Vol Thru, %            | 100%  | 0%    | 0%    | 100%  | 0%    |
| Vol Right, %           | 0%    | 100%  | 0%    | 0%    | 62%   |
| Sign Control           | Stop  | Stop  | Stop  | Stop  | Stop  |
| Traffic Vol by Lane    | 1604  | 489   | 625   | 1139  | 1214  |
| LT Vol                 | 0     | 0     | 625   | 0     | 466   |
| Through Vol            | 1604  | 0     | 0     | 1139  | 0     |
| RT Vol                 | 0     | 489   | 0     | 0     | 748   |
| Lane Flow Rate         | 1743  | 532   | 679   | 1238  | 1320  |
| Geometry Grp           | 7     | 7     | 7     | 7     | 2     |
| Degree of Util (X)     | 1     | 1     | 1     | 1     | 1     |
| Departure Headway (Hd) | 7.715 | 7.015 | 8.297 | 7.797 | 6.696 |
| Convergence, Y/N       | Yes   | Yes   | Yes   | Yes   | Yes   |
| Cap                    | 488   | 516   | 442   | 483   | 554   |
| Service Time           | 5.497 | 4.797 | 5.997 | 5.497 | 4.704 |
| HCM Lane V/C Ratio     | 3.572 | 1.031 | 1.536 | 2.563 | 2.383 |
| HCM Control Delay      | 69.7  | 66.3  | 72.1  | 69.7  | 64.6  |
| HCM Lane LOS           | F     | F     | F     | F     | F     |
| HCM 95th-tile Q        | 13.2  | 13.8  | 12.8  | 13.2  | 14.2  |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 466  | 0    | 748  |
| Peak Hour Factor  | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 507  | 0    | 813  |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 64.6

HCM LOS F

Lane

**Intersection**

Int Delay, s/veh 182.5

| Movement                 | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Vol, veh/h               | 607  | 1463 | 0    | 0    | 1471 | 554  | 293  | 0    | 950  | 0    | 0    | 0    |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -    | -    | None | -    | -    | None | -    | -    | None | -    | -    | None |
| Storage Length           | 230  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | -    | 0    | -    | -    | 0    | -    | -    | 2    | -    | -    | 0    | -    |
| Grade, %                 | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   |
| Heavy Vehicles, %        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 660  | 1590 | 0    | 0    | 1599 | 602  | 318  | 0    | 1033 | 0    | 0    | 0    |

| Major/Minor          | Major1 |   |   | Major2 |   |   | Minor1 |      |      |
|----------------------|--------|---|---|--------|---|---|--------|------|------|
| Conflicting Flow All | 2201   | 0 | 0 | 1590   | 0 | 0 | 4810   | 5111 | 1590 |
| Stage 1              | -      | - | - | -      | - | - | 2910   | 2910 | -    |
| Stage 2              | -      | - | - | -      | - | - | 1900   | 2201 | -    |
| Critical Hdwy        | 2      | - | - | 2      | - | - | 2      | 2    | 2    |
| Critical Hdwy Stg 1  | -      | - | - | -      | - | - | 2      | 2    | -    |
| Critical Hdwy Stg 2  | -      | - | - | -      | - | - | 2      | 2    | -    |
| Follow-up Hdwy       | 2      | - | - | 2      | - | - | 2      | 2    | 2    |
| Pot Cap-1 Maneuver   | 918    | - | - | 1121   | - | - | 357    | 317  | 1121 |
| Stage 1              | -      | - | - | -      | - | - | 721    | 721  | -    |
| Stage 2              | -      | - | - | -      | - | - | 1014   | 918  | -    |
| Platoon blocked, %   | -      | - | - | -      | - | - | -      | -    | -    |
| Mov Cap-1 Maneuver   | 918    | - | - | 1121   | - | - | ~ 100  | 0    | 1121 |
| Mov Cap-2 Maneuver   | -      | - | - | -      | - | - | ~ 182  | 0    | -    |
| Stage 1              | -      | - | - | -      | - | - | ~ 203  | 0    | -    |
| Stage 2              | -      | - | - | -      | - | - | 1014   | 0    | -    |

| Approach             | EB  | WB | NB       |
|----------------------|-----|----|----------|
| HCM Control Delay, s | 5.4 | 0  | \$ 774.9 |
| HCM LOS              |     |    | F        |

| Minor Lane/Major Mvmt | NBLn1    | EBL   | EBT | EBR | WBL  | WBT | WBR |
|-----------------------|----------|-------|-----|-----|------|-----|-----|
| Capacity (veh/h)      | 506      | 918   | -   | -   | 1121 | -   | -   |
| HCM Lane V/C Ratio    | 2.67     | 0.719 | -   | -   | -    | -   | -   |
| HCM Control Delay (s) | \$ 774.9 | 18.3  | -   | -   | 0    | -   | -   |
| HCM Lane LOS          | F        | C     | -   | -   | A    | -   | -   |
| HCM 95th %tile Q(veh) | 110.2    | 6.4   | -   | -   | 0    | -   | -   |

**Notes**

~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

Intersection

Int Delay, s/veh 0.2

| Movement                 | EBL  | EBT  | WBT  | WBR  | SBL  | SBR   |
|--------------------------|------|------|------|------|------|-------|
| Vol, veh/h               | 0    | 2413 | 1983 | 0    | 0    | 42    |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0     |
| Sign Control             | Free | Free | Free | Free | Stop | Stop  |
| RT Channelized           | -    | None | -    | None | -    | Yield |
| Storage Length           | -    | -    | -    | -    | -    | 0     |
| Veh in Median Storage, # | -    | 0    | 0    | -    | 0    | -     |
| Grade, %                 | -    | 0    | 0    | -    | 0    | -     |
| Peak Hour Factor         | 67   | 67   | 67   | 67   | 67   | 67    |
| Heavy Vehicles, %        | 0    | 0    | 0    | 0    | 0    | 0     |
| Mvmt Flow                | 0    | 3601 | 2960 | 0    | 0    | 63    |

| Major/Minor          | Major1 | Major2 | Minor2 |
|----------------------|--------|--------|--------|
| Conflicting Flow All | 2960   | 0      | 4401   |
| Stage 1              | -      | -      | 2960   |
| Stage 2              | -      | -      | 1441   |
| Critical Hdwy        | 5.3    | -      | 5.7    |
| Critical Hdwy Stg 1  | -      | -      | 6.6    |
| Critical Hdwy Stg 2  | -      | -      | 6      |
| Follow-up Hdwy       | 3.1    | -      | 3.8    |
| Pot Cap-1 Maneuver   | 41     | -      | 4      |
| Stage 1              | -      | -      | 14     |
| Stage 2              | -      | -      | 167    |
| Platoon blocked, %   | -      | -      | -      |
| Mov Cap-1 Maneuver   | 41     | -      | 4      |
| Mov Cap-2 Maneuver   | -      | -      | 4      |
| Stage 1              | -      | -      | 14     |
| Stage 2              | -      | -      | 167    |

| Approach             | EB | WB | SB   |
|----------------------|----|----|------|
| HCM Control Delay, s | 0  | 0  | 20.7 |
| HCM LOS              |    |    | C    |

| Minor Lane/Major Mvmt | EBL | EBT | WBT | WBR | SBLn1 |
|-----------------------|-----|-----|-----|-----|-------|
| Capacity (veh/h)      | 41  | -   | -   | -   | 291   |
| HCM Lane V/C Ratio    | -   | -   | -   | -   | 0.215 |
| HCM Control Delay (s) | 0   | -   | -   | -   | 20.7  |
| HCM Lane LOS          | A   | -   | -   | -   | C     |
| HCM 95th %tile Q(veh) | 0   | -   | -   | -   | 0.8   |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.2    |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 47     | 2366 | 1983   | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 70     | 3531 | 2960   | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 2960   | 0    | -      | 0    | 4513   | 1480 |
| Stage 1                  | -      | -    | -      | -    | 2960   | -    |
| Stage 2                  | -      | -    | -      | -    | 1553   | -    |
| Critical Hdwy            | 2.5    | -    | -      | -    | 5.7    | 7.1  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 6.6    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 6      | -    |
| Follow-up Hdwy           | 3.1    | -    | -      | -    | 3.8    | 3.9  |
| Pot Cap-1 Maneuver       | 411    | -    | -      | -    | 4      | 100  |
| Stage 1                  | -      | -    | -      | -    | 14     | -    |
| Stage 2                  | -      | -    | -      | -    | 145    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 411    | -    | -      | -    | 3      | 100  |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 3      | -    |
| Stage 1                  | -      | -    | -      | -    | 14     | -    |
| Stage 2                  | -      | -    | -      | -    | 120    | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 0.3    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 411    | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.171  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 15.6   | -    | -      | -    | 0      |      |
| HCM Lane LOS             | C      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0.6    | -    | -      | -    | -      |      |

| Intersection              |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Intersection Delay, s/veh | 68.6 |      |      |      |      |      |      |      |      |      |      |      |
| Intersection LOS          | F    |      |      |      |      |      |      |      |      |      |      |      |
| Movement                  | EBU  | EBL  | EBT  | EBR  | WBU  | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
| Vol, veh/h                | 0    | 0    | 1896 | 608  | 0    | 767  | 1629 | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor          | 0.92 | 0.95 | 0.95 | 0.95 | 0.92 | 0.95 | 0.95 | 0.95 | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, %         | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                 | 0    | 0    | 1996 | 640  | 0    | 807  | 1715 | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes           | 0    | 0    | 1    | 1    | 0    | 1    | 1    | 0    | 0    | 0    | 0    | 0    |

| Approach                   |  |  | EB   | WB   |
|----------------------------|--|--|------|------|
| Opposing Approach          |  |  | WB   | EB   |
| Opposing Lanes             |  |  | 2    | 2    |
| Conflicting Approach Left  |  |  | SB   |      |
| Conflicting Lanes Left     |  |  | 1    | 0    |
| Conflicting Approach Right |  |  |      | SB   |
| Conflicting Lanes Right    |  |  | 0    | 1    |
| HCM Control Delay          |  |  | 68.9 | 70.5 |
| HCM LOS                    |  |  | F    | F    |

| Lane                   | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |
|------------------------|-------|-------|-------|-------|-------|
| Vol Left, %            | 0%    | 0%    | 100%  | 0%    | 54%   |
| Vol Thru, %            | 100%  | 0%    | 0%    | 100%  | 0%    |
| Vol Right, %           | 0%    | 100%  | 0%    | 0%    | 46%   |
| Sign Control           | Stop  | Stop  | Stop  | Stop  | Stop  |
| Traffic Vol by Lane    | 1896  | 608   | 767   | 1629  | 1549  |
| LT Vol                 | 0     | 0     | 767   | 0     | 839   |
| Through Vol            | 1896  | 0     | 0     | 1629  | 0     |
| RT Vol                 | 0     | 608   | 0     | 0     | 710   |
| Lane Flow Rate         | 1996  | 640   | 807   | 1715  | 1631  |
| Geometry Grp           | 7     | 7     | 7     | 7     | 2     |
| Degree of Util (X)     | 1     | 1     | 1     | 1     | 1     |
| Departure Headway (Hd) | 7.737 | 7.038 | 8.207 | 7.708 | 6.822 |
| Convergence, Y/N       | Yes   | Yes   | Yes   | Yes   | Yes   |
| Cap                    | 499   | 518   | 444   | 480   | 554   |
| Service Time           | 5.497 | 4.797 | 5.997 | 5.497 | 4.831 |
| HCM Lane V/C Ratio     | 4     | 1.236 | 1.818 | 3.573 | 2.944 |
| HCM Control Delay      | 69.7  | 66.3  | 72.1  | 69.7  | 65.3  |
| HCM Lane LOS           | F     | F     | F     | F     | F     |
| HCM 95th-tile Q        | 13.2  | 13.8  | 12.8  | 13.2  | 14.1  |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 839  | 0    | 710  |
| Peak Hour Factor  | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 883  | 0    | 747  |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 65.3

HCM LOS F

Lane

| Intersection               |           |                        |      |                            |      |      |                                |      |      |      |      |      |
|----------------------------|-----------|------------------------|------|----------------------------|------|------|--------------------------------|------|------|------|------|------|
| Int Delay, s/veh           | 440.8     |                        |      |                            |      |      |                                |      |      |      |      |      |
|                            |           |                        |      |                            |      |      |                                |      |      |      |      |      |
| Movement                   | EBL       | EBT                    | EBR  | WBL                        | WBT  | WBR  | NBL                            | NBT  | NBR  | SBL  | SBT  | SBR  |
| Vol, veh/h                 | 770       | 1965                   | 0    | 0                          | 1947 | 551  | 449                            | 0    | 745  | 0    | 0    | 0    |
| Conflicting Peds, #/hr     | 0         | 0                      | 0    | 0                          | 0    | 0    | 0                              | 0    | 0    | 0    | 0    | 0    |
| Sign Control               | Free      | Free                   | Free | Free                       | Free | Free | Stop                           | Stop | Stop | Stop | Stop | Stop |
| RT Channelized             | -         | -                      | None | -                          | -    | None | -                              | -    | None | -    | -    | None |
| Storage Length             | 230       | -                      | -    | -                          | -    | -    | -                              | -    | -    | -    | -    | -    |
| Veh in Median Storage, #   | -         | 0                      | -    | -                          | 0    | -    | -                              | 2    | -    | -    | 0    | -    |
| Grade, %                   | -         | 0                      | -    | -                          | 0    | -    | -                              | 0    | -    | -    | 0    | -    |
| Peak Hour Factor           | 92        | 92                     | 92   | 92                         | 92   | 92   | 92                             | 92   | 92   | 92   | 92   | 92   |
| Heavy Vehicles, %          | 0         | 0                      | 0    | 0                          | 0    | 0    | 0                              | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                  | 837       | 2136                   | 0    | 0                          | 2116 | 599  | 488                            | 0    | 810  | 0    | 0    | 0    |
|                            |           |                        |      |                            |      |      |                                |      |      |      |      |      |
| Major/Minor                | Major1    |                        |      | Major2                     |      |      | Minor1                         |      |      |      |      |      |
| Conflicting Flow All       | 2715      | 0                      | 0    | 2136                       | 0    | 0    | 6226                           | 6525 | 2136 |      |      |      |
| Stage 1                    | -         | -                      | -    | -                          | -    | -    | 3810                           | 3810 | -    |      |      |      |
| Stage 2                    | -         | -                      | -    | -                          | -    | -    | 2416                           | 2715 | -    |      |      |      |
| Critical Hdwy              | 2         | -                      | -    | 2                          | -    | -    | 2                              | 2    | 2    |      |      |      |
| Critical Hdwy Stg 1        | -         | -                      | -    | -                          | -    | -    | 2                              | 2    | -    |      |      |      |
| Critical Hdwy Stg 2        | -         | -                      | -    | -                          | -    | -    | 2                              | 2    | -    |      |      |      |
| Follow-up Hdwy             | 2         | -                      | -    | 2                          | -    | -    | 2                              | 2    | 2    |      |      |      |
| Pot Cap-1 Maneuver         | ~ 771     | -                      | -    | 938                        | -    | -    | ~ 202                          | 179  | 938  |      |      |      |
| Stage 1                    | -         | -                      | -    | -                          | -    | -    | 522                            | 522  | -    |      |      |      |
| Stage 2                    | -         | -                      | -    | -                          | -    | -    | 854                            | 771  | -    |      |      |      |
| Platoon blocked, %         |           |                        |      |                            |      |      |                                |      |      |      |      |      |
| Mov Cap-1 Maneuver         | ~ 771     | -                      | -    | 938                        | -    | -    | ~ 202                          | 0    | 938  |      |      |      |
| Mov Cap-2 Maneuver         | -         | -                      | -    | -                          | -    | -    | ~ 94                           | 0    | -    |      |      |      |
| Stage 1                    | -         | -                      | -    | -                          | -    | -    | 522                            | 0    | -    |      |      |      |
| Stage 2                    | -         | -                      | -    | -                          | -    | -    | 854                            | 0    | -    |      |      |      |
|                            |           |                        |      |                            |      |      |                                |      |      |      |      |      |
| Approach                   | EB        |                        |      | WB                         |      |      | NB                             |      |      |      |      |      |
| HCM Control Delay, s       | 22.6      |                        |      | 0                          |      |      | \$ 2320.9                      |      |      |      |      |      |
| HCM LOS                    |           |                        |      |                            |      |      | F                              |      |      |      |      |      |
|                            |           |                        |      |                            |      |      |                                |      |      |      |      |      |
| Minor Lane/Major Mvmt      | NBLn1     | EBL                    | EBT  | EBR                        | WBL  | WBT  | WBR                            |      |      |      |      |      |
| Capacity (veh/h)           | 214       | ~ 771                  | -    | -                          | 938  | -    | -                              |      |      |      |      |      |
| HCM Lane V/C Ratio         | 6.065     | 1.086                  | -    | -                          | -    | -    | -                              |      |      |      |      |      |
| HCM Control Delay (s)      | \$ 2320.9 | 80.4                   | -    | -                          | 0    | -    | -                              |      |      |      |      |      |
| HCM Lane LOS               | F         | F                      | -    | -                          | A    | -    | -                              |      |      |      |      |      |
| HCM 95th %tile Q(veh)      | 139       | 22.3                   | -    | -                          | 0    | -    | -                              |      |      |      |      |      |
| Notes                      |           |                        |      |                            |      |      |                                |      |      |      |      |      |
| ~: Volume exceeds capacity |           | \$: Delay exceeds 300s |      | +: Computation Not Defined |      |      | *: All major volume in platoon |      |      |      |      |      |



| Intersection             |        |      |        |      |        |       |
|--------------------------|--------|------|--------|------|--------|-------|
| Int Delay, s/veh         | 0      |      |        |      |        |       |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR   |
| Vol, veh/h               | 0      | 2710 | 2493   | 0    | 0      | 5     |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0     |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop  |
| RT Channelized           | -      | None | -      | None | -      | Yield |
| Storage Length           | -      | -    | -      | -    | -      | 0     |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -     |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -     |
| Peak Hour Factor         | 88     | 88   | 88     | 88   | 88     | 88    |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0     |
| Mvmt Flow                | 0      | 3080 | 2833   | 0    | 0      | 6     |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |       |
| Conflicting Flow All     | 2833   | 0    | -      | 0    | 4065   | 1416  |
| Stage 1                  | -      | -    | -      | -    | 2833   | -     |
| Stage 2                  | -      | -    | -      | -    | 1232   | -     |
| Critical Hdwy            | 5.3    | -    | -      | -    | 5.7    | 4.5   |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 6.6    | -     |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 6      | -     |
| Follow-up Hdwy           | 3.1    | -    | -      | -    | 3.8    | 3.9   |
| Pot Cap-1 Maneuver       | 48     | -    | -      | -    | 7      | 308   |
| Stage 1                  | -      | -    | -      | -    | 17     | -     |
| Stage 2                  | -      | -    | -      | -    | 217    | -     |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -     |
| Mov Cap-1 Maneuver       | 48     | -    | -      | -    | 7      | 308   |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 7      | -     |
| Stage 1                  | -      | -    | -      | -    | 17     | -     |
| Stage 2                  | -      | -    | -      | -    | 217    | -     |
| Approach                 | EB     |      | WB     |      | SB     |       |
| HCM Control Delay, s     | 0      |      | 0      |      | 16.9   |       |
| HCM LOS                  |        |      |        |      | C      |       |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |       |
| Capacity (veh/h)         | 48     | -    | -      | -    | 308    |       |
| HCM Lane V/C Ratio       | -      | -    | -      | -    | 0.018  |       |
| HCM Control Delay (s)    | 0      | -    | -      | -    | 16.9   |       |
| HCM Lane LOS             | A      | -    | -      | -    | C      |       |
| HCM 95th %tile Q(veh)    | 0      | -    | -      | -    | 0.1    |       |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0      |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 4      | 2706 | 2493   | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 6      | 4039 | 3721   | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 3721   | 0    | -      | 0    | 5348   | 1860 |
| Stage 1                  | -      | -    | -      | -    | 3721   | -    |
| Stage 2                  | -      | -    | -      | -    | 1627   | -    |
| Critical Hdwy            | 2.5    | -    | -      | -    | 5.7    | 7.1  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 6.6    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 6      | -    |
| Follow-up Hdwy           | 3.1    | -    | -      | -    | 3.8    | 3.9  |
| Pot Cap-1 Maneuver       | 293    | -    | -      | -    | 1      | 55   |
| Stage 1                  | -      | -    | -      | -    | 4      | -    |
| Stage 2                  | -      | -    | -      | -    | 132    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 293    | -    | -      | -    | 1      | 55   |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 1      | -    |
| Stage 1                  | -      | -    | -      | -    | 4      | -    |
| Stage 2                  | -      | -    | -      | -    | 129    | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 0      |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 293    | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.02   | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 17.5   | -    | -      | -    | 0      |      |
| HCM Lane LOS             | C      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0.1    | -    | -      | -    | -      |      |

## **APPENDIX 8.2:**

### **HORIZON YEAR (2035) WITH PROJECT CONDITIONS INTERSECTION OPERATIONS ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| Intersection               |       |       |       |       |       |      |      |      |      |      |      |      |
|----------------------------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|
| Intersection Delay, s/veh  | 68.5  |       |       |       |       |      |      |      |      |      |      |      |
| Intersection LOS           | F     |       |       |       |       |      |      |      |      |      |      |      |
| Movement                   | EBU   | EBL   | EBT   | EBR   | WBU   | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
| Vol, veh/h                 | 0     | 0     | 1608  | 489   | 0     | 639  | 1143 | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor           | 0.92  | 0.92  | 0.92  | 0.92  | 0.92  | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles, %          | 0     | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                  | 0     | 0     | 1748  | 532   | 0     | 695  | 1242 | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes            | 0     | 0     | 1     | 1     | 0     | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| Approach                   |       |       | EB    |       | WB    |      |      |      |      |      |      |      |
| Opposing Approach          |       |       | WB    |       | EB    |      |      |      |      |      |      |      |
| Opposing Lanes             |       |       | 2     |       | 2     |      |      |      |      |      |      |      |
| Conflicting Approach Left  |       |       | SB    |       |       |      |      |      |      |      |      |      |
| Conflicting Lanes Left     |       |       | 1     |       | 0     |      |      |      |      |      |      |      |
| Conflicting Approach Right |       |       |       |       | SB    |      |      |      |      |      |      |      |
| Conflicting Lanes Right    |       |       | 0     |       | 1     |      |      |      |      |      |      |      |
| HCM Control Delay          |       |       | 68.9  |       | 70.6  |      |      |      |      |      |      |      |
| HCM LOS                    |       |       | F     |       | F     |      |      |      |      |      |      |      |
| Lane                       | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |      |      |      |      |      |      |      |
| Vol Left, %                | 0%    | 0%    | 100%  | 0%    | 39%   |      |      |      |      |      |      |      |
| Vol Thru, %                | 100%  | 0%    | 0%    | 100%  | 0%    |      |      |      |      |      |      |      |
| Vol Right, %               | 0%    | 100%  | 0%    | 0%    | 61%   |      |      |      |      |      |      |      |
| Sign Control               | Stop  | Stop  | Stop  | Stop  | Stop  |      |      |      |      |      |      |      |
| Traffic Vol by Lane        | 1608  | 489   | 639   | 1143  | 1228  |      |      |      |      |      |      |      |
| LT Vol                     | 0     | 0     | 639   | 0     | 480   |      |      |      |      |      |      |      |
| Through Vol                | 1608  | 0     | 0     | 1143  | 0     |      |      |      |      |      |      |      |
| RT Vol                     | 0     | 489   | 0     | 0     | 748   |      |      |      |      |      |      |      |
| Lane Flow Rate             | 1748  | 532   | 695   | 1242  | 1335  |      |      |      |      |      |      |      |
| Geometry Grp               | 7     | 7     | 7     | 7     | 2     |      |      |      |      |      |      |      |
| Degree of Util (X)         | 1     | 1     | 1     | 1     | 1     |      |      |      |      |      |      |      |
| Departure Headway (Hd)     | 7.717 | 7.018 | 8.297 | 7.797 | 6.702 |      |      |      |      |      |      |      |
| Convergence, Y/N           | Yes   | Yes   | Yes   | Yes   | Yes   |      |      |      |      |      |      |      |
| Cap                        | 489   | 516   | 445   | 485   | 561   |      |      |      |      |      |      |      |
| Service Time               | 5.497 | 4.797 | 5.997 | 5.497 | 4.71  |      |      |      |      |      |      |      |
| HCM Lane V/C Ratio         | 3.575 | 1.031 | 1.562 | 2.561 | 2.38  |      |      |      |      |      |      |      |
| HCM Control Delay          | 69.7  | 66.3  | 72.1  | 69.7  | 64.7  |      |      |      |      |      |      |      |
| HCM Lane LOS               | F     | F     | F     | F     | F     |      |      |      |      |      |      |      |
| HCM 95th-tile Q            | 13.2  | 13.8  | 12.8  | 13.2  | 14.2  |      |      |      |      |      |      |      |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 480  | 0    | 748  |
| Peak Hour Factor  | 0.92 | 0.92 | 0.92 | 0.92 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 522  | 0    | 813  |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 64.7

HCM LOS F

Lane

**Intersection**

Int Delay, s/veh 191.4

| Movement                 | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Vol, veh/h               | 607  | 1481 | 0    | 0    | 1489 | 566  | 293  | 0    | 966  | 0    | 0    | 0    |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -    | -    | None | -    | -    | None | -    | -    | None | -    | -    | None |
| Storage Length           | 230  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | -    | 0    | -    | -    | 0    | -    | -    | 2    | -    | -    | 0    | -    |
| Grade, %                 | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   |
| Heavy Vehicles, %        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 660  | 1610 | 0    | 0    | 1618 | 615  | 318  | 0    | 1050 | 0    | 0    | 0    |

| Major/Minor          | Major1 |   |   | Major2 |   |   | Minor1 |      |      |
|----------------------|--------|---|---|--------|---|---|--------|------|------|
| Conflicting Flow All | 2234   | 0 | 0 | 1610   | 0 | 0 | 4855   | 5163 | 1610 |
| Stage 1              | -      | - | - | -      | - | - | 2929   | 2929 | -    |
| Stage 2              | -      | - | - | -      | - | - | 1926   | 2234 | -    |
| Critical Hdwy        | 2      | - | - | 2      | - | - | 2      | 2    | 2    |
| Critical Hdwy Stg 1  | -      | - | - | -      | - | - | 2      | 2    | -    |
| Critical Hdwy Stg 2  | -      | - | - | -      | - | - | 2      | 2    | -    |
| Follow-up Hdwy       | 2      | - | - | 2      | - | - | 2      | 2    | 2    |
| Pot Cap-1 Maneuver   | 908    | - | - | 1113   | - | - | 351    | 311  | 1113 |
| Stage 1              | -      | - | - | -      | - | - | 716    | 716  | -    |
| Stage 2              | -      | - | - | -      | - | - | 1006   | 908  | -    |
| Platoon blocked, %   | -      | - | - | -      | - | - | -      | -    | -    |
| Mov Cap-1 Maneuver   | 908    | - | - | 1113   | - | - | ~ 96   | 0    | 1113 |
| Mov Cap-2 Maneuver   | -      | - | - | -      | - | - | ~ 176  | 0    | -    |
| Stage 1              | -      | - | - | -      | - | - | ~ 196  | 0    | -    |
| Stage 2              | -      | - | - | -      | - | - | 1006   | 0    | -    |

| Approach             | EB  | WB | NB       |
|----------------------|-----|----|----------|
| HCM Control Delay, s | 5.4 | 0  | \$ 812.5 |
| HCM LOS              |     |    | F        |

| Minor Lane/Major Mvmt | NBLn1    | EBL   | EBT | EBR | WBL  | WBT | WBR |
|-----------------------|----------|-------|-----|-----|------|-----|-----|
| Capacity (veh/h)      | 497      | 908   | -   | -   | 1113 | -   | -   |
| HCM Lane V/C Ratio    | 2.753    | 0.727 | -   | -   | -    | -   | -   |
| HCM Control Delay (s) | \$ 812.5 | 18.7  | -   | -   | 0    | -   | -   |
| HCM Lane LOS          | F        | C     | -   | -   | A    | -   | -   |
| HCM 95th %tile Q(veh) | 113.5    | 6.6   | -   | -   | 0    | -   | -   |

**Notes**

~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

Intersection

Int Delay, s/veh 0.4

| Movement                 | EBL  | EBT  | WBT  | WBR  | SBL  | SBR   |
|--------------------------|------|------|------|------|------|-------|
| Vol, veh/h               | 0    | 2447 | 1983 | 0    | 0    | 72    |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0     |
| Sign Control             | Free | Free | Free | Free | Stop | Stop  |
| RT Channelized           | -    | None | -    | None | -    | Yield |
| Storage Length           | -    | -    | -    | -    | -    | 0     |
| Veh in Median Storage, # | -    | 0    | 0    | -    | 0    | -     |
| Grade, %                 | -    | 0    | 0    | -    | 0    | -     |
| Peak Hour Factor         | 67   | 67   | 67   | 67   | 67   | 67    |
| Heavy Vehicles, %        | 0    | 0    | 0    | 0    | 0    | 0     |
| Mvmt Flow                | 0    | 3652 | 2960 | 0    | 0    | 107   |

| Major/Minor          | Major1 | Major2 | Minor2 |
|----------------------|--------|--------|--------|
| Conflicting Flow All | 2960   | 0      | 4421   |
| Stage 1              | -      | -      | 2960   |
| Stage 2              | -      | -      | 1461   |
| Critical Hdwy        | 5.3    | -      | 5.7    |
| Critical Hdwy Stg 1  | -      | -      | 6.6    |
| Critical Hdwy Stg 2  | -      | -      | 6      |
| Follow-up Hdwy       | 3.1    | -      | 3.8    |
| Pot Cap-1 Maneuver   | 41     | -      | 4      |
| Stage 1              | -      | -      | 14     |
| Stage 2              | -      | -      | 163    |
| Platoon blocked, %   | -      | -      | -      |
| Mov Cap-1 Maneuver   | 41     | -      | 4      |
| Mov Cap-2 Maneuver   | -      | -      | 4      |
| Stage 1              | -      | -      | 14     |
| Stage 2              | -      | -      | 163    |

| Approach             | EB | WB | SB   |
|----------------------|----|----|------|
| HCM Control Delay, s | 0  | 0  | 24.4 |
| HCM LOS              |    |    | C    |

| Minor Lane/Major Mvmt | EBL | EBT | WBT | WBR | SBLn1 |
|-----------------------|-----|-----|-----|-----|-------|
| Capacity (veh/h)      | 41  | -   | -   | -   | 291   |
| HCM Lane V/C Ratio    | -   | -   | -   | -   | 0.369 |
| HCM Control Delay (s) | 0   | -   | -   | -   | 24.4  |
| HCM Lane LOS          | A   | -   | -   | -   | C     |
| HCM 95th %tile Q(veh) | 0   | -   | -   | -   | 1.6   |



| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.3    |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 81     | 2366 | 1983   | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 121    | 3531 | 2960   | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 2960   | 0    | -      | 0    | 4614   | 1480 |
| Stage 1                  | -      | -    | -      | -    | 2960   | -    |
| Stage 2                  | -      | -    | -      | -    | 1654   | -    |
| Critical Hdwy            | 2.5    | -    | -      | -    | 5.7    | 7.1  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 6.6    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 6      | -    |
| Follow-up Hdwy           | 3.1    | -    | -      | -    | 3.8    | 3.9  |
| Pot Cap-1 Maneuver       | 411    | -    | -      | -    | 3      | 100  |
| Stage 1                  | -      | -    | -      | -    | 14     | -    |
| Stage 2                  | -      | -    | -      | -    | 127    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 411    | -    | -      | -    | 2      | 100  |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 2      | -    |
| Stage 1                  | -      | -    | -      | -    | 14     | -    |
| Stage 2                  | -      | -    | -      | -    | 90     | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 0.6    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 411    | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.294  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 17.4   | -    | -      | -    | 0      |      |
| HCM Lane LOS             | C      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 1.2    | -    | -      | -    | -      |      |

| Intersection               |       |       |       |       |       |      |      |      |      |      |      |      |
|----------------------------|-------|-------|-------|-------|-------|------|------|------|------|------|------|------|
| Intersection Delay, s/veh  | 68.6  |       |       |       |       |      |      |      |      |      |      |      |
| Intersection LOS           | F     |       |       |       |       |      |      |      |      |      |      |      |
| Movement                   | EBU   | EBL   | EBT   | EBR   | WBU   | WBL  | WBT  | WBR  | NBU  | NBL  | NBT  | NBR  |
| Vol, veh/h                 | 0     | 0     | 1899  | 608   | 0     | 780  | 1632 | 0    | 0    | 0    | 0    | 0    |
| Peak Hour Factor           | 0.92  | 0.95  | 0.95  | 0.95  | 0.92  | 0.95 | 0.95 | 0.95 | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, %          | 0     | 0     | 0     | 0     | 0     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                  | 0     | 0     | 1999  | 640   | 0     | 821  | 1718 | 0    | 0    | 0    | 0    | 0    |
| Number of Lanes            | 0     | 0     | 1     | 1     | 0     | 1    | 1    | 0    | 0    | 0    | 0    | 0    |
| Approach                   |       |       | EB    |       | WB    |      |      |      |      |      |      |      |
| Opposing Approach          |       |       | WB    |       | EB    |      |      |      |      |      |      |      |
| Opposing Lanes             |       |       | 2     |       | 2     |      |      |      |      |      |      |      |
| Conflicting Approach Left  |       |       | SB    |       |       |      |      |      |      |      |      |      |
| Conflicting Lanes Left     |       |       | 1     |       | 0     |      |      |      |      |      |      |      |
| Conflicting Approach Right |       |       |       |       | SB    |      |      |      |      |      |      |      |
| Conflicting Lanes Right    |       |       | 0     |       | 1     |      |      |      |      |      |      |      |
| HCM Control Delay          |       |       | 68.9  |       | 70.5  |      |      |      |      |      |      |      |
| HCM LOS                    |       |       | F     |       | F     |      |      |      |      |      |      |      |
| Lane                       | EBLn1 | EBLn2 | WBLn1 | WBLn2 | SBLn1 |      |      |      |      |      |      |      |
| Vol Left, %                | 0%    | 0%    | 100%  | 0%    | 54%   |      |      |      |      |      |      |      |
| Vol Thru, %                | 100%  | 0%    | 0%    | 100%  | 0%    |      |      |      |      |      |      |      |
| Vol Right, %               | 0%    | 100%  | 0%    | 0%    | 46%   |      |      |      |      |      |      |      |
| Sign Control               | Stop  | Stop  | Stop  | Stop  | Stop  |      |      |      |      |      |      |      |
| Traffic Vol by Lane        | 1899  | 608   | 780   | 1632  | 1559  |      |      |      |      |      |      |      |
| LT Vol                     | 0     | 0     | 780   | 0     | 849   |      |      |      |      |      |      |      |
| Through Vol                | 1899  | 0     | 0     | 1632  | 0     |      |      |      |      |      |      |      |
| RT Vol                     | 0     | 608   | 0     | 0     | 710   |      |      |      |      |      |      |      |
| Lane Flow Rate             | 1999  | 640   | 821   | 1718  | 1641  |      |      |      |      |      |      |      |
| Geometry Grp               | 7     | 7     | 7     | 7     | 2     |      |      |      |      |      |      |      |
| Degree of Util (X)         | 1     | 1     | 1     | 1     | 1     |      |      |      |      |      |      |      |
| Departure Headway (Hd)     | 7.74  | 7.04  | 8.207 | 7.708 | 6.825 |      |      |      |      |      |      |      |
| Convergence, Y/N           | Yes   | Yes   | Yes   | Yes   | Yes   |      |      |      |      |      |      |      |
| Cap                        | 500   | 518   | 443   | 481   | 558   |      |      |      |      |      |      |      |
| Service Time               | 5.497 | 4.797 | 5.997 | 5.497 | 4.833 |      |      |      |      |      |      |      |
| HCM Lane V/C Ratio         | 3.998 | 1.236 | 1.853 | 3.572 | 2.941 |      |      |      |      |      |      |      |
| HCM Control Delay          | 69.7  | 66.3  | 72.1  | 69.7  | 65.3  |      |      |      |      |      |      |      |
| HCM Lane LOS               | F     | F     | F     | F     | F     |      |      |      |      |      |      |      |
| HCM 95th-tile Q            | 13.2  | 13.8  | 12.8  | 13.2  | 14.1  |      |      |      |      |      |      |      |

Intersection

Intersection Delay, s/veh

Intersection LOS

| Movement          | SBU  | SBL  | SBT  | SBR  |
|-------------------|------|------|------|------|
| Vol, veh/h        | 0    | 849  | 0    | 710  |
| Peak Hour Factor  | 0.92 | 0.95 | 0.95 | 0.95 |
| Heavy Vehicles, % | 0    | 0    | 0    | 0    |
| Mvmt Flow         | 0    | 894  | 0    | 747  |
| Number of Lanes   | 0    | 0    | 1    | 0    |

Approach SB

Opposing Approach

Opposing Lanes 0

Conflicting Approach Left WB

Conflicting Lanes Left 2

Conflicting Approach Right EB

Conflicting Lanes Right 2

HCM Control Delay 65.3

HCM LOS F

Lane

**Intersection**

Int Delay, s/veh 451.9

| Movement                 | EBL  | EBT  | EBR  | WBL  | WBT  | WBR  | NBL  | NBT  | NBR  | SBL  | SBT  | SBR  |
|--------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
| Vol, veh/h               | 770  | 1979 | 0    | 0    | 1963 | 562  | 449  | 0    | 757  | 0    | 0    | 0    |
| Conflicting Peds, #/hr   | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Sign Control             | Free | Free | Free | Free | Free | Free | Stop | Stop | Stop | Stop | Stop | Stop |
| RT Channelized           | -    | -    | None | -    | -    | None | -    | -    | None | -    | -    | None |
| Storage Length           | 230  | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    | -    |
| Veh in Median Storage, # | -    | 0    | -    | -    | 0    | -    | -    | 2    | -    | -    | 0    | -    |
| Grade, %                 | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    | -    | 0    | -    |
| Peak Hour Factor         | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   | 92   |
| Heavy Vehicles, %        | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Mvmt Flow                | 837  | 2151 | 0    | 0    | 2134 | 611  | 488  | 0    | 823  | 0    | 0    | 0    |

| Major/Minor          | Major1 |   |   | Major2 |   |   | Minor1 |      |      |
|----------------------|--------|---|---|--------|---|---|--------|------|------|
| Conflicting Flow All | 2745   | 0 | 0 | 2151   | 0 | 0 | 6264   | 6570 | 2151 |
| Stage 1              | -      | - | - | -      | - | - | 3825   | 3825 | -    |
| Stage 2              | -      | - | - | -      | - | - | 2439   | 2745 | -    |
| Critical Hdwy        | 2      | - | - | 2      | - | - | 2      | 2    | 2    |
| Critical Hdwy Stg 1  | -      | - | - | -      | - | - | 2      | 2    | -    |
| Critical Hdwy Stg 2  | -      | - | - | -      | - | - | 2      | 2    | -    |
| Follow-up Hdwy       | 2      | - | - | 2      | - | - | 2      | 2    | 2    |
| Pot Cap-1 Maneuver   | ~ 764  | - | - | 934    | - | - | ~ 199  | 175  | 934  |
| Stage 1              | -      | - | - | -      | - | - | 519    | 519  | -    |
| Stage 2              | -      | - | - | -      | - | - | 848    | 764  | -    |
| Platoon blocked, %   |        | - | - |        | - | - |        |      |      |
| Mov Cap-1 Maneuver   | ~ 764  | - | - | 934    | - | - | ~ 199  | 0    | 934  |
| Mov Cap-2 Maneuver   | -      | - | - | -      | - | - | ~ 92   | 0    | -    |
| Stage 1              | -      | - | - | -      | - | - | 519    | 0    | -    |
| Stage 2              | -      | - | - | -      | - | - | 848    | 0    | -    |

| Approach             | EB   | WB | NB        |
|----------------------|------|----|-----------|
| HCM Control Delay, s | 23.5 | 0  | \$ 2374.6 |
| HCM LOS              |      |    | F         |

| Minor Lane/Major Mvmt | NBLn1     | EBL   | EBT | EBR | WBL | WBT | WBR |
|-----------------------|-----------|-------|-----|-----|-----|-----|-----|
| Capacity (veh/h)      | 212       | ~ 764 | -   | -   | 934 | -   | -   |
| HCM Lane V/C Ratio    | 6.183     | 1.095 | -   | -   | -   | -   | -   |
| HCM Control Delay (s) | \$ 2374.6 | 84    | -   | -   | 0   | -   | -   |
| HCM Lane LOS          | F         | F     | -   | -   | A   | -   | -   |
| HCM 95th %tile Q(veh) | 140.8     | 22.9  | -   | -   | 0   | -   | -   |

**Notes**

~: Volume exceeds capacity    \$: Delay exceeds 300s    +: Computation Not Defined    \*: All major volume in platoon

| Intersection             |        |      |        |      |        |       |
|--------------------------|--------|------|--------|------|--------|-------|
| Int Delay, s/veh         | 0.1    |      |        |      |        |       |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR   |
| Vol, veh/h               | 0      | 2736 | 2493   | 0    | 0      | 32    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0     |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop  |
| RT Channelized           | -      | None | -      | None | -      | Yield |
| Storage Length           | -      | -    | -      | -    | -      | 0     |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -     |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -     |
| Peak Hour Factor         | 88     | 88   | 88     | 88   | 88     | 88    |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0     |
| Mvmt Flow                | 0      | 3109 | 2833   | 0    | 0      | 36    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |       |
| Conflicting Flow All     | 2833   | 0    | -      | 0    | 4077   | 1416  |
| Stage 1                  | -      | -    | -      | -    | 2833   | -     |
| Stage 2                  | -      | -    | -      | -    | 1244   | -     |
| Critical Hdwy            | 5.3    | -    | -      | -    | 5.7    | 4.5   |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 6.6    | -     |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 6      | -     |
| Follow-up Hdwy           | 3.1    | -    | -      | -    | 3.8    | 3.9   |
| Pot Cap-1 Maneuver       | 48     | -    | -      | -    | 6      | 308   |
| Stage 1                  | -      | -    | -      | -    | 17     | -     |
| Stage 2                  | -      | -    | -      | -    | 214    | -     |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -     |
| Mov Cap-1 Maneuver       | 48     | -    | -      | -    | 6      | 308   |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 6      | -     |
| Stage 1                  | -      | -    | -      | -    | 17     | -     |
| Stage 2                  | -      | -    | -      | -    | 214    | -     |
| Approach                 | EB     |      | WB     |      | SB     |       |
| HCM Control Delay, s     | 0      |      | 0      |      | 18.2   |       |
| HCM LOS                  |        |      |        |      | C      |       |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |       |
| Capacity (veh/h)         | 48     | -    | -      | -    | 308    |       |
| HCM Lane V/C Ratio       | -      | -    | -      | -    | 0.118  |       |
| HCM Control Delay (s)    | 0      | -    | -      | -    | 18.2   |       |
| HCM Lane LOS             | A      | -    | -      | -    | C      |       |
| HCM 95th %tile Q(veh)    | 0      | -    | -      | -    | 0.4    |       |

| Intersection             |        |      |        |      |        |      |
|--------------------------|--------|------|--------|------|--------|------|
| Int Delay, s/veh         | 0.1    |      |        |      |        |      |
| Movement                 | EBL    | EBT  | WBT    | WBR  | SBL    | SBR  |
| Vol, veh/h               | 30     | 2706 | 2493   | 0    | 0      | 0    |
| Conflicting Peds, #/hr   | 0      | 0    | 0      | 0    | 0      | 0    |
| Sign Control             | Free   | Free | Free   | Free | Stop   | Stop |
| RT Channelized           | -      | None | -      | None | -      | None |
| Storage Length           | 100    | -    | -      | -    | 0      | -    |
| Veh in Median Storage, # | -      | 0    | 0      | -    | 0      | -    |
| Grade, %                 | -      | 0    | 0      | -    | 0      | -    |
| Peak Hour Factor         | 67     | 67   | 67     | 67   | 67     | 67   |
| Heavy Vehicles, %        | 0      | 0    | 0      | 0    | 0      | 0    |
| Mvmt Flow                | 45     | 4039 | 3721   | 0    | 0      | 0    |
| Major/Minor              | Major1 |      | Major2 |      | Minor2 |      |
| Conflicting Flow All     | 3721   | 0    | -      | 0    | 5426   | 1860 |
| Stage 1                  | -      | -    | -      | -    | 3721   | -    |
| Stage 2                  | -      | -    | -      | -    | 1705   | -    |
| Critical Hdwy            | 2.5    | -    | -      | -    | 5.7    | 7.1  |
| Critical Hdwy Stg 1      | -      | -    | -      | -    | 6.6    | -    |
| Critical Hdwy Stg 2      | -      | -    | -      | -    | 6      | -    |
| Follow-up Hdwy           | 3.1    | -    | -      | -    | 3.8    | 3.9  |
| Pot Cap-1 Maneuver       | 293    | -    | -      | -    | 1      | 55   |
| Stage 1                  | -      | -    | -      | -    | 4      | -    |
| Stage 2                  | -      | -    | -      | -    | 119    | -    |
| Platoon blocked, %       | -      | -    | -      | -    | -      | -    |
| Mov Cap-1 Maneuver       | 293    | -    | -      | -    | 1      | 55   |
| Mov Cap-2 Maneuver       | -      | -    | -      | -    | 1      | -    |
| Stage 1                  | -      | -    | -      | -    | 4      | -    |
| Stage 2                  | -      | -    | -      | -    | 101    | -    |
| Approach                 | EB     |      | WB     |      | SB     |      |
| HCM Control Delay, s     | 0.2    |      | 0      |      | 0      |      |
| HCM LOS                  |        |      |        |      | A      |      |
| Minor Lane/Major Mvmt    | EBL    | EBT  | WBT    | WBR  | SBLn1  |      |
| Capacity (veh/h)         | 293    | -    | -      | -    | -      |      |
| HCM Lane V/C Ratio       | 0.153  | -    | -      | -    | -      |      |
| HCM Control Delay (s)    | 19.5   | -    | -      | -    | 0      |      |
| HCM Lane LOS             | C      | -    | -      | -    | A      |      |
| HCM 95th %tile Q(veh)    | 0.5    | -    | -      | -    | -      |      |

**APPENDIX 8.3:**

**HORIZON YEAR (2035) WITHOUT PROJECT CONDITIONS BASIC FREEWAY SEGMENT  
ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank



| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year 2035 Without Project                                                                |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4365                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 8                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.962                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1645                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 67.7                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 24.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year 2035 Without Project                                                                |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4265                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 9                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.957                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1615                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 68.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 23.7                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year 2035 Without Project                                                                |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 6355                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 9                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.957                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2406                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 53.1                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 45.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | F                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year 2035 Without Project                                                                |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 6437                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2449                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 51.9                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 47.2                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | F                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year 2035 Without Project                                                                |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 6634                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 8                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.962                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2500                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 50.4                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 49.6                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | F                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year 2035 Without Project                                                                |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 6460                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 8                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.962                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2434                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 52.3                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 46.5                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | F                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year 2035 Without Project                                                                |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 5792                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2214                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 58.1                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 38.1                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | E                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year 2035 Without Project                                                                |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 5665                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2165                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 59.2                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 36.6                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | E                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |



**APPENDIX 8.4:**

**HORIZON YEAR (2035) WITH PROJECT CONDITIONS BASIC FREEWAY SEGMENT  
ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year 2035 With Project                                                                   |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4370                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 8                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.962                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1647                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 67.7                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 24.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year 2035 With Project                                                                   |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 4270                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 9                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.957                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 1617                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 68.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 23.8                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | C                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year 2035 With Project                                                                   |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 6359                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 9                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.957                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2408                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 53.1                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 45.4                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | F                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year 2035 With Project                                                                   |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 6443                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2451                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 51.8                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 47.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | F                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year 2035 With Project                                                                   |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 6638                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 8                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.962                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2501                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 50.4                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 49.7                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | F                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year 2035 With Project                                                                   |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 6465                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 8                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.962                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2436                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 52.3                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 46.6                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | F                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |



| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year 2035 With Project                                                                   |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 5796                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2216                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 58.0                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 38.2                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | E                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year 2035 With Project                                                                   |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 5669                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2167                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | pc/h/ln                                                                                           |                                        |     |
| S                                                           | 59.2                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 36.6                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | E                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

**APPENDIX 8.5:**

**HORIZON YEAR (2035) WITHOUT PROJECT CONDITIONS FREEWAY MERGE/DIVERGE  
ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |               |                                                                                                                                                                                                                         |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound      |               |                                                                                                                                                                                                                         |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp     |               |                                                                                                                                                                                                                         |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans             |               |                                                                                                                                                                                                                         |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 Without Project |               |                                                                                                                                                                                                                         |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                    |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 1114 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                    |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 220                  |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4365                 |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1214                 |               |                                                                                                                                                                                                                         |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$             | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                    |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4365            | 0.92                            | Level                | 8                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.962                | 1.00          | 4934                                                                                                                                                                                                                    |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1214            | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990                | 1.00          | 1333                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1114            | 0.92                            | Level                | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.985                | 1.00          | 1229                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                      |               |                                                                                                                                                                                                                         |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |               |                                                                                                                                                                                                                         |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.575 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3405 pc/h<br>$V_3$ or $V_{av34}$ 1529 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                      |               |                                                                                                                                                                                                                         |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual               | Capacity      |                                                                                                                                                                                                                         | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4934                 | Exhibit 13-8  | 7200                                                                                                                                                                                                                    | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 3601                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200                 | No            |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 1333                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100                 | No            |                                                                                                                                                                                                                         |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual               | Max Desirable |                                                                                                                                                                                                                         | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3405                 | Exhibit 13-8  | 4400:All                                                                                                                                                                                                                | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |               |                                                                                                                                                                                                                         |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 31.6 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                      |               |                                                                                                                                                                                                                         |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.418 (Exhibit 13-12)<br>$S_R =$ 58.3 mph (Exhibit 13-12)<br>$S_0 =$ 74.7 mph (Exhibit 13-12)<br>$S =$ 62.6 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                      |               |                                                                                                                                                                                                                         |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |               |                                                                                                                                                                                                    |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Southbound      |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp      |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans             |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | AM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2035 Without Project |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2075$ ft<br><br>$V_u = 1214$ veh/h                                                                                                                                                                                                                                                                                             |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                    |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1                    |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 230                  |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3151                 |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1114                 |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$             | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3151            | 0.92                            | Level    | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.948                | 1.00          | 3613                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1114            | 0.92                            | Level    | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.985                | 1.00          | 1229                                                                                                                                                                                               |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1214            | 0.92                            | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.990                | 1.00          | 1333                                                                                                                                                                                               |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                      |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 1089.71$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.584$ using Equation (Exhibit 13-6)<br>$V_{12} = 2110$ pc/h<br>$V_3$ or $V_{av34} = 1503$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 2110$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                      |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual               | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4842            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                      | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                      | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual               | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3339            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 29.5$ (pc/mi/ln)<br>LOS = D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                      |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                      |               |                                                                                                                                                                                                    |            |
| $M_S = 0.410$ (Exhibit 13-11)<br>$S_R = 58.5$ mph (Exhibit 13-11)<br>$S_0 = 66.4$ mph (Exhibit 13-11)<br>$S = 60.8$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                      |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------|----------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                   |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                |                |                                              |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               | CHS                                               |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | I-15 Northbound                                                                                                                                                |                |                                              |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               | Urban Crossroads, Inc.                            |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Nichols On-Ramp                                                                                                                                                |                |                                              |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               | 6/3/2015                                          |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Caltrans                                                                                                                                                       |                |                                              |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               | AM Peak Hour                                      |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2035 Without Project                                                                                                                                           |                |                                              |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| Upstream Adj Ramp<br><br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               | Freeway Number of Lanes, N                      3 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Downstream Adj Ramp<br><br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Ramp Number of Lanes, N                      1    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| L <sub>up</sub> =                      2130   ft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               | Acceleration Lane Length, L <sub>A</sub> 800      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | L <sub>down</sub> =                      ft                                                                                                                    |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Deceleration Lane Length L <sub>D</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| V <sub>u</sub> =                      1243   veh/h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               | Freeway Volume, V <sub>F</sub> 5194               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | V <sub>D</sub> =                      veh/h                                                                                                                    |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Ramp Volume, V <sub>R</sub> 1161                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Freeway Free-Flow Speed, S <sub>FF</sub> 70.0     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Ramp Free-Flow Speed, S <sub>FR</sub> 45.0        |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | V<br>(Veh/hr) | PHF                                               | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | f <sub>HV</sub>                                                                                                                                                | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub> |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 5194          | 0.92                                              | Level    | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.948                                                                                                                                                          | 1.00           | 5956                                         |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1161          | 0.92                                              | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.995                                                                                                                                                          | 1.00           | 1268                                         |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1243          | 0.92                                              | Level    | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.985                                                                                                                                                          | 1.00           | 1371                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                   |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                |                |                                              |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |                                                   |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                |                |                                              |            |
| V <sub>12</sub> = V <sub>F</sub> ( P <sub>FM</sub> )<br>L <sub>EQ</sub> =                      1852.54   (Equation 13-6 or 13-7)<br>P <sub>FM</sub> =                      0.600   using Equation (Exhibit 13-6)<br>V <sub>12</sub> =                      3573   pc/h<br>V <sub>3</sub> or V <sub>av34</sub> 2383   pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> =                      3573   pc/h (Equation 13-16, 13-18, or 13-19) |               |                                                   |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> =                      (Equation 13-12 or 13-13)<br>P <sub>FD</sub> =                      using Equation (Exhibit 13-7)<br>V <sub>12</sub> =                      pc/h<br>V <sub>3</sub> or V <sub>av34</sub> pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> =                      pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                |                |                                              |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                                   |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual        | Capacity                                          |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual                                                                                                                                                         | Capacity       |                                              | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 7224          | Exhibit 13-8                                      |          | Yes                   | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                                                   |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                                                   |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                | Exhibit 13-10  |                                              |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                                                   |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual        | Max Desirable                                     |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual                                                                                                                                                         | Max Desirable  |                                              | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4841          | Exhibit 13-8                                      | 4600:All | Yes                   | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                                                   |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                |                |                                              |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> =                      37.6 (pc/mi/ln)<br>LOS =                      F (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                                                   |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> =                      (pc/mi/ln)<br>LOS =                      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                |                |                                              |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                   |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                |                |                                              |            |
| M <sub>S</sub> =                      0.743 (Exhibit 13-11)<br>S <sub>R</sub> =                      49.2 mph (Exhibit 13-11)<br>S <sub>0</sub> =                      63.0 mph (Exhibit 13-11)<br>S =                      53.0 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                   |          |                       | D <sub>s</sub> =                      (Exhibit 13-12)<br>S <sub>R</sub> =                      mph (Exhibit 13-12)<br>S <sub>0</sub> =                      mph (Exhibit 13-12)<br>S =                      mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                      |               |                                                                                                                                                                                                                         |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | I-15 Northbound      |               |                                                                                                                                                                                                                         |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Nichols Off-Ramp     |               |                                                                                                                                                                                                                         |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Caltrans             |               |                                                                                                                                                                                                                         |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2035 Without Project |               |                                                                                                                                                                                                                         |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3                    |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 1161 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1                    |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 225                  |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6437                 |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1243                 |               |                                                                                                                                                                                                                         |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | $f_{HV}$             | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                    |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6437            | 0.92                            | Level                | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.952                | 1.00          | 7347                                                                                                                                                                                                                    |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1243            | 0.92                            | Level                | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.985                | 1.00          | 1371                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1161            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.995                | 1.00          | 1268                                                                                                                                                                                                                    |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                 |                      |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |               |                                                                                                                                                                                                                         |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |               |                                                                                                                                                                                                                         |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.513 using Equation (Exhibit 13-7)<br>$V_{12} =$ 4438 pc/h<br>$V_3$ or $V_{av34}$ 2909 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ 4647 pc/h (Equation 13-16, 13-18, or 13-19) |                      |               |                                                                                                                                                                                                                         |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual               | Capacity      |                                                                                                                                                                                                                         | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 7347                 | Exhibit 13-8  | 7200                                                                                                                                                                                                                    | Yes        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 5976                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 7200                 | No            |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 1371                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2100                 | No            |                                                                                                                                                                                                                         |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual               | Max Desirable |                                                                                                                                                                                                                         | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4438                 | Exhibit 13-8  | 4400:All                                                                                                                                                                                                                | Yes        |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |               |                                                                                                                                                                                                                         |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 42.2 (pc/mi/ln)<br>LOS =      F (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                           |                      |               |                                                                                                                                                                                                                         |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |               |                                                                                                                                                                                                                         |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.421 (Exhibit 13-12)<br>$S_R =$ 58.2 mph (Exhibit 13-12)<br>$S_0 =$ 70.2 mph (Exhibit 13-12)<br>$S =$ 62.1 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                       |                      |               |                                                                                                                                                                                                                         |            |



| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                      |               |                                                                                                                                                                                                                         |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | I-15 Southbound      |               |                                                                                                                                                                                                                         |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Nichols Off-Ramp     |               |                                                                                                                                                                                                                         |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Caltrans             |               |                                                                                                                                                                                                                         |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2035 Without Project |               |                                                                                                                                                                                                                         |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3                    |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 1375 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1                    |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 220                  |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6634                 |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1549                 |               |                                                                                                                                                                                                                         |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | $f_{HV}$             | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                    |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6634            | 0.92                            | Level                | 8                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.962                | 1.00          | 7499                                                                                                                                                                                                                    |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1549            | 0.92                            | Level                | 0                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1.000                | 1.00          | 1684                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1375            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.995                | 1.00          | 1502                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |               |                                                                                                                                                                                                                         |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.495 using Equation (Exhibit 13-7)<br>$V_{12} =$ 4563 pc/h<br>$V_3$ or $V_{av34}$ 2936 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ 4799 pc/h (Equation 13-16, 13-18, or 13-19) |                      |               |                                                                                                                                                                                                                         |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual               | Capacity      |                                                                                                                                                                                                                         | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 7499                 | Exhibit 13-8  | 7200                                                                                                                                                                                                                    | Yes        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 5815                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 7200                 | No            |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 1684                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2100                 | No            |                                                                                                                                                                                                                         |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual               | Max Desirable |                                                                                                                                                                                                                         | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4563                 | Exhibit 13-8  | 4400:All                                                                                                                                                                                                                | Yes        |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |               |                                                                                                                                                                                                                         |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 43.5 (pc/mi/ln)<br>LOS =      F (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                           |                      |               |                                                                                                                                                                                                                         |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      |               |                                                                                                                                                                                                                         |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.450 (Exhibit 13-12)<br>$S_R =$ 57.4 mph (Exhibit 13-12)<br>$S_0 =$ 70.2 mph (Exhibit 13-12)<br>$S =$ 61.4 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                       |                      |               |                                                                                                                                                                                                                         |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------|----------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                                                   |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                |                |                                              |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               | CHS                                               |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | I-15 Southbound                                                                                                                                                |                |                                              |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               | Urban Crossroads, Inc.                            |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Nichols On-Ramp                                                                                                                                                |                |                                              |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               | 6/3/2015                                          |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Caltrans                                                                                                                                                       |                |                                              |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | PM Peak Hour                                      |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2035 Without Project                                                                                                                                           |                |                                              |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| Upstream Adj Ramp<br><br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               | Freeway Number of Lanes, N                      3 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Downstream Adj Ramp<br><br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               | Ramp Number of Lanes, N                      1    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| L <sub>up</sub> =            2075    ft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               | Acceleration Lane Length, L <sub>A</sub> 230      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | L <sub>down</sub> =            ft                                                                                                                              |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               | Deceleration Lane Length L <sub>D</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| V <sub>u</sub> =            1549    veh/h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               | Freeway Volume, V <sub>F</sub> 5085               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | V <sub>D</sub> =            veh/h                                                                                                                              |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               | Ramp Volume, V <sub>R</sub> 1375                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               | Freeway Free-Flow Speed, S <sub>FF</sub> 70.0     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               | Ramp Free-Flow Speed, S <sub>FR</sub> 45.0        |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | V<br>(Veh/hr) | PHF                                               | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | f <sub>HV</sub>                                                                                                                                                | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub> |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 5085          | 0.92                                              | Level    | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.952                                                                                                                                                          | 1.00           | 5804                                         |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1375          | 0.92                                              | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.995                                                                                                                                                          | 1.00           | 1502                                         |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 1549          | 0.92                                              | Level    | 0                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1.000                                                                                                                                                          | 1.00           | 1684                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                                   |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                |                |                                              |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                   |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                |                |                                              |            |
| V <sub>12</sub> = V <sub>F</sub> ( P <sub>FM</sub> )<br>L <sub>EQ</sub> =                      1617.00    (Equation 13-6 or 13-7)<br>P <sub>FM</sub> =                      0.584    using Equation (Exhibit 13-6)<br>V <sub>12</sub> =                      3389    pc/h<br>V <sub>3</sub> or V <sub>av34</sub> 2415    pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> =                      3389    pc/h (Equation 13-16, 13-18, or 13-19) |               |                                                   |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> =                      (Equation 13-12 or 13-13)<br>P <sub>FD</sub> =                      using Equation (Exhibit 13-7)<br>V <sub>12</sub> =                      pc/h<br>V <sub>3</sub> or V <sub>av34</sub> pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> =                      pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                |                |                                              |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |                                                   |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual        | Capacity                                          |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual                                                                                                                                                         | Capacity       |                                              | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7306          | Exhibit 13-8                                      |          | Yes                   | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                   |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                   |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                | Exhibit 13-10  |                                              |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                   |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual        | Max Desirable                                     |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual                                                                                                                                                         | Max Desirable  |                                              | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4891          | Exhibit 13-8                                      | 4600:All | Yes                   | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |                                                   |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                |                |                                              |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> =                      41.5 (pc/mi/ln)<br>LOS =                      F (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                   |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> =                      (pc/mi/ln)<br>LOS =                      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                |                |                                              |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                                                   |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                |                |                                              |            |
| M <sub>S</sub> =                      0.819 (Exhibit 13-11)<br>S <sub>R</sub> =                      47.1 mph (Exhibit 13-11)<br>S <sub>0</sub> =                      62.8 mph (Exhibit 13-11)<br>S =                      51.3 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                                                   |          |                       | D <sub>s</sub> =                      (Exhibit 13-12)<br>S <sub>R</sub> =                      mph (Exhibit 13-12)<br>S <sub>0</sub> =                      mph (Exhibit 13-12)<br>S =                      mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                |                                                                                                                                                                                                            |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      |                |                                                                                                                                                                                                            |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            | CHS                                      |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Northbound      |                |                                                                                                                                                                                                            |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | Urban Crossroads, Inc.                   |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp      |                |                                                                                                                                                                                                            |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            | 6/3/2015                                 |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans             |                |                                                                                                                                                                                                            |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | PM Peak Hour                             |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2035 Without Project |                |                                                                                                                                                                                                            |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                |                                                                                                                                                                                                            |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                |                                                                                                                                                                                                            |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2130 ft<br>V <sub>u</sub> = 1194 veh/h                                                                                                                                                                                                                                                                                                                                                                                                  |            | Freeway Number of Lanes, N               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                    |                | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Number of Lanes, N                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                    |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Acceleration Lane Length, L <sub>A</sub> |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 800                  |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Deceleration Lane Length L <sub>D</sub>  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Freeway Volume, V <sub>F</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4471                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Volume, V <sub>R</sub>              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1321                 |                |                                                                                                                                                                                                            |            |
| Freeway Free-Flow Speed, S <sub>FF</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                                          |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                |                                                                                                                                                                                                            |            |
| Ramp Free-Flow Speed, S <sub>FR</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                          |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                |                                                                                                                                                                                                            |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                |                                                                                                                                                                                                            |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | V (Veh/hr) | PHF                                      | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub>      | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub>                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4471       | 0.92                                     | Level    | 13                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.939                | 1.00           | 5176                                                                                                                                                                                                       |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1321       | 0.92                                     | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.995                | 1.00           | 1443                                                                                                                                                                                                       |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1194       | 0.92                                     | Level    | 0                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1.000                | 1.00           | 1298                                                                                                                                                                                                       |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |                |                                                                                                                                                                                                            |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |                |                                                                                                                                                                                                            |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |                |                                                                                                                                                                                                            |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 1723.07 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.600 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 3105 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 2071 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 3105 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                          |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                      |                |                                                                                                                                                                                                            |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                          |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                      |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Capacity                                 |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual               | Capacity       |                                                                                                                                                                                                            | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 6619       | Exhibit 13-8                             |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      | Exhibit 13-10  |                                                                                                                                                                                                            |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Max Desirable                            |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual               | Max Desirable  |                                                                                                                                                                                                            | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4548       | Exhibit 13-8                             | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      | Exhibit 13-8   |                                                                                                                                                                                                            |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                      |                |                                                                                                                                                                                                            |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 35.3 (pc/mi/ln)<br>LOS = E (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                      |                |                                                                                                                                                                                                            |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |                |                                                                                                                                                                                                            |            |
| M <sub>S</sub> = 0.617 (Exhibit 13-11)<br>S <sub>R</sub> = 52.7 mph (Exhibit 13-11)<br>S <sub>0</sub> = 64.3 mph (Exhibit 13-11)<br>S = 55.9 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |                |                                                                                                                                                                                                            |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      |               |                                                                                                                                                                                                                         |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound      |               |                                                                                                                                                                                                                         |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp     |               |                                                                                                                                                                                                                         |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans             |               |                                                                                                                                                                                                                         |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 Without Project |               |                                                                                                                                                                                                                         |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                    |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 1321 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                    |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 225                  |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5665                 |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1194                 |               |                                                                                                                                                                                                                         |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$             | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                    |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5665            | 0.92                            | Level                | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.948                | 1.00          | 6496                                                                                                                                                                                                                    |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1194            | 0.92                            | Level                | 0                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1.000                | 1.00          | 1298                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                      |               |                                                                                                                                                                                                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1321            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                | 1.00          | 1443                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                      |               |                                                                                                                                                                                                                         |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                      |               |                                                                                                                                                                                                                         |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.538 using Equation (Exhibit 13-7)<br>$V_{12} =$ 4094 pc/h<br>$V_3$ or $V_{av34}$ 2402 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                      |               |                                                                                                                                                                                                                         |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual               | Capacity      |                                                                                                                                                                                                                         | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6496                 | Exhibit 13-8  | 7200                                                                                                                                                                                                                    | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 5198                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200                 | No            |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 1298                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100                 | No            |                                                                                                                                                                                                                         |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                      |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual               | Max Desirable |                                                                                                                                                                                                                         | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4094                 | Exhibit 13-8  | 4400:All                                                                                                                                                                                                                | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |               |                                                                                                                                                                                                                         |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 37.4 (pc/mi/ln)<br>LOS =      E (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                      |               |                                                                                                                                                                                                                         |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                      |               |                                                                                                                                                                                                                         |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.415 (Exhibit 13-12)<br>$S_R =$ 58.4 mph (Exhibit 13-12)<br>$S_0 =$ 71.3 mph (Exhibit 13-12)<br>$S =$ 62.6 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                      |               |                                                                                                                                                                                                                         |            |

**APPENDIX 8.6:**

**HORIZON YEAR (2035) WITH PROJECT CONDITIONS FREEWAY MERGE/DIVERGE  
ANALYSIS WORKSHEETS**

This Page Intentionally Left Blank

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                    |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                                |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound                                                                                                                                                                                                         |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.             |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp                                                                                                                                                                                                        |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                           |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                                                                                                                                                                                                                |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                       |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 With Project                                                                                                                                                                                                       |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      3  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 1119 veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N      1     |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$ 220 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$ 4370         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$ 1219            |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Freeway Free-Flow Speed, $S_{FF}$ 70.0                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Ramp Free-Flow Speed, $S_{FR}$ 45.0                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                                | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                                                                                                                                                                                                                | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4370            | 0.92                               | Level                | 8                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.962                                                                                                                                                                                                                   | 1.00          | 4940                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1219            | 0.92                               | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990                                                                                                                                                                                                                   | 1.00          | 1338                                 |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1119            | 0.92                               | Level                | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.980                                                                                                                                                                                                                   | 1.00          | 1241                                 |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                    |                      |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                    |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                         |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                    |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.575 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3409 pc/h<br>$V_3$ or $V_{av34}$ 1531 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                    |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                           |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                  | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                       |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4940                                                                                                                                                                                                                    | Exhibit 13-8  | 7200                                 | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    | $V_{FO} = V_F - V_R$ | 3602                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200                                                                                                                                                                                                                    | No            |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    | $V_R$                | 1338                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100                                                                                                                                                                                                                    | No            |                                      |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                    |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                      |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                  | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                       |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3409                                                                                                                                                                                                                    | Exhibit 13-8  | 4400:All                             | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                    |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                         |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                    |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 31.6 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                    |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                         |               |                                      |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                    |                      |                       | $D_S =$ 0.418 (Exhibit 13-12)<br>$S_R =$ 58.3 mph (Exhibit 13-12)<br>$S_0 =$ 74.7 mph (Exhibit 13-12)<br>$S =$ 62.5 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |               |                                      |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                              |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                            |                |                                              |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            | CHS                                          |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Southbound                                                                                                                                                                                            |                |                                              |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | Urban Crossroads, Inc.                       |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp                                                                                                                                                                                            |                |                                              |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            | 6/3/2015                                     |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans                                                                                                                                                                                                   |                |                                              |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | AM Peak Hour                                 |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2035 With Project                                                                                                                                                                                          |                |                                              |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2075 ft<br>V <sub>u</sub> = 1219 veh/h                                                                                                                                                                                                                                                                                                                                                                                                  |            | Freeway Number of Lanes, N 3                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Number of Lanes, N 1                    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Acceleration Lane Length, L <sub>A</sub> 230 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Deceleration Lane Length L <sub>D</sub>      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Freeway Volume, V <sub>F</sub> 3151          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Volume, V <sub>R</sub> 1119             |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| Freeway Free-Flow Speed, S <sub>FF</sub> 70.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| Ramp Free-Flow Speed, S <sub>FR</sub> 45.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | V (Veh/hr) | PHF                                          | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub>                                                                                                                                                                                            | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub> |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 3151       | 0.92                                         | Level    | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.948                                                                                                                                                                                                      | 1.00           | 3613                                         |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1119       | 0.92                                         | Level    | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.980                                                                                                                                                                                                      | 1.00           | 1241                                         |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1219       | 0.92                                         | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.990                                                                                                                                                                                                      | 1.00           | 1338                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |                |                                              |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                              |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |                |                                              |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                              |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                            |                |                                              |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 1092.28 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.584 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 2110 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 1503 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 2110 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                              |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                            |                |                                              |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                              |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Capacity                                     |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                                                                                                                                                                                                     | Capacity       |                                              | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4854       | Exhibit 13-8                                 |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                            | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                              |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                            | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                              |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                            | Exhibit 13-10  |                                              |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                              |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                            |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Max Desirable                                |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                                                                                                                                                                                                     | Max Desirable  |                                              | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 3351       | Exhibit 13-8                                 | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            | Exhibit 13-8   |                                              |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                              |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                            |                |                                              |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 29.6 (pc/mi/ln)<br>LOS = D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                              |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                            |                |                                              |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                              |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                            |                |                                              |            |
| M <sub>S</sub> = 0.412 (Exhibit 13-11)<br>S <sub>R</sub> = 58.5 mph (Exhibit 13-11)<br>S <sub>0</sub> = 66.4 mph (Exhibit 13-11)<br>S = 60.7 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                              |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                            |                |                                              |            |



| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                     |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                    |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | CHS                                 |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | I-15 Northbound                                                                                                                                                                                    |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | Urban Crossroads, Inc.              |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Nichols On-Ramp                                                                                                                                                                                    |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | 6/3/2015                            |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Caltrans                                                                                                                                                                                           |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | AM Peak Hour                        |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 2035 With Project                                                                                                                                                                                  |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} =$ 2130   ft<br><br>$V_u =$ 1249   veh/h                                                                                                                                                                                                                                                                                            |                 | Freeway Number of Lanes, $N$ 3      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | Ramp Number of Lanes, $N$ 1         |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | Acceleration Lane Length, $L_A$ 800 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | Deceleration Lane Length $L_D$      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | Freeway Volume, $V_F$ 5194          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 | Ramp Volume, $V_R$ 1165             |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
| Freeway Free-Flow Speed, $S_{FF}$ 70.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
| Ramp Free-Flow Speed, $S_{FR}$ 45.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | $V$<br>(Veh/hr) | PHF                                 | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                | $f_{HV}$                                                                                                                                                                                           | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 5194            | 0.92                                | Level    | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.948                                                                                                                                                                                              | 1.00          | 5956                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1165            | 0.92                                | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.990                                                                                                                                                                                              | 1.00          | 1279                                 |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1249            | 0.92                                | Level    | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 0.985                                                                                                                                                                                              | 1.00          | 1378                                 |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                     |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                    |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                     |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                    |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ 1854.89   (Equation 13-6 or 13-7)<br>$P_{FM} =$ 0.600   using Equation (Exhibit 13-6)<br>$V_{12} =$ 3573   pc/h<br>$V_3$ or $V_{av34}$ 2383   pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ 3573   pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                     |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                    |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                     |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Actual          | Capacity                            |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Actual                                                                                                                                                                                             | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 7235            | Exhibit 13-8                        |          | Yes                   | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                    | Exhibit 13-8  |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                     |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                    | Exhibit 13-8  |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                     |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                    | Exhibit 13-10 |                                      |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                     |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Actual          | Max Desirable                       |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Actual                                                                                                                                                                                             | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4852            | Exhibit 13-8                        | 4600:All | Yes                   | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                    | Exhibit 13-8  |                                      |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                     |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                    |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ 37.7 (pc/mi/ln)<br>LOS =      F (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                     |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                    |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                     |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| $M_S =$ 0.748 (Exhibit 13-11)<br>$S_R =$ 49.1 mph (Exhibit 13-11)<br>$S_0 =$ 63.0 mph (Exhibit 13-11)<br>$S =$ 52.9 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                            |                 |                                     |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                    |               |                                      |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                                             |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------|---------|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                                             |         |                                                   | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                       |                |                                              |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               | CHS                                         |         | Freeway/Dir of Travel                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Northbound                                                                                                                                                                                                                                       |                |                                              |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Urban Crossroads, Inc.                      |         | Junction                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols Off-Ramp                                                                                                                                                                                                                                      |                |                                              |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               | 6/3/2015                                    |         | Jurisdiction                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans                                                                                                                                                                                                                                              |                |                                              |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               | AM Peak Hour                                |         | Analysis Year                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2035 With Project                                                                                                                                                                                                                                     |                |                                              |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                                             |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |                                             |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>L <sub>up</sub> =      ft<br><br>V <sub>u</sub> =      veh/h                                                                                                                                                                                                                                                                                                                                                                |               | Freeway Number of Lanes, N      3           |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>L <sub>down</sub> =      2130 ft<br><br>V <sub>D</sub> =      1165 veh/h |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | Ramp Number of Lanes, N      1              |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | Acceleration Lane Length, L <sub>A</sub>    |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | Deceleration Lane Length L <sub>D</sub> 225 |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | Freeway Volume, V <sub>F</sub> 6443         |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | Ramp Volume, V <sub>R</sub> 1249            |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
| Freeway Free-Flow Speed, S <sub>FF</sub> 70.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |                                             |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
| Ramp Free-Flow Speed, S <sub>FR</sub> 45.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                                             |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                             |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | V<br>(Veh/hr) | PHF                                         | Terrain | %Truck                                            | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | f <sub>HV</sub>                                                                                                                                                                                                                                       | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub> |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 6443          | 0.92                                        | Level   | 10                                                | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.952                                                                                                                                                                                                                                                 | 1.00           | 7353                                         |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1249          | 0.92                                        | Level   | 3                                                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.985                                                                                                                                                                                                                                                 | 1.00           | 1378                                         |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                             |         |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                       |                |                                              |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1165          | 0.92                                        | Level   | 2                                                 | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.990                                                                                                                                                                                                                                                 | 1.00           | 1279                                         |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                                             |         |                                                   | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                       |                |                                              |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |                                             |         |                                                   | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                       |                |                                              |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> =      (Equation 13-6 or 13-7)<br>P <sub>FM</sub> =      using Equation (Exhibit 13-6)<br>V <sub>12</sub> =      pc/h<br>V <sub>3</sub> or V <sub>av34</sub> pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> =      pc/h (Equation 13-16, 13-18, or 13-19) |               |                                             |         |                                                   | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> =      (Equation 13-12 or 13-13)<br>P <sub>FD</sub> =      0.513 using Equation (Exhibit 13-7)<br>V <sub>12</sub> =      4442 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> 2911 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, V <sub>12a</sub> =      4653 pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                                                                       |                |                                              |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                             |         |                                                   | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                       |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Actual        | Capacity                                    |         | LOS F?                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual                                                                                                                                                                                                                                                | Capacity       |                                              | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | Exhibit 13-8                                |         |                                                   | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7353                                                                                                                                                                                                                                                  | Exhibit 13-8   | 7200                                         | Yes        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                             |         | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub> | 5975                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Exhibit 13-8                                                                                                                                                                                                                                          | 7200           | No                                           |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                             |         | V <sub>R</sub>                                    | 1378                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Exhibit 13-10                                                                                                                                                                                                                                         | 2100           | No                                           |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                                             |         |                                                   | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                       |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Actual        | Max Desirable                               |         | Violation?                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual                                                                                                                                                                                                                                                | Max Desirable  |                                              | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               | Exhibit 13-8                                |         |                                                   | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 4442                                                                                                                                                                                                                                                  | Exhibit 13-8   | 4400:All                                     | Yes        |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                             |         |                                                   | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                       |                |                                              |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> =      (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                                             |         |                                                   | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> =      42.2 (pc/mi/ln)<br>LOS =      F (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                       |                |                                              |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |               |                                             |         |                                                   | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                       |                |                                              |            |
| M <sub>S</sub> =      (Exhibit 13-11)<br>S <sub>R</sub> =      mph (Exhibit 13-11)<br>S <sub>0</sub> =      mph (Exhibit 13-11)<br>S =      mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                             |         |                                                   | D <sub>S</sub> =      0.422 (Exhibit 13-12)<br>S <sub>R</sub> =      58.2 mph (Exhibit 13-12)<br>S <sub>0</sub> =      70.2 mph (Exhibit 13-12)<br>S =      62.1 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                       |                |                                              |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |               |                                                                                                                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |               |                                                                                                                                                                                                                         |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | I-15 Southbound   |               |                                                                                                                                                                                                                         |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Nichols Off-Ramp  |               |                                                                                                                                                                                                                         |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Caltrans          |               |                                                                                                                                                                                                                         |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 2035 With Project |               |                                                                                                                                                                                                                         |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |               |                                                                                                                                                                                                                         |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |               |                                                                                                                                                                                                                         |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3                 |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 1380 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1                 |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 220               |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6638              |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1553              |               |                                                                                                                                                                                                                         |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |               |                                                                                                                                                                                                                         |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |               |                                                                                                                                                                                                                         |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |               |                                                                                                                                                                                                                         |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | $f_{HV}$          | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                    |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 6638            | 0.92                            | Level                | 8                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.962             | 1.00          | 7504                                                                                                                                                                                                                    |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1553            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.995             | 1.00          | 1696                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |               |                                                                                                                                                                                                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1380            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 0.995             | 1.00          | 1507                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |               |                                                                                                                                                                                                                         |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                   |               |                                                                                                                                                                                                                         |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.494 using Equation (Exhibit 13-7)<br>$V_{12} =$ 4567 pc/h<br>$V_3$ or $V_{av34}$ 2937 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ 4804 pc/h (Equation 13-16, 13-18, or 13-19) |                   |               |                                                                                                                                                                                                                         |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                   |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual            | Capacity      |                                                                                                                                                                                                                         | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 7504              | Exhibit 13-8  | 7200                                                                                                                                                                                                                    | Yes        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 5808                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 7200              | No            |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 1696                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 2100              | No            |                                                                                                                                                                                                                         |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual            | Max Desirable |                                                                                                                                                                                                                         | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4567              | Exhibit 13-8  | 4400:All                                                                                                                                                                                                                | Yes        |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |               |                                                                                                                                                                                                                         |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 43.6 (pc/mi/ln)<br>LOS =      F (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                           |                   |               |                                                                                                                                                                                                                         |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                   |               |                                                                                                                                                                                                                         |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.451 (Exhibit 13-12)<br>$S_R =$ 57.4 mph (Exhibit 13-12)<br>$S_0 =$ 70.2 mph (Exhibit 13-12)<br>$S =$ 61.4 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                       |                   |               |                                                                                                                                                                                                                         |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |                                                   |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|---------------------------------------------------|-----------------------|------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |                                                   |                       |            | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                |                |                                              |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | CHS                    |                                                   | Freeway/Dir of Travel |            | I-15 Southbound                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Urban Crossroads, Inc. |                                                   | Junction              |            | Nichols On-Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 6/3/2015               |                                                   | Jurisdiction          |            | Caltrans                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                |                |                                              |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | PM Peak Hour           |                                                   | Analysis Year         |            | 2035 With Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                |                |                                              |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |                                                   |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                        |                                                   |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| Upstream Adj Ramp<br><br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        | Freeway Number of Lanes, N                      3 |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Downstream Adj Ramp<br><br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        | Ramp Number of Lanes, N                      1    |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| L <sub>up</sub> =            2075    ft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                        | Acceleration Lane Length, L <sub>A</sub> 230      |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | L <sub>down</sub> =            ft                                                                                                                              |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        | Deceleration Lane Length L <sub>D</sub>           |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| V <sub>u</sub> =            1553    veh/h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        | Freeway Volume, V <sub>F</sub> 5085               |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | V <sub>D</sub> =            veh/h                                                                                                                              |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        | Ramp Volume, V <sub>R</sub> 1380                  |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        | Freeway Free-Flow Speed, S <sub>FF</sub> 70.0     |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        | Ramp Free-Flow Speed, S <sub>FR</sub> 45.0        |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        |                                                   |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | V<br>(Veh/hr)          | PHF                                               | Terrain               | %Truck     | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | f <sub>HV</sub>                                                                                                                                                | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub> |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5085                   | 0.92                                              | Level                 | 10         | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.952                                                                                                                                                          | 1.00           | 5804                                         |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 1380                   | 0.92                                              | Level                 | 1          | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.995                                                                                                                                                          | 1.00           | 1507                                         |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 1553                   | 0.92                                              | Level                 | 1          | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.995                                                                                                                                                          | 1.00           | 1696                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |                                                   |                       |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                        |                                                   |                       |            | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                |                |                                              |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                        |                                                   |                       |            | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                |                |                                              |            |
| V <sub>12</sub> = V <sub>F</sub> ( P <sub>FM</sub> )<br>L <sub>EQ</sub> =            1618.07    (Equation 13-6 or 13-7)<br>P <sub>FM</sub> =            0.584    using Equation (Exhibit 13-6)<br>V <sub>12</sub> =            3389    pc/h<br>V <sub>3</sub> or V <sub>av34</sub> 2415    pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> =            3389    pc/h (Equation 13-16, 13-18, or 13-19) |                        |                                                   |                       |            | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> =                                      (Equation 13-12 or 13-13)<br>P <sub>FD</sub> =                                      using Equation (Exhibit 13-7)<br>V <sub>12</sub> =                                      pc/h<br>V <sub>3</sub> or V <sub>av34</sub> pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> =                                      pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                |                |                                              |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                        |                                                   |                       |            | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Actual                 | Capacity                                          |                       | LOS F?     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual                                                                                                                                                         | Capacity       |                                              | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 7311                   | Exhibit 13-8                                      |                       | Yes        | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        |                                                   |                       |            | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                        |                                                   |                       |            | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                | Exhibit 13-10  |                                              |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |                                                   |                       |            | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Actual                 | Max Desirable                                     |                       | Violation? |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual                                                                                                                                                         | Max Desirable  |                                              | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4896                   | Exhibit 13-8                                      | 4600:All              | Yes        | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                        |                                                   |                       |            | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                |                |                                              |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> =    41.5 (pc/mi/ln)<br>LOS =    F (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                        |                                                   |                       |            | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> =    (pc/mi/ln)<br>LOS =    (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                |                |                                              |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |                                                   |                       |            | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                |                |                                              |            |
| M <sub>S</sub> =    0.822 (Exhibit 13-11)<br>S <sub>R</sub> =    47.0 mph (Exhibit 13-11)<br>S <sub>0</sub> =    62.8 mph (Exhibit 13-11)<br>S =    51.2 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                        |                                                   |                       |            | D <sub>s</sub> =    (Exhibit 13-12)<br>S <sub>R</sub> =    mph (Exhibit 13-12)<br>S <sub>0</sub> =    mph (Exhibit 13-12)<br>S =    mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                |                |                                              |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                |                                                                                                                                                                                                            |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                   |                |                                                                                                                                                                                                            |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            | CHS                                      |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Northbound   |                |                                                                                                                                                                                                            |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | Urban Crossroads, Inc.                   |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp   |                |                                                                                                                                                                                                            |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            | 6/3/2015                                 |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans          |                |                                                                                                                                                                                                            |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | PM Peak Hour                             |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2035 With Project |                |                                                                                                                                                                                                            |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                |                                                                                                                                                                                                            |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                |                                                                                                                                                                                                            |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2130 ft<br>V <sub>u</sub> = 1198 veh/h                                                                                                                                                                                                                                                                                                                                                                                                  |            | Freeway Number of Lanes, N               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                 |                | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Number of Lanes, N                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                 |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Acceleration Lane Length, L <sub>A</sub> |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 800               |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Deceleration Lane Length L <sub>D</sub>  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Freeway Volume, V <sub>F</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4471              |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Volume, V <sub>R</sub>              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1325              |                |                                                                                                                                                                                                            |            |
| Freeway Free-Flow Speed, S <sub>FF</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                                          |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                |                                                                                                                                                                                                            |            |
| Ramp Free-Flow Speed, S <sub>FR</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                          |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                |                                                                                                                                                                                                            |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                |                                                                                                                                                                                                            |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | V (Veh/hr) | PHF                                      | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub>   | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub>                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4471       | 0.92                                     | Level    | 14                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.935             | 1.00           | 5200                                                                                                                                                                                                       |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1325       | 0.92                                     | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.995             | 1.00           | 1447                                                                                                                                                                                                       |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1198       | 0.92                                     | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.995             | 1.00           | 1309                                                                                                                                                                                                       |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |                |                                                                                                                                                                                                            |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                   |                |                                                                                                                                                                                                            |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |                |                                                                                                                                                                                                            |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 1729.06 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.600 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 3119 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 2081 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 3119 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                          |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                   |                |                                                                                                                                                                                                            |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                          |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                   |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Capacity                                 |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual            | Capacity       |                                                                                                                                                                                                            | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 6647       | Exhibit 13-8                             |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                   | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   | Exhibit 13-10  |                                                                                                                                                                                                            |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Max Desirable                            |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual            | Max Desirable  |                                                                                                                                                                                                            | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4566       | Exhibit 13-8                             | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   | Exhibit 13-8   |                                                                                                                                                                                                            |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                   |                |                                                                                                                                                                                                            |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 35.4 (pc/mi/ln)<br>LOS = E (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |                |                                                                                                                                                                                                            |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                   |                |                                                                                                                                                                                                            |            |
| M <sub>S</sub> = 0.624 (Exhibit 13-11)<br>S <sub>R</sub> = 52.5 mph (Exhibit 13-11)<br>S <sub>0</sub> = 64.3 mph (Exhibit 13-11)<br>S = 55.7 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                   |                |                                                                                                                                                                                                            |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------|---------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                    |         |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                                |         | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound                                                                                                                                                                                                         |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.             |         | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp                                                                                                                                                                                                        |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                           |         | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                                                                                                                                                                                                                |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                       |         | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 With Project                                                                                                                                                                                                       |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      3  |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 1325 veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N      1     |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$ 225 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$ 5669         |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$ 1198            |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Freeway Free-Flow Speed, $S_{FF}$ 70.0                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Ramp Free-Flow Speed, $S_{FR}$ 45.0                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                                | Terrain | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                                                                                                                                                                                                                | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5669            | 0.92                               | Level   | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.948                                                                                                                                                                                                                   | 1.00          | 6501                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1198            | 0.92                               | Level   | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                                                                                                                                                                                                                   | 1.00          | 1309                                 |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1325            | 0.92                               | Level   | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                                                                                                                                                                                                                   | 1.00          | 1447                                 |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                    |         |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                    |         |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                         |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                    |         |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.537 using Equation (Exhibit 13-7)<br>$V_{12} =$ 4098 pc/h<br>$V_3$ or $V_{av34}$ 2403 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                    |         |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                           |         | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                  | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                       |         |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6501                                                                                                                                                                                                                    | Exhibit 13-8  | 7200                                 | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |         | $V_{FO} = V_F - V_R$  | 5192                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-8                                                                                                                                                                                                            | 7200          | No                                   |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |         | $V_R$                 | 1309                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-10                                                                                                                                                                                                           | 2100          | No                                   |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                    |         |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                      |         | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                  | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                       |         |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4098                                                                                                                                                                                                                    | Exhibit 13-8  | 4400:All                             | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                    |         |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                         |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                    |         |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 37.5 (pc/mi/ln)<br>LOS =      E (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                    |         |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                         |               |                                      |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                    |         |                       | $D_S =$ 0.416 (Exhibit 13-12)<br>$S_R =$ 58.4 mph (Exhibit 13-12)<br>$S_0 =$ 71.3 mph (Exhibit 13-12)<br>$S =$ 62.6 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |               |                                      |            |

**APPENDIX 8.7:**

**HORIZON YEAR (2035) WITHOUT PROJECT CONDITIONS INTERSECTION OPERATIONS  
ANALYSIS WORKSHEETS WITH IMPROVEMENTS**

This Page Intentionally Left Blank



HCM 2010 Signalized Intersection Summary  
1: I-15 SB On-Ramp/I-15 SB Off-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                                                                      |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Movement                                                             | EBL                                                                               | EBT                                                                               | EBR                                                                               | WBL                                                                               | WBT                                                                               | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                 | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations                                                  |                                                                                   | ↑↑↑                                                                               | ↑                                                                                 | ↑↑                                                                                | ↑↑↑                                                                               |                                                                                   |                                                                                    |                                                                                     |                                                                                     | ↑↑                                                                                  | ↑                                                                                   | ↑                                                                                   |
| Volume (veh/h)                                                       | 0                                                                                 | 1604                                                                              | 489                                                                               | 625                                                                               | 1139                                                                              | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   | 466                                                                                 | 0                                                                                   | 748                                                                                 |
| Number                                                               | 5                                                                                 | 2                                                                                 | 12                                                                                | 1                                                                                 | 6                                                                                 | 16                                                                                |                                                                                    |                                                                                     |                                                                                     | 7                                                                                   | 4                                                                                   | 14                                                                                  |
| Initial Q (Qb), veh                                                  | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Ped-Bike Adj(A_pbT)                                                  | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                |                                                                                     | 1.00                                                                                |
| Parking Bus, Adj                                                     | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 1.00                                                                                | 1.00                                                                                |
| Adj Sat Flow, veh/h/ln                                               | 0                                                                                 | 1900                                                                              | 1900                                                                              | 1900                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1900                                                                                | 1900                                                                                | 1900                                                                                |
| Adj Flow Rate, veh/h                                                 | 0                                                                                 | 1743                                                                              | 0                                                                                 | 679                                                                               | 1238                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 507                                                                                 | 0                                                                                   | 813                                                                                 |
| Adj No. of Lanes                                                     | 0                                                                                 | 3                                                                                 | 1                                                                                 | 2                                                                                 | 3                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 2                                                                                   | 0                                                                                   | 2                                                                                   |
| Peak Hour Factor                                                     | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.92                                                                                | 0.92                                                                                | 0.92                                                                                |
| Percent Heavy Veh, %                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Cap, veh/h                                                           | 0                                                                                 | 2307                                                                              | 654                                                                               | 743                                                                               | 3734                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 850                                                                                 | 0                                                                                   | 759                                                                                 |
| Arrive On Green                                                      | 0.00                                                                              | 0.40                                                                              | 0.00                                                                              | 0.41                                                                              | 1.00                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.23                                                                                | 0.00                                                                                | 0.23                                                                                |
| Sat Flow, veh/h                                                      | 0                                                                                 | 5700                                                                              | 1615                                                                              | 3619                                                                              | 5700                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 3619                                                                                | 0                                                                                   | 3230                                                                                |
| Grp Volume(v), veh/h                                                 | 0                                                                                 | 1743                                                                              | 0                                                                                 | 679                                                                               | 1238                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 507                                                                                 | 0                                                                                   | 813                                                                                 |
| Grp Sat Flow(s),veh/h/ln                                             | 0                                                                                 | 1900                                                                              | 1615                                                                              | 1810                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1810                                                                                | 0                                                                                   | 1615                                                                                |
| Q Serve(g_s), s                                                      | 0.0                                                                               | 26.2                                                                              | 0.0                                                                               | 17.7                                                                              | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 12.5                                                                                | 0.0                                                                                 | 23.5                                                                                |
| Cycle Q Clear(g_c), s                                                | 0.0                                                                               | 26.2                                                                              | 0.0                                                                               | 17.7                                                                              | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 12.5                                                                                | 0.0                                                                                 | 23.5                                                                                |
| Prop In Lane                                                         | 0.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                |                                                                                     | 1.00                                                                                |
| Lane Grp Cap(c), veh/h                                               | 0                                                                                 | 2307                                                                              | 654                                                                               | 743                                                                               | 3734                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 850                                                                                 | 0                                                                                   | 759                                                                                 |
| V/C Ratio(X)                                                         | 0.00                                                                              | 0.76                                                                              | 0.00                                                                              | 0.91                                                                              | 0.33                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.60                                                                                | 0.00                                                                                | 1.07                                                                                |
| Avail Cap(c_a), veh/h                                                | 0                                                                                 | 2307                                                                              | 654                                                                               | 814                                                                               | 3734                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 850                                                                                 | 0                                                                                   | 759                                                                                 |
| HCM Platoon Ratio                                                    | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 2.00                                                                              | 2.00                                                                              | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 1.00                                                                                | 1.00                                                                                |
| Upstream Filter(I)                                                   | 0.00                                                                              | 1.00                                                                              | 0.00                                                                              | 0.56                                                                              | 0.56                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 0.00                                                                                | 1.00                                                                                |
| Uniform Delay (d), s/veh                                             | 0.0                                                                               | 25.5                                                                              | 0.0                                                                               | 28.7                                                                              | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 34.0                                                                                | 0.0                                                                                 | 38.3                                                                                |
| Incr Delay (d2), s/veh                                               | 0.0                                                                               | 1.5                                                                               | 0.0                                                                               | 8.7                                                                               | 0.1                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 3.1                                                                                 | 0.0                                                                                 | 53.4                                                                                |
| Initial Q Delay(d3),s/veh                                            | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 0.0                                                                                 | 0.0                                                                                 | 0.0                                                                                 |
| %ile BackOfQ(50%),veh/ln                                             | 0.0                                                                               | 14.0                                                                              | 0.0                                                                               | 9.6                                                                               | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 6.6                                                                                 | 0.0                                                                                 | 16.1                                                                                |
| LnGrp Delay(d),s/veh                                                 | 0.0                                                                               | 27.0                                                                              | 0.0                                                                               | 37.4                                                                              | 0.1                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 37.1                                                                                | 0.0                                                                                 | 91.6                                                                                |
| LnGrp LOS                                                            |                                                                                   | C                                                                                 |                                                                                   | D                                                                                 | A                                                                                 |                                                                                   |                                                                                    |                                                                                     |                                                                                     | D                                                                                   |                                                                                     | F                                                                                   |
| Approach Vol, veh/h                                                  |                                                                                   | 1743                                                                              |                                                                                   |                                                                                   | 1917                                                                              |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | 1320                                                                                |                                                                                     |
| Approach Delay, s/veh                                                |                                                                                   | 27.0                                                                              |                                                                                   |                                                                                   | 13.3                                                                              |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | 70.7                                                                                |                                                                                     |
| Approach LOS                                                         |                                                                                   | C                                                                                 |                                                                                   |                                                                                   | B                                                                                 |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | E                                                                                   |                                                                                     |
| Timer                                                                | 1                                                                                 | 2                                                                                 | 3                                                                                 | 4                                                                                 | 5                                                                                 | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                                                         | 1                                                                                 | 2                                                                                 |                                                                                   | 4                                                                                 |                                                                                   | 6                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s                                             | 25.0                                                                              | 46.0                                                                              |                                                                                   | 29.0                                                                              |                                                                                   | 71.0                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s                                              | 4.5                                                                               | 5.5                                                                               |                                                                                   | 5.5                                                                               |                                                                                   | 5.5                                                                               |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s                                          | 22.5                                                                              | 38.5                                                                              |                                                                                   | 23.5                                                                              |                                                                                   | 65.5                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+I1), s                                         | 19.7                                                                              | 28.2                                                                              |                                                                                   | 25.5                                                                              |                                                                                   | 2.0                                                                               |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s                                              | 0.8                                                                               | 9.6                                                                               |                                                                                   | 0.0                                                                               |                                                                                   | 46.2                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| <b>Intersection Summary</b>                                          |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay                                                  |                                                                                   |                                                                                   | 33.3                                                                              |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                                                         |                                                                                   |                                                                                   | C                                                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| <b>Notes</b>                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| User approved volume balancing among the lanes for turning movement. |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

# HCM 2010 Signalized Intersection Summary

## 2: I-15 NB Off-Ramp/I-15 NB On-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                                                                      |                                                                                    |                                                                                                                                                                      |  |  |                                                                                                                                                                      |  |  |  |                                                                                      |  |  |  |
|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Movement                                                             | EBL                                                                                                                                                                 | EBT                                                                                                                                                                                                                                                   | EBR                                                                               | WBL                                                                               | WBT                                                                                                                                                                                                                                                   | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                                                                                                     | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations                                                  |   |    |                                                                                   |                                                                                   |    |  |  |  |   |                                                                                     |                                                                                     |                                                                                     |
| Volume (veh/h)                                                       | 607                                                                                                                                                                 | 1463                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1471                                                                                                                                                                                                                                                  | 554                                                                               | 293                                                                                | 0                                                                                   | 950                                                                                                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Number                                                               | 5                                                                                                                                                                   | 2                                                                                                                                                                                                                                                     | 12                                                                                | 1                                                                                 | 6                                                                                                                                                                                                                                                     | 16                                                                                | 3                                                                                  | 8                                                                                   | 18                                                                                                                                                                      |                                                                                     |                                                                                     |                                                                                     |
| Initial Q (Qb), veh                                                  | 0                                                                                                                                                                   | 0                                                                                                                                                                                                                                                     | 0                                                                                 | 0                                                                                 | 0                                                                                                                                                                                                                                                     | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                                                                                                       |                                                                                     |                                                                                     |                                                                                     |
| Ped-Bike Adj(A_pbT)                                                  | 1.00                                                                                                                                                                |                                                                                                                                                                                                                                                       | 1.00                                                                              | 1.00                                                                              |                                                                                                                                                                                                                                                       | 1.00                                                                              | 1.00                                                                               |                                                                                     | 1.00                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Parking Bus, Adj                                                     | 1.00                                                                                                                                                                | 1.00                                                                                                                                                                                                                                                  | 1.00                                                                              | 1.00                                                                              | 1.00                                                                                                                                                                                                                                                  | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Adj Sat Flow, veh/h/ln                                               | 1900                                                                                                                                                                | 1900                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1900                                                                                                                                                                                                                                                  | 1900                                                                              | 1900                                                                               | 1900                                                                                | 1900                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Adj Flow Rate, veh/h                                                 | 660                                                                                                                                                                 | 1590                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1599                                                                                                                                                                                                                                                  | 602                                                                               | 318                                                                                | 0                                                                                   | 1033                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Adj No. of Lanes                                                     | 2                                                                                                                                                                   | 3                                                                                                                                                                                                                                                     | 0                                                                                 | 0                                                                                 | 3                                                                                                                                                                                                                                                     | 1                                                                                 | 2                                                                                  | 0                                                                                   | 2                                                                                                                                                                       |                                                                                     |                                                                                     |                                                                                     |
| Peak Hour Factor                                                     | 0.92                                                                                                                                                                | 0.92                                                                                                                                                                                                                                                  | 0.92                                                                              | 0.92                                                                              | 0.92                                                                                                                                                                                                                                                  | 0.92                                                                              | 0.92                                                                               | 0.92                                                                                | 0.92                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Percent Heavy Veh, %                                                 | 0                                                                                                                                                                   | 0                                                                                                                                                                                                                                                     | 0                                                                                 | 0                                                                                 | 0                                                                                                                                                                                                                                                     | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                                                                                                       |                                                                                     |                                                                                     |                                                                                     |
| Cap, veh/h                                                           | 731                                                                                                                                                                 | 3386                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1978                                                                                                                                                                                                                                                  | 560                                                                               | 1071                                                                               | 0                                                                                   | 956                                                                                                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Arrive On Green                                                      | 0.20                                                                                                                                                                | 0.59                                                                                                                                                                                                                                                  | 0.00                                                                              | 0.00                                                                              | 0.35                                                                                                                                                                                                                                                  | 0.35                                                                              | 0.30                                                                               | 0.00                                                                                | 0.30                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Sat Flow, veh/h                                                      | 3619                                                                                                                                                                | 5700                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 5700                                                                                                                                                                                                                                                  | 1615                                                                              | 3619                                                                               | 0                                                                                   | 3230                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Grp Volume(v), veh/h                                                 | 660                                                                                                                                                                 | 1590                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1599                                                                                                                                                                                                                                                  | 602                                                                               | 318                                                                                | 0                                                                                   | 1033                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Grp Sat Flow(s),veh/h/ln                                             | 1810                                                                                                                                                                | 1900                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1900                                                                                                                                                                                                                                                  | 1615                                                                              | 1810                                                                               | 0                                                                                   | 1615                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Q Serve(g_s), s                                                      | 17.8                                                                                                                                                                | 15.7                                                                                                                                                                                                                                                  | 0.0                                                                               | 0.0                                                                               | 25.5                                                                                                                                                                                                                                                  | 34.7                                                                              | 6.8                                                                                | 0.0                                                                                 | 29.6                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Cycle Q Clear(g_c), s                                                | 17.8                                                                                                                                                                | 15.7                                                                                                                                                                                                                                                  | 0.0                                                                               | 0.0                                                                               | 25.5                                                                                                                                                                                                                                                  | 34.7                                                                              | 6.8                                                                                | 0.0                                                                                 | 29.6                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Prop In Lane                                                         | 1.00                                                                                                                                                                |                                                                                                                                                                                                                                                       | 0.00                                                                              | 0.00                                                                              |                                                                                                                                                                                                                                                       | 1.00                                                                              | 1.00                                                                               |                                                                                     | 1.00                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Lane Grp Cap(c), veh/h                                               | 731                                                                                                                                                                 | 3386                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1978                                                                                                                                                                                                                                                  | 560                                                                               | 1071                                                                               | 0                                                                                   | 956                                                                                                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| V/C Ratio(X)                                                         | 0.90                                                                                                                                                                | 0.47                                                                                                                                                                                                                                                  | 0.00                                                                              | 0.00                                                                              | 0.81                                                                                                                                                                                                                                                  | 1.07                                                                              | 0.30                                                                               | 0.00                                                                                | 1.08                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Avail Cap(c_a), veh/h                                                | 764                                                                                                                                                                 | 3386                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1978                                                                                                                                                                                                                                                  | 560                                                                               | 1071                                                                               | 0                                                                                   | 956                                                                                                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM Platoon Ratio                                                    | 1.00                                                                                                                                                                | 1.00                                                                                                                                                                                                                                                  | 1.00                                                                              | 1.00                                                                              | 1.00                                                                                                                                                                                                                                                  | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Upstream Filter(I)                                                   | 0.62                                                                                                                                                                | 0.62                                                                                                                                                                                                                                                  | 0.00                                                                              | 0.00                                                                              | 1.00                                                                                                                                                                                                                                                  | 1.00                                                                              | 1.00                                                                               | 0.00                                                                                | 1.00                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Uniform Delay (d), s/veh                                             | 38.9                                                                                                                                                                | 11.4                                                                                                                                                                                                                                                  | 0.0                                                                               | 0.0                                                                               | 29.6                                                                                                                                                                                                                                                  | 32.7                                                                              | 27.2                                                                               | 0.0                                                                                 | 35.2                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Incr Delay (d2), s/veh                                               | 9.2                                                                                                                                                                 | 0.3                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                               | 3.7                                                                                                                                                                                                                                                   | 59.5                                                                              | 0.7                                                                                | 0.0                                                                                 | 53.4                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Initial Q Delay(d3),s/veh                                            | 0.0                                                                                                                                                                 | 0.0                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                               | 0.0                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                                | 0.0                                                                                 | 0.0                                                                                                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| %ile BackOfQ(50%),veh/ln                                             | 9.8                                                                                                                                                                 | 8.2                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                               | 14.0                                                                                                                                                                                                                                                  | 24.7                                                                              | 3.5                                                                                | 0.0                                                                                 | 20.2                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| LnGrp Delay(d),s/veh                                                 | 48.1                                                                                                                                                                | 11.7                                                                                                                                                                                                                                                  | 0.0                                                                               | 0.0                                                                               | 33.3                                                                                                                                                                                                                                                  | 92.2                                                                              | 27.9                                                                               | 0.0                                                                                 | 88.6                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| LnGrp LOS                                                            | D                                                                                                                                                                   | B                                                                                                                                                                                                                                                     |                                                                                   |                                                                                   | C                                                                                                                                                                                                                                                     | F                                                                                 | C                                                                                  |                                                                                     | F                                                                                                                                                                       |                                                                                     |                                                                                     |                                                                                     |
| Approach Vol, veh/h                                                  | 2250                                                                                                                                                                |                                                                                                                                                                                                                                                       |                                                                                   | 2201                                                                              |                                                                                                                                                                                                                                                       |                                                                                   | 1351                                                                               |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Approach Delay, s/veh                                                | 22.4                                                                                                                                                                |                                                                                                                                                                                                                                                       |                                                                                   | 49.4                                                                              |                                                                                                                                                                                                                                                       |                                                                                   | 74.3                                                                               |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Approach LOS                                                         | C                                                                                                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   | D                                                                                 |                                                                                                                                                                                                                                                       |                                                                                   | E                                                                                  |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Timer                                                                | 1                                                                                                                                                                   | 2                                                                                                                                                                                                                                                     | 3                                                                                 | 4                                                                                 | 5                                                                                                                                                                                                                                                     | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                                                         | 2                                                                                                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   | 5                                                                                 |                                                                                                                                                                                                                                                       |                                                                                   | 8                                                                                  |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s                                             | 64.9                                                                                                                                                                |                                                                                                                                                                                                                                                       |                                                                                   | 24.7                                                                              |                                                                                                                                                                                                                                                       |                                                                                   | 35.1                                                                               |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s                                              | 5.5                                                                                                                                                                 |                                                                                                                                                                                                                                                       |                                                                                   | 4.5                                                                               |                                                                                                                                                                                                                                                       |                                                                                   | 5.5                                                                                |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s                                          | 59.4                                                                                                                                                                |                                                                                                                                                                                                                                                       |                                                                                   | 21.1                                                                              |                                                                                                                                                                                                                                                       |                                                                                   | 29.6                                                                               |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+l1), s                                         | 17.7                                                                                                                                                                |                                                                                                                                                                                                                                                       |                                                                                   | 19.8                                                                              |                                                                                                                                                                                                                                                       |                                                                                   | 31.6                                                                               |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s                                              | 37.5                                                                                                                                                                |                                                                                                                                                                                                                                                       |                                                                                   | 0.4                                                                               |                                                                                                                                                                                                                                                       |                                                                                   | 0.0                                                                                |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Intersection Summary                                                 |                                                                                                                                                                     |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                    |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay                                                  | 44.7                                                                                                                                                                |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                    |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                                                         | D                                                                                                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                    |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Notes                                                                |                                                                                                                                                                     |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                    |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| User approved volume balancing among the lanes for turning movement. |                                                                                                                                                                     |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                    |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |

HCM 2010 Signalized Intersection Summary  
 1: I-15 SB On-Ramp/I-15 SB Off-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                                                                      |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Movement                                                             | EBL                                                                               | EBT                                                                               | EBR                                                                               | WBL                                                                               | WBT                                                                               | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                 | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations                                                  |                                                                                   |  |  |  |  |                                                                                   |                                                                                    |                                                                                     |                                                                                     |  |  |  |
| Volume (veh/h)                                                       | 0                                                                                 | 1896                                                                              | 608                                                                               | 767                                                                               | 1629                                                                              | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   | 839                                                                                 | 0                                                                                   | 710                                                                                 |
| Number                                                               | 5                                                                                 | 2                                                                                 | 12                                                                                | 1                                                                                 | 6                                                                                 | 16                                                                                |                                                                                    |                                                                                     |                                                                                     | 7                                                                                   | 4                                                                                   | 14                                                                                  |
| Initial Q (Qb), veh                                                  | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Ped-Bike Adj(A_pbT)                                                  | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                |                                                                                     | 1.00                                                                                |
| Parking Bus, Adj                                                     | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 1.00                                                                                | 1.00                                                                                |
| Adj Sat Flow, veh/h/ln                                               | 0                                                                                 | 1900                                                                              | 1900                                                                              | 1900                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1900                                                                                | 1900                                                                                | 1900                                                                                |
| Adj Flow Rate, veh/h                                                 | 0                                                                                 | 1996                                                                              | 0                                                                                 | 807                                                                               | 1715                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 883                                                                                 | 0                                                                                   | 747                                                                                 |
| Adj No. of Lanes                                                     | 0                                                                                 | 3                                                                                 | 1                                                                                 | 2                                                                                 | 3                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 2                                                                                   | 0                                                                                   | 2                                                                                   |
| Peak Hour Factor                                                     | 0.95                                                                              | 0.95                                                                              | 0.95                                                                              | 0.95                                                                              | 0.95                                                                              | 0.95                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.95                                                                                | 0.95                                                                                | 0.95                                                                                |
| Percent Heavy Veh, %                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Cap, veh/h                                                           | 0                                                                                 | 1912                                                                              | 542                                                                               | 906                                                                               | 3553                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1031                                                                                | 0                                                                                   | 921                                                                                 |
| Arrive On Green                                                      | 0.00                                                                              | 0.34                                                                              | 0.00                                                                              | 0.17                                                                              | 0.42                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.28                                                                                | 0.00                                                                                | 0.28                                                                                |
| Sat Flow, veh/h                                                      | 0                                                                                 | 5700                                                                              | 1615                                                                              | 3619                                                                              | 5700                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 3619                                                                                | 0                                                                                   | 3230                                                                                |
| Grp Volume(v), veh/h                                                 | 0                                                                                 | 1996                                                                              | 0                                                                                 | 807                                                                               | 1715                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 883                                                                                 | 0                                                                                   | 747                                                                                 |
| Grp Sat Flow(s),veh/h/ln                                             | 0                                                                                 | 1900                                                                              | 1615                                                                              | 1810                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1810                                                                                | 0                                                                                   | 1615                                                                                |
| Q Serve(g_s), s                                                      | 0.0                                                                               | 40.2                                                                              | 0.0                                                                               | 26.2                                                                              | 26.3                                                                              | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 27.7                                                                                | 0.0                                                                                 | 25.8                                                                                |
| Cycle Q Clear(g_c), s                                                | 0.0                                                                               | 40.2                                                                              | 0.0                                                                               | 26.2                                                                              | 26.3                                                                              | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 27.7                                                                                | 0.0                                                                                 | 25.8                                                                                |
| Prop In Lane                                                         | 0.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                |                                                                                     | 1.00                                                                                |
| Lane Grp Cap(c), veh/h                                               | 0                                                                                 | 1912                                                                              | 542                                                                               | 906                                                                               | 3553                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1031                                                                                | 0                                                                                   | 921                                                                                 |
| V/C Ratio(X)                                                         | 0.00                                                                              | 1.04                                                                              | 0.00                                                                              | 0.89                                                                              | 0.48                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.86                                                                                | 0.00                                                                                | 0.81                                                                                |
| Avail Cap(c_a), veh/h                                                | 0                                                                                 | 1912                                                                              | 542                                                                               | 1050                                                                              | 3553                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1031                                                                                | 0                                                                                   | 921                                                                                 |
| HCM Platoon Ratio                                                    | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 0.67                                                                              | 0.67                                                                              | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 1.00                                                                                | 1.00                                                                                |
| Upstream Filter(I)                                                   | 0.00                                                                              | 1.00                                                                              | 0.00                                                                              | 0.41                                                                              | 0.41                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 0.00                                                                                | 1.00                                                                                |
| Uniform Delay (d), s/veh                                             | 0.0                                                                               | 39.9                                                                              | 0.0                                                                               | 48.3                                                                              | 20.8                                                                              | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 40.6                                                                                | 0.0                                                                                 | 39.9                                                                                |
| Incr Delay (d2), s/veh                                               | 0.0                                                                               | 33.2                                                                              | 0.0                                                                               | 3.9                                                                               | 0.2                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 9.1                                                                                 | 0.0                                                                                 | 7.7                                                                                 |
| Initial Q Delay(d3),s/veh                                            | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 0.0                                                                                 | 0.0                                                                                 | 0.0                                                                                 |
| %ile BackOfQ(50%),veh/ln                                             | 0.0                                                                               | 26.9                                                                              | 0.0                                                                               | 13.6                                                                              | 13.9                                                                              | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 15.2                                                                                | 0.0                                                                                 | 12.5                                                                                |
| LnGrp Delay(d),s/veh                                                 | 0.0                                                                               | 73.1                                                                              | 0.0                                                                               | 52.3                                                                              | 21.0                                                                              | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 49.7                                                                                | 0.0                                                                                 | 47.6                                                                                |
| LnGrp LOS                                                            |                                                                                   | F                                                                                 |                                                                                   | D                                                                                 | C                                                                                 |                                                                                   |                                                                                    |                                                                                     |                                                                                     | D                                                                                   |                                                                                     | D                                                                                   |
| Approach Vol, veh/h                                                  |                                                                                   | 1996                                                                              |                                                                                   |                                                                                   | 2522                                                                              |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | 1630                                                                                |                                                                                     |
| Approach Delay, s/veh                                                |                                                                                   | 73.1                                                                              |                                                                                   |                                                                                   | 31.0                                                                              |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | 48.7                                                                                |                                                                                     |
| Approach LOS                                                         |                                                                                   | E                                                                                 |                                                                                   |                                                                                   | C                                                                                 |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | D                                                                                   |                                                                                     |
| Timer                                                                | 1                                                                                 | 2                                                                                 | 3                                                                                 | 4                                                                                 | 5                                                                                 | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                                                         | 1                                                                                 | 2                                                                                 |                                                                                   | 4                                                                                 |                                                                                   | 6                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s                                             | 34.6                                                                              | 45.7                                                                              |                                                                                   | 39.7                                                                              |                                                                                   | 80.3                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s                                              | 4.5                                                                               | 5.5                                                                               |                                                                                   | 5.5                                                                               |                                                                                   | 5.5                                                                               |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s                                          | 34.8                                                                              | 35.5                                                                              |                                                                                   | 34.2                                                                              |                                                                                   | 74.8                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+l1), s                                         | 28.2                                                                              | 42.2                                                                              |                                                                                   | 29.7                                                                              |                                                                                   | 28.3                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s                                              | 1.9                                                                               | 0.0                                                                               |                                                                                   | 2.7                                                                               |                                                                                   | 42.4                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Intersection Summary                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay                                                  |                                                                                   |                                                                                   | 49.4                                                                              |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                                                         |                                                                                   |                                                                                   | D                                                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Notes                                                                |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| User approved volume balancing among the lanes for turning movement. |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

HCM 2010 Signalized Intersection Summary  
2: I-15 NB Off-Ramp/I-15 NB On-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                                                                      |                                                                                    |                                                                                                                                                                      |  |  |                                                                                                                                                                      |  |  |  |                                                                                      |  |  |  |
|----------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Movement                                                             | EBL                                                                                                                                                                 | EBT                                                                                                                                                                                                                                                   | EBR                                                                               | WBL                                                                               | WBT                                                                                                                                                                                                                                                   | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                                                                                                     | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations                                                  |   |    |                                                                                   |                                                                                   |    |  |  |  |   |                                                                                     |                                                                                     |                                                                                     |
| Volume (veh/h)                                                       | 770                                                                                                                                                                 | 1965                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1947                                                                                                                                                                                                                                                  | 551                                                                               | 449                                                                                | 0                                                                                   | 745                                                                                                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Number                                                               | 5                                                                                                                                                                   | 2                                                                                                                                                                                                                                                     | 12                                                                                | 1                                                                                 | 6                                                                                                                                                                                                                                                     | 16                                                                                | 3                                                                                  | 8                                                                                   | 18                                                                                                                                                                      |                                                                                     |                                                                                     |                                                                                     |
| Initial Q (Qb), veh                                                  | 0                                                                                                                                                                   | 0                                                                                                                                                                                                                                                     | 0                                                                                 | 0                                                                                 | 0                                                                                                                                                                                                                                                     | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                                                                                                       |                                                                                     |                                                                                     |                                                                                     |
| Ped-Bike Adj(A_pbT)                                                  | 1.00                                                                                                                                                                |                                                                                                                                                                                                                                                       | 1.00                                                                              | 1.00                                                                              |                                                                                                                                                                                                                                                       | 1.00                                                                              | 1.00                                                                               |                                                                                     | 1.00                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Parking Bus, Adj                                                     | 1.00                                                                                                                                                                | 1.00                                                                                                                                                                                                                                                  | 1.00                                                                              | 1.00                                                                              | 1.00                                                                                                                                                                                                                                                  | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Adj Sat Flow, veh/h/ln                                               | 1900                                                                                                                                                                | 1900                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1900                                                                                                                                                                                                                                                  | 1900                                                                              | 1900                                                                               | 1900                                                                                | 1900                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Adj Flow Rate, veh/h                                                 | 837                                                                                                                                                                 | 2136                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 2116                                                                                                                                                                                                                                                  | 599                                                                               | 488                                                                                | 0                                                                                   | 810                                                                                                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Adj No. of Lanes                                                     | 2                                                                                                                                                                   | 3                                                                                                                                                                                                                                                     | 0                                                                                 | 0                                                                                 | 3                                                                                                                                                                                                                                                     | 1                                                                                 | 2                                                                                  | 0                                                                                   | 2                                                                                                                                                                       |                                                                                     |                                                                                     |                                                                                     |
| Peak Hour Factor                                                     | 0.92                                                                                                                                                                | 0.92                                                                                                                                                                                                                                                  | 0.92                                                                              | 0.92                                                                              | 0.92                                                                                                                                                                                                                                                  | 0.92                                                                              | 0.92                                                                               | 0.92                                                                                | 0.92                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Percent Heavy Veh, %                                                 | 0                                                                                                                                                                   | 0                                                                                                                                                                                                                                                     | 0                                                                                 | 0                                                                                 | 0                                                                                                                                                                                                                                                     | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                                                                                                       |                                                                                     |                                                                                     |                                                                                     |
| Cap, veh/h                                                           | 860                                                                                                                                                                 | 3966                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 2399                                                                                                                                                                                                                                                  | 680                                                                               | 769                                                                                | 0                                                                                   | 686                                                                                                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Arrive On Green                                                      | 0.47                                                                                                                                                                | 1.00                                                                                                                                                                                                                                                  | 0.00                                                                              | 0.00                                                                              | 0.42                                                                                                                                                                                                                                                  | 0.42                                                                              | 0.21                                                                               | 0.00                                                                                | 0.21                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Sat Flow, veh/h                                                      | 3619                                                                                                                                                                | 5700                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 5700                                                                                                                                                                                                                                                  | 1615                                                                              | 3619                                                                               | 0                                                                                   | 3230                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Grp Volume(v), veh/h                                                 | 837                                                                                                                                                                 | 2136                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 2116                                                                                                                                                                                                                                                  | 599                                                                               | 488                                                                                | 0                                                                                   | 810                                                                                                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Grp Sat Flow(s),veh/h/ln                                             | 1810                                                                                                                                                                | 1900                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 1900                                                                                                                                                                                                                                                  | 1615                                                                              | 1810                                                                               | 0                                                                                   | 1615                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Q Serve(g_s), s                                                      | 27.1                                                                                                                                                                | 0.0                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                               | 41.0                                                                                                                                                                                                                                                  | 41.0                                                                              | 14.7                                                                               | 0.0                                                                                 | 25.5                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Cycle Q Clear(g_c), s                                                | 27.1                                                                                                                                                                | 0.0                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                               | 41.0                                                                                                                                                                                                                                                  | 41.0                                                                              | 14.7                                                                               | 0.0                                                                                 | 25.5                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Prop In Lane                                                         | 1.00                                                                                                                                                                |                                                                                                                                                                                                                                                       | 0.00                                                                              | 0.00                                                                              |                                                                                                                                                                                                                                                       | 1.00                                                                              | 1.00                                                                               |                                                                                     | 1.00                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Lane Grp Cap(c), veh/h                                               | 860                                                                                                                                                                 | 3966                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 2399                                                                                                                                                                                                                                                  | 680                                                                               | 769                                                                                | 0                                                                                   | 686                                                                                                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| V/C Ratio(X)                                                         | 0.97                                                                                                                                                                | 0.54                                                                                                                                                                                                                                                  | 0.00                                                                              | 0.00                                                                              | 0.88                                                                                                                                                                                                                                                  | 0.88                                                                              | 0.63                                                                               | 0.00                                                                                | 1.18                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Avail Cap(c_a), veh/h                                                | 860                                                                                                                                                                 | 3966                                                                                                                                                                                                                                                  | 0                                                                                 | 0                                                                                 | 2399                                                                                                                                                                                                                                                  | 680                                                                               | 769                                                                                | 0                                                                                   | 686                                                                                                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM Platoon Ratio                                                    | 2.00                                                                                                                                                                | 2.00                                                                                                                                                                                                                                                  | 1.00                                                                              | 1.00                                                                              | 1.00                                                                                                                                                                                                                                                  | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Upstream Filter(I)                                                   | 0.13                                                                                                                                                                | 0.13                                                                                                                                                                                                                                                  | 0.00                                                                              | 0.00                                                                              | 1.00                                                                                                                                                                                                                                                  | 1.00                                                                              | 1.00                                                                               | 0.00                                                                                | 1.00                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Uniform Delay (d), s/veh                                             | 31.1                                                                                                                                                                | 0.0                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                               | 32.0                                                                                                                                                                                                                                                  | 32.0                                                                              | 43.0                                                                               | 0.0                                                                                 | 47.2                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Incr Delay (d2), s/veh                                               | 6.3                                                                                                                                                                 | 0.1                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                               | 5.1                                                                                                                                                                                                                                                   | 15.3                                                                              | 4.0                                                                                | 0.0                                                                                 | 95.6                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| Initial Q Delay(d3),s/veh                                            | 0.0                                                                                                                                                                 | 0.0                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                               | 0.0                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                                | 0.0                                                                                 | 0.0                                                                                                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| %ile BackOfQ(50%),veh/ln                                             | 14.0                                                                                                                                                                | 0.0                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                               | 22.5                                                                                                                                                                                                                                                  | 21.0                                                                              | 7.8                                                                                | 0.0                                                                                 | 20.5                                                                                                                                                                    |                                                                                     |                                                                                     |                                                                                     |
| LnGrp Delay(d),s/veh                                                 | 37.5                                                                                                                                                                | 0.1                                                                                                                                                                                                                                                   | 0.0                                                                               | 0.0                                                                               | 37.1                                                                                                                                                                                                                                                  | 47.3                                                                              | 47.0                                                                               | 0.0                                                                                 | 142.9                                                                                                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| LnGrp LOS                                                            | D                                                                                                                                                                   | A                                                                                                                                                                                                                                                     |                                                                                   |                                                                                   | D                                                                                                                                                                                                                                                     | D                                                                                 | D                                                                                  |                                                                                     | F                                                                                                                                                                       |                                                                                     |                                                                                     |                                                                                     |
| Approach Vol, veh/h                                                  | 2973                                                                                                                                                                |                                                                                                                                                                                                                                                       |                                                                                   | 2715                                                                              |                                                                                                                                                                                                                                                       |                                                                                   | 1298                                                                               |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Approach Delay, s/veh                                                | 10.6                                                                                                                                                                |                                                                                                                                                                                                                                                       |                                                                                   | 39.4                                                                              |                                                                                                                                                                                                                                                       |                                                                                   | 106.8                                                                              |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Approach LOS                                                         | B                                                                                                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   | D                                                                                 |                                                                                                                                                                                                                                                       |                                                                                   | F                                                                                  |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Timer                                                                | 1                                                                                                                                                                   | 2                                                                                                                                                                                                                                                     | 3                                                                                 | 4                                                                                 | 5                                                                                                                                                                                                                                                     | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                                                         |                                                                                                                                                                     | 2                                                                                                                                                                                                                                                     |                                                                                   |                                                                                   | 5                                                                                                                                                                                                                                                     | 6                                                                                 |                                                                                    | 8                                                                                   |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s                                             |                                                                                                                                                                     | 89.0                                                                                                                                                                                                                                                  |                                                                                   |                                                                                   | 33.0                                                                                                                                                                                                                                                  | 56.0                                                                              |                                                                                    | 31.0                                                                                |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s                                              |                                                                                                                                                                     | 5.5                                                                                                                                                                                                                                                   |                                                                                   |                                                                                   | 4.5                                                                                                                                                                                                                                                   | 5.5                                                                               |                                                                                    | 5.5                                                                                 |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s                                          |                                                                                                                                                                     | 83.5                                                                                                                                                                                                                                                  |                                                                                   |                                                                                   | 28.5                                                                                                                                                                                                                                                  | 50.5                                                                              |                                                                                    | 25.5                                                                                |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+l1), s                                         |                                                                                                                                                                     | 2.0                                                                                                                                                                                                                                                   |                                                                                   |                                                                                   | 29.1                                                                                                                                                                                                                                                  | 43.0                                                                              |                                                                                    | 27.5                                                                                |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s                                              |                                                                                                                                                                     | 78.2                                                                                                                                                                                                                                                  |                                                                                   |                                                                                   | 0.0                                                                                                                                                                                                                                                   | 7.4                                                                               |                                                                                    | 0.0                                                                                 |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Intersection Summary                                                 |                                                                                                                                                                     |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                    |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay                                                  | 39.7                                                                                                                                                                |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                    |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                                                         | D                                                                                                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                    |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| Notes                                                                |                                                                                                                                                                     |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                    |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |
| User approved volume balancing among the lanes for turning movement. |                                                                                                                                                                     |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                   |                                                                                                                                                                                                                                                       |                                                                                   |                                                                                    |                                                                                     |                                                                                                                                                                         |                                                                                     |                                                                                     |                                                                                     |

**APPENDIX 8.8:**

**HORIZON YEAR (2035) WITH PROJECT CONDITIONS INTERSECTION OPERATIONS  
ANALYSIS WORKSHEETS WITH IMPROVEMENTS**

This Page Intentionally Left Blank

HCM 2010 Signalized Intersection Summary  
1: I-15 SB On-Ramp/I-15 SB Off-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                                                                      |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Movement                                                             | EBL                                                                               | EBT                                                                               | EBR                                                                               | WBL                                                                               | WBT                                                                               | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                 | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations                                                  |                                                                                   | ↑↑↑                                                                               | ↑                                                                                 | ↑↑                                                                                | ↑↑↑                                                                               |                                                                                   |                                                                                    |                                                                                     |                                                                                     | ↑↑                                                                                  | ↑                                                                                   | ↑                                                                                   |
| Volume (veh/h)                                                       | 0                                                                                 | 1608                                                                              | 489                                                                               | 639                                                                               | 1143                                                                              | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   | 480                                                                                 | 0                                                                                   | 748                                                                                 |
| Number                                                               | 5                                                                                 | 2                                                                                 | 12                                                                                | 1                                                                                 | 6                                                                                 | 16                                                                                |                                                                                    |                                                                                     |                                                                                     | 7                                                                                   | 4                                                                                   | 14                                                                                  |
| Initial Q (Qb), veh                                                  | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Ped-Bike Adj(A_pbT)                                                  | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                |                                                                                     | 1.00                                                                                |
| Parking Bus, Adj                                                     | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 1.00                                                                                | 1.00                                                                                |
| Adj Sat Flow, veh/h/ln                                               | 0                                                                                 | 1900                                                                              | 1900                                                                              | 1900                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1900                                                                                | 1900                                                                                | 1900                                                                                |
| Adj Flow Rate, veh/h                                                 | 0                                                                                 | 1748                                                                              | 0                                                                                 | 695                                                                               | 1242                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 522                                                                                 | 0                                                                                   | 813                                                                                 |
| Adj No. of Lanes                                                     | 0                                                                                 | 3                                                                                 | 1                                                                                 | 2                                                                                 | 3                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 2                                                                                   | 0                                                                                   | 2                                                                                   |
| Peak Hour Factor                                                     | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.92                                                                                | 0.92                                                                                | 0.92                                                                                |
| Percent Heavy Veh, %                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Cap, veh/h                                                           | 0                                                                                 | 2287                                                                              | 648                                                                               | 756                                                                               | 3734                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 850                                                                                 | 0                                                                                   | 759                                                                                 |
| Arrive On Green                                                      | 0.00                                                                              | 0.40                                                                              | 0.00                                                                              | 0.42                                                                              | 1.00                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.23                                                                                | 0.00                                                                                | 0.23                                                                                |
| Sat Flow, veh/h                                                      | 0                                                                                 | 5700                                                                              | 1615                                                                              | 3619                                                                              | 5700                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 3619                                                                                | 0                                                                                   | 3230                                                                                |
| Grp Volume(v), veh/h                                                 | 0                                                                                 | 1748                                                                              | 0                                                                                 | 695                                                                               | 1242                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 522                                                                                 | 0                                                                                   | 813                                                                                 |
| Grp Sat Flow(s),veh/h/ln                                             | 0                                                                                 | 1900                                                                              | 1615                                                                              | 1810                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1810                                                                                | 0                                                                                   | 1615                                                                                |
| Q Serve(g_s), s                                                      | 0.0                                                                               | 26.5                                                                              | 0.0                                                                               | 18.2                                                                              | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 12.9                                                                                | 0.0                                                                                 | 23.5                                                                                |
| Cycle Q Clear(g_c), s                                                | 0.0                                                                               | 26.5                                                                              | 0.0                                                                               | 18.2                                                                              | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 12.9                                                                                | 0.0                                                                                 | 23.5                                                                                |
| Prop In Lane                                                         | 0.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                |                                                                                     | 1.00                                                                                |
| Lane Grp Cap(c), veh/h                                               | 0                                                                                 | 2287                                                                              | 648                                                                               | 756                                                                               | 3734                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 850                                                                                 | 0                                                                                   | 759                                                                                 |
| V/C Ratio(X)                                                         | 0.00                                                                              | 0.76                                                                              | 0.00                                                                              | 0.92                                                                              | 0.33                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.61                                                                                | 0.00                                                                                | 1.07                                                                                |
| Avail Cap(c_a), veh/h                                                | 0                                                                                 | 2287                                                                              | 648                                                                               | 814                                                                               | 3734                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 850                                                                                 | 0                                                                                   | 759                                                                                 |
| HCM Platoon Ratio                                                    | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 2.00                                                                              | 2.00                                                                              | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 1.00                                                                                | 1.00                                                                                |
| Upstream Filter(I)                                                   | 0.00                                                                              | 1.00                                                                              | 0.00                                                                              | 0.54                                                                              | 0.54                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 0.00                                                                                | 1.00                                                                                |
| Uniform Delay (d), s/veh                                             | 0.0                                                                               | 25.9                                                                              | 0.0                                                                               | 28.3                                                                              | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 34.2                                                                                | 0.0                                                                                 | 38.3                                                                                |
| Incr Delay (d2), s/veh                                               | 0.0                                                                               | 1.6                                                                               | 0.0                                                                               | 9.1                                                                               | 0.1                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 3.3                                                                                 | 0.0                                                                                 | 53.4                                                                                |
| Initial Q Delay(d3),s/veh                                            | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 0.0                                                                                 | 0.0                                                                                 | 0.0                                                                                 |
| %ile BackOfQ(50%),veh/ln                                             | 0.0                                                                               | 14.1                                                                              | 0.0                                                                               | 9.8                                                                               | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 6.8                                                                                 | 0.0                                                                                 | 16.1                                                                                |
| LnGrp Delay(d),s/veh                                                 | 0.0                                                                               | 27.4                                                                              | 0.0                                                                               | 37.5                                                                              | 0.1                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 37.5                                                                                | 0.0                                                                                 | 91.6                                                                                |
| LnGrp LOS                                                            |                                                                                   | C                                                                                 |                                                                                   | D                                                                                 | A                                                                                 |                                                                                   |                                                                                    |                                                                                     |                                                                                     | D                                                                                   |                                                                                     | F                                                                                   |
| Approach Vol, veh/h                                                  |                                                                                   | 1748                                                                              |                                                                                   |                                                                                   | 1937                                                                              |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | 1335                                                                                |                                                                                     |
| Approach Delay, s/veh                                                |                                                                                   | 27.4                                                                              |                                                                                   |                                                                                   | 13.5                                                                              |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | 70.5                                                                                |                                                                                     |
| Approach LOS                                                         |                                                                                   | C                                                                                 |                                                                                   |                                                                                   | B                                                                                 |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | E                                                                                   |                                                                                     |
| Timer                                                                | 1                                                                                 | 2                                                                                 | 3                                                                                 | 4                                                                                 | 5                                                                                 | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                                                         | 1                                                                                 | 2                                                                                 |                                                                                   | 4                                                                                 |                                                                                   | 6                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s                                             | 25.4                                                                              | 45.6                                                                              |                                                                                   | 29.0                                                                              |                                                                                   | 71.0                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s                                              | 4.5                                                                               | 5.5                                                                               |                                                                                   | 5.5                                                                               |                                                                                   | 5.5                                                                               |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s                                          | 22.5                                                                              | 38.5                                                                              |                                                                                   | 23.5                                                                              |                                                                                   | 65.5                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+I1), s                                         | 20.2                                                                              | 28.5                                                                              |                                                                                   | 25.5                                                                              |                                                                                   | 2.0                                                                               |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s                                              | 0.7                                                                               | 9.4                                                                               |                                                                                   | 0.0                                                                               |                                                                                   | 46.4                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Intersection Summary                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay                                                  |                                                                                   |                                                                                   | 33.5                                                                              |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                                                         |                                                                                   |                                                                                   | C                                                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Notes                                                                |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| User approved volume balancing among the lanes for turning movement. |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

HCM 2010 Signalized Intersection Summary  
2: I-15 NB Off-Ramp/I-15 NB On-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                                                                      |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Movement                                                             | EBL                                                                               | EBT                                                                               | EBR                                                                               | WBL                                                                               | WBT                                                                               | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                 | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations                                                  |  |  |                                                                                   |                                                                                   |  |  |  |  |  |                                                                                     |                                                                                     |                                                                                     |
| Volume (veh/h)                                                       | 607                                                                               | 1481                                                                              | 0                                                                                 | 0                                                                                 | 1489                                                                              | 566                                                                               | 293                                                                                | 0                                                                                   | 966                                                                                 | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Number                                                               | 5                                                                                 | 2                                                                                 | 12                                                                                | 1                                                                                 | 6                                                                                 | 16                                                                                | 3                                                                                  | 8                                                                                   | 18                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| Initial Q (Qb), veh                                                  | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Ped-Bike Adj(A_pbT)                                                  | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                               |                                                                                     | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Parking Bus, Adj                                                     | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Adj Sat Flow, veh/h/ln                                               | 1900                                                                              | 1900                                                                              | 0                                                                                 | 0                                                                                 | 1900                                                                              | 1900                                                                              | 1900                                                                               | 1900                                                                                | 1900                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Adj Flow Rate, veh/h                                                 | 660                                                                               | 1610                                                                              | 0                                                                                 | 0                                                                                 | 1618                                                                              | 615                                                                               | 318                                                                                | 0                                                                                   | 1050                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Adj No. of Lanes                                                     | 2                                                                                 | 3                                                                                 | 0                                                                                 | 0                                                                                 | 3                                                                                 | 1                                                                                 | 2                                                                                  | 0                                                                                   | 2                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Peak Hour Factor                                                     | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                               | 0.92                                                                                | 0.92                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Percent Heavy Veh, %                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Cap, veh/h                                                           | 731                                                                               | 3386                                                                              | 0                                                                                 | 0                                                                                 | 1978                                                                              | 560                                                                               | 1071                                                                               | 0                                                                                   | 956                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Arrive On Green                                                      | 0.20                                                                              | 0.59                                                                              | 0.00                                                                              | 0.00                                                                              | 0.35                                                                              | 0.35                                                                              | 0.30                                                                               | 0.00                                                                                | 0.30                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Sat Flow, veh/h                                                      | 3619                                                                              | 5700                                                                              | 0                                                                                 | 0                                                                                 | 5700                                                                              | 1615                                                                              | 3619                                                                               | 0                                                                                   | 3230                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Grp Volume(v), veh/h                                                 | 660                                                                               | 1610                                                                              | 0                                                                                 | 0                                                                                 | 1618                                                                              | 615                                                                               | 318                                                                                | 0                                                                                   | 1050                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Grp Sat Flow(s),veh/h/ln                                             | 1810                                                                              | 1900                                                                              | 0                                                                                 | 0                                                                                 | 1900                                                                              | 1615                                                                              | 1810                                                                               | 0                                                                                   | 1615                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Q Serve(g_s), s                                                      | 17.8                                                                              | 16.0                                                                              | 0.0                                                                               | 0.0                                                                               | 25.9                                                                              | 34.7                                                                              | 6.8                                                                                | 0.0                                                                                 | 29.6                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Cycle Q Clear(g_c), s                                                | 17.8                                                                              | 16.0                                                                              | 0.0                                                                               | 0.0                                                                               | 25.9                                                                              | 34.7                                                                              | 6.8                                                                                | 0.0                                                                                 | 29.6                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Prop In Lane                                                         | 1.00                                                                              |                                                                                   | 0.00                                                                              | 0.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                               |                                                                                     | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Lane Grp Cap(c), veh/h                                               | 731                                                                               | 3386                                                                              | 0                                                                                 | 0                                                                                 | 1978                                                                              | 560                                                                               | 1071                                                                               | 0                                                                                   | 956                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| V/C Ratio(X)                                                         | 0.90                                                                              | 0.48                                                                              | 0.00                                                                              | 0.00                                                                              | 0.82                                                                              | 1.10                                                                              | 0.30                                                                               | 0.00                                                                                | 1.10                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Avail Cap(c_a), veh/h                                                | 764                                                                               | 3386                                                                              | 0                                                                                 | 0                                                                                 | 1978                                                                              | 560                                                                               | 1071                                                                               | 0                                                                                   | 956                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| HCM Platoon Ratio                                                    | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Upstream Filter(I)                                                   | 0.61                                                                              | 0.61                                                                              | 0.00                                                                              | 0.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                               | 0.00                                                                                | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Uniform Delay (d), s/veh                                             | 38.9                                                                              | 11.5                                                                              | 0.0                                                                               | 0.0                                                                               | 29.8                                                                              | 32.7                                                                              | 27.2                                                                               | 0.0                                                                                 | 35.2                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Incr Delay (d2), s/veh                                               | 9.0                                                                               | 0.3                                                                               | 0.0                                                                               | 0.0                                                                               | 3.9                                                                               | 67.4                                                                              | 0.7                                                                                | 0.0                                                                                 | 59.8                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Initial Q Delay(d3),s/veh                                            | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                                | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| %ile BackOfQ(50%),veh/ln                                             | 9.8                                                                               | 8.4                                                                               | 0.0                                                                               | 0.0                                                                               | 14.2                                                                              | 25.9                                                                              | 3.5                                                                                | 0.0                                                                                 | 21.1                                                                                |                                                                                     |                                                                                     |                                                                                     |
| LnGrp Delay(d),s/veh                                                 | 48.0                                                                              | 11.8                                                                              | 0.0                                                                               | 0.0                                                                               | 33.7                                                                              | 100.0                                                                             | 27.9                                                                               | 0.0                                                                                 | 95.0                                                                                |                                                                                     |                                                                                     |                                                                                     |
| LnGrp LOS                                                            | D                                                                                 | B                                                                                 |                                                                                   |                                                                                   | C                                                                                 | F                                                                                 | C                                                                                  |                                                                                     | F                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Approach Vol, veh/h                                                  |                                                                                   | 2270                                                                              |                                                                                   |                                                                                   | 2233                                                                              |                                                                                   |                                                                                    | 1368                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Approach Delay, s/veh                                                |                                                                                   | 22.3                                                                              |                                                                                   |                                                                                   | 52.0                                                                              |                                                                                   |                                                                                    | 79.4                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Approach LOS                                                         |                                                                                   | C                                                                                 |                                                                                   |                                                                                   | D                                                                                 |                                                                                   |                                                                                    | E                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Timer                                                                | 1                                                                                 | 2                                                                                 | 3                                                                                 | 4                                                                                 | 5                                                                                 | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                                                         |                                                                                   | 2                                                                                 |                                                                                   |                                                                                   | 5                                                                                 | 6                                                                                 |                                                                                    | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s                                             |                                                                                   | 64.9                                                                              |                                                                                   |                                                                                   | 24.7                                                                              | 40.2                                                                              |                                                                                    | 35.1                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s                                              |                                                                                   | 5.5                                                                               |                                                                                   |                                                                                   | 4.5                                                                               | 5.5                                                                               |                                                                                    | 5.5                                                                                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s                                          |                                                                                   | 59.4                                                                              |                                                                                   |                                                                                   | 21.1                                                                              | 33.8                                                                              |                                                                                    | 29.6                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+l1), s                                         |                                                                                   | 18.0                                                                              |                                                                                   |                                                                                   | 19.8                                                                              | 36.7                                                                              |                                                                                    | 31.6                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s                                              |                                                                                   | 37.5                                                                              |                                                                                   |                                                                                   | 0.4                                                                               | 0.0                                                                               |                                                                                    | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| <b>Intersection Summary</b>                                          |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay                                                  |                                                                                   |                                                                                   | 46.9                                                                              |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                                                         |                                                                                   |                                                                                   | D                                                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| <b>Notes</b>                                                         |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| User approved volume balancing among the lanes for turning movement. |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |



HCM 2010 Signalized Intersection Summary  
1: I-15 SB On-Ramp/I-15 SB Off-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                                                                      |  |  |  |  |  |  |  |  |  |  |  |  |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
| Movement                                                             | EBL                                                                               | EBT                                                                               | EBR                                                                               | WBL                                                                               | WBT                                                                               | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                 | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations                                                  |                                                                                   | ↑↑↑                                                                               | ↑                                                                                 | ↑↑                                                                                | ↑↑↑                                                                               |                                                                                   |                                                                                    |                                                                                     |                                                                                     | ↑↑                                                                                  | ↑                                                                                   | ↑                                                                                   |
| Volume (veh/h)                                                       | 0                                                                                 | 1899                                                                              | 608                                                                               | 780                                                                               | 1632                                                                              | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   | 849                                                                                 | 0                                                                                   | 710                                                                                 |
| Number                                                               | 5                                                                                 | 2                                                                                 | 12                                                                                | 1                                                                                 | 6                                                                                 | 16                                                                                |                                                                                    |                                                                                     |                                                                                     | 7                                                                                   | 4                                                                                   | 14                                                                                  |
| Initial Q (Qb), veh                                                  | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Ped-Bike Adj(A_pbT)                                                  | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                |                                                                                     | 1.00                                                                                |
| Parking Bus, Adj                                                     | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 1.00                                                                                | 1.00                                                                                |
| Adj Sat Flow, veh/h/ln                                               | 0                                                                                 | 1900                                                                              | 1900                                                                              | 1900                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1900                                                                                | 1900                                                                                | 1900                                                                                |
| Adj Flow Rate, veh/h                                                 | 0                                                                                 | 1999                                                                              | 0                                                                                 | 821                                                                               | 1718                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 894                                                                                 | 0                                                                                   | 747                                                                                 |
| Adj No. of Lanes                                                     | 0                                                                                 | 3                                                                                 | 1                                                                                 | 2                                                                                 | 3                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 2                                                                                   | 0                                                                                   | 2                                                                                   |
| Peak Hour Factor                                                     | 0.95                                                                              | 0.95                                                                              | 0.95                                                                              | 0.95                                                                              | 0.95                                                                              | 0.95                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.95                                                                                | 0.95                                                                                | 0.95                                                                                |
| Percent Heavy Veh, %                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Cap, veh/h                                                           | 0                                                                                 | 1892                                                                              | 536                                                                               | 919                                                                               | 3553                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1031                                                                                | 0                                                                                   | 921                                                                                 |
| Arrive On Green                                                      | 0.00                                                                              | 0.33                                                                              | 0.00                                                                              | 0.17                                                                              | 0.42                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.28                                                                                | 0.00                                                                                | 0.28                                                                                |
| Sat Flow, veh/h                                                      | 0                                                                                 | 5700                                                                              | 1615                                                                              | 3619                                                                              | 5700                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 3619                                                                                | 0                                                                                   | 3230                                                                                |
| Grp Volume(v), veh/h                                                 | 0                                                                                 | 1999                                                                              | 0                                                                                 | 821                                                                               | 1718                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 894                                                                                 | 0                                                                                   | 747                                                                                 |
| Grp Sat Flow(s),veh/h/ln                                             | 0                                                                                 | 1900                                                                              | 1615                                                                              | 1810                                                                              | 1900                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1810                                                                                | 0                                                                                   | 1615                                                                                |
| Q Serve(g_s), s                                                      | 0.0                                                                               | 39.8                                                                              | 0.0                                                                               | 26.6                                                                              | 26.4                                                                              | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 28.1                                                                                | 0.0                                                                                 | 25.8                                                                                |
| Cycle Q Clear(g_c), s                                                | 0.0                                                                               | 39.8                                                                              | 0.0                                                                               | 26.6                                                                              | 26.4                                                                              | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 28.1                                                                                | 0.0                                                                                 | 25.8                                                                                |
| Prop In Lane                                                         | 0.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                |                                                                                     | 1.00                                                                                |
| Lane Grp Cap(c), veh/h                                               | 0                                                                                 | 1892                                                                              | 536                                                                               | 919                                                                               | 3553                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1031                                                                                | 0                                                                                   | 921                                                                                 |
| V/C Ratio(X)                                                         | 0.00                                                                              | 1.06                                                                              | 0.00                                                                              | 0.89                                                                              | 0.48                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 0.87                                                                                | 0.00                                                                                | 0.81                                                                                |
| Avail Cap(c_a), veh/h                                                | 0                                                                                 | 1892                                                                              | 536                                                                               | 1050                                                                              | 3553                                                                              | 0                                                                                 |                                                                                    |                                                                                     |                                                                                     | 1031                                                                                | 0                                                                                   | 921                                                                                 |
| HCM Platoon Ratio                                                    | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 0.67                                                                              | 0.67                                                                              | 1.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 1.00                                                                                | 1.00                                                                                |
| Upstream Filter(I)                                                   | 0.00                                                                              | 1.00                                                                              | 0.00                                                                              | 0.40                                                                              | 0.40                                                                              | 0.00                                                                              |                                                                                    |                                                                                     |                                                                                     | 1.00                                                                                | 0.00                                                                                | 1.00                                                                                |
| Uniform Delay (d), s/veh                                             | 0.0                                                                               | 40.1                                                                              | 0.0                                                                               | 48.2                                                                              | 20.8                                                                              | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 40.7                                                                                | 0.0                                                                                 | 39.9                                                                                |
| Incr Delay (d2), s/veh                                               | 0.0                                                                               | 37.5                                                                              | 0.0                                                                               | 4.0                                                                               | 0.2                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 9.8                                                                                 | 0.0                                                                                 | 7.7                                                                                 |
| Initial Q Delay(d3),s/veh                                            | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 0.0                                                                                 | 0.0                                                                                 | 0.0                                                                                 |
| %ile BackOfQ(50%),veh/ln                                             | 0.0                                                                               | 27.4                                                                              | 0.0                                                                               | 13.9                                                                              | 13.9                                                                              | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 15.4                                                                                | 0.0                                                                                 | 12.5                                                                                |
| LnGrp Delay(d),s/veh                                                 | 0.0                                                                               | 77.6                                                                              | 0.0                                                                               | 52.2                                                                              | 21.0                                                                              | 0.0                                                                               |                                                                                    |                                                                                     |                                                                                     | 50.5                                                                                | 0.0                                                                                 | 47.6                                                                                |
| LnGrp LOS                                                            |                                                                                   | F                                                                                 |                                                                                   | D                                                                                 | C                                                                                 |                                                                                   |                                                                                    |                                                                                     |                                                                                     | D                                                                                   |                                                                                     | D                                                                                   |
| Approach Vol, veh/h                                                  |                                                                                   | 1999                                                                              |                                                                                   |                                                                                   | 2539                                                                              |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | 1641                                                                                |                                                                                     |
| Approach Delay, s/veh                                                |                                                                                   | 77.6                                                                              |                                                                                   |                                                                                   | 31.1                                                                              |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | 49.2                                                                                |                                                                                     |
| Approach LOS                                                         |                                                                                   | E                                                                                 |                                                                                   |                                                                                   | C                                                                                 |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     | D                                                                                   |                                                                                     |
| Timer                                                                | 1                                                                                 | 2                                                                                 | 3                                                                                 | 4                                                                                 | 5                                                                                 | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                                                         | 1                                                                                 | 2                                                                                 |                                                                                   | 4                                                                                 |                                                                                   | 6                                                                                 |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s                                             | 35.0                                                                              | 45.3                                                                              |                                                                                   | 39.7                                                                              |                                                                                   | 80.3                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s                                              | 4.5                                                                               | 5.5                                                                               |                                                                                   | 5.5                                                                               |                                                                                   | 5.5                                                                               |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s                                          | 34.8                                                                              | 35.5                                                                              |                                                                                   | 34.2                                                                              |                                                                                   | 74.8                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+l1), s                                         | 28.6                                                                              | 41.8                                                                              |                                                                                   | 30.1                                                                              |                                                                                   | 28.4                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s                                              | 1.8                                                                               | 0.0                                                                               |                                                                                   | 2.5                                                                               |                                                                                   | 42.4                                                                              |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Intersection Summary                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay                                                  |                                                                                   |                                                                                   | 50.9                                                                              |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                                                         |                                                                                   |                                                                                   | D                                                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Notes                                                                |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| User approved volume balancing among the lanes for turning movement. |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

HCM 2010 Signalized Intersection Summary  
2: I-15 NB Off-Ramp/I-15 NB On-Ramp & Nichols Rd

Nichols Mine Expansion (JN 09599)

6/11/2015

|                                                                      |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
|----------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------|
|                                                                      |  |  |  |  |  |  |  |  |  |  |  |  |
| Movement                                                             | EBL                                                                               | EBT                                                                               | EBR                                                                               | WBL                                                                               | WBT                                                                               | WBR                                                                               | NBL                                                                                | NBT                                                                                 | NBR                                                                                 | SBL                                                                                 | SBT                                                                                 | SBR                                                                                 |
| Lane Configurations                                                  |  |  |                                                                                   |                                                                                   |  |  |  |  |  |                                                                                     |                                                                                     |                                                                                     |
| Volume (veh/h)                                                       | 770                                                                               | 1979                                                                              | 0                                                                                 | 0                                                                                 | 1963                                                                              | 562                                                                               | 449                                                                                | 0                                                                                   | 757                                                                                 | 0                                                                                   | 0                                                                                   | 0                                                                                   |
| Number                                                               | 5                                                                                 | 2                                                                                 | 12                                                                                | 1                                                                                 | 6                                                                                 | 16                                                                                | 3                                                                                  | 8                                                                                   | 18                                                                                  |                                                                                     |                                                                                     |                                                                                     |
| Initial Q (Qb), veh                                                  | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Ped-Bike Adj(A_pbT)                                                  | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                               |                                                                                     | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Parking Bus, Adj                                                     | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Adj Sat Flow, veh/h/ln                                               | 1900                                                                              | 1900                                                                              | 0                                                                                 | 0                                                                                 | 1900                                                                              | 1900                                                                              | 1900                                                                               | 1900                                                                                | 1900                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Adj Flow Rate, veh/h                                                 | 837                                                                               | 2151                                                                              | 0                                                                                 | 0                                                                                 | 2134                                                                              | 611                                                                               | 488                                                                                | 0                                                                                   | 823                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Adj No. of Lanes                                                     | 2                                                                                 | 3                                                                                 | 0                                                                                 | 0                                                                                 | 3                                                                                 | 1                                                                                 | 2                                                                                  | 0                                                                                   | 2                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Peak Hour Factor                                                     | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                              | 0.92                                                                               | 0.92                                                                                | 0.92                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Percent Heavy Veh, %                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                 | 0                                                                                  | 0                                                                                   | 0                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Cap, veh/h                                                           | 860                                                                               | 3966                                                                              | 0                                                                                 | 0                                                                                 | 2399                                                                              | 680                                                                               | 769                                                                                | 0                                                                                   | 686                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Arrive On Green                                                      | 0.47                                                                              | 1.00                                                                              | 0.00                                                                              | 0.00                                                                              | 0.42                                                                              | 0.42                                                                              | 0.21                                                                               | 0.00                                                                                | 0.21                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Sat Flow, veh/h                                                      | 3619                                                                              | 5700                                                                              | 0                                                                                 | 0                                                                                 | 5700                                                                              | 1615                                                                              | 3619                                                                               | 0                                                                                   | 3230                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Grp Volume(v), veh/h                                                 | 837                                                                               | 2151                                                                              | 0                                                                                 | 0                                                                                 | 2134                                                                              | 611                                                                               | 488                                                                                | 0                                                                                   | 823                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| Grp Sat Flow(s),veh/h/ln                                             | 1810                                                                              | 1900                                                                              | 0                                                                                 | 0                                                                                 | 1900                                                                              | 1615                                                                              | 1810                                                                               | 0                                                                                   | 1615                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Q Serve(g_s), s                                                      | 27.1                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 41.6                                                                              | 42.3                                                                              | 14.7                                                                               | 0.0                                                                                 | 25.5                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Cycle Q Clear(g_c), s                                                | 27.1                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 41.6                                                                              | 42.3                                                                              | 14.7                                                                               | 0.0                                                                                 | 25.5                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Prop In Lane                                                         | 1.00                                                                              |                                                                                   | 0.00                                                                              | 0.00                                                                              |                                                                                   | 1.00                                                                              | 1.00                                                                               |                                                                                     | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Lane Grp Cap(c), veh/h                                               | 860                                                                               | 3966                                                                              | 0                                                                                 | 0                                                                                 | 2399                                                                              | 680                                                                               | 769                                                                                | 0                                                                                   | 686                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| V/C Ratio(X)                                                         | 0.97                                                                              | 0.54                                                                              | 0.00                                                                              | 0.00                                                                              | 0.89                                                                              | 0.90                                                                              | 0.63                                                                               | 0.00                                                                                | 1.20                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Avail Cap(c_a), veh/h                                                | 860                                                                               | 3966                                                                              | 0                                                                                 | 0                                                                                 | 2399                                                                              | 680                                                                               | 769                                                                                | 0                                                                                   | 686                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| HCM Platoon Ratio                                                    | 2.00                                                                              | 2.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                               | 1.00                                                                                | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Upstream Filter(I)                                                   | 0.10                                                                              | 0.10                                                                              | 0.00                                                                              | 0.00                                                                              | 1.00                                                                              | 1.00                                                                              | 1.00                                                                               | 0.00                                                                                | 1.00                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Uniform Delay (d), s/veh                                             | 31.1                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 32.2                                                                              | 32.4                                                                              | 43.0                                                                               | 0.0                                                                                 | 47.2                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Incr Delay (d2), s/veh                                               | 5.2                                                                               | 0.1                                                                               | 0.0                                                                               | 0.0                                                                               | 5.5                                                                               | 17.1                                                                              | 4.0                                                                                | 0.0                                                                                 | 103.3                                                                               |                                                                                     |                                                                                     |                                                                                     |
| Initial Q Delay(d3),s/veh                                            | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 0.0                                                                                | 0.0                                                                                 | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |
| %ile BackOfQ(50%),veh/ln                                             | 13.9                                                                              | 0.0                                                                               | 0.0                                                                               | 0.0                                                                               | 22.9                                                                              | 22.1                                                                              | 7.8                                                                                | 0.0                                                                                 | 21.2                                                                                |                                                                                     |                                                                                     |                                                                                     |
| LnGrp Delay(d),s/veh                                                 | 36.4                                                                              | 0.1                                                                               | 0.0                                                                               | 0.0                                                                               | 37.6                                                                              | 49.5                                                                              | 47.0                                                                               | 0.0                                                                                 | 150.5                                                                               |                                                                                     |                                                                                     |                                                                                     |
| LnGrp LOS                                                            | D                                                                                 | A                                                                                 |                                                                                   |                                                                                   | D                                                                                 | D                                                                                 | D                                                                                  |                                                                                     | F                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Approach Vol, veh/h                                                  | 2988                                                                              |                                                                                   |                                                                                   |                                                                                   | 2745                                                                              |                                                                                   |                                                                                    |                                                                                     | 1311                                                                                |                                                                                     |                                                                                     |                                                                                     |
| Approach Delay, s/veh                                                | 10.2                                                                              |                                                                                   |                                                                                   |                                                                                   | 40.3                                                                              |                                                                                   |                                                                                    |                                                                                     | 112.0                                                                               |                                                                                     |                                                                                     |                                                                                     |
| Approach LOS                                                         | B                                                                                 |                                                                                   |                                                                                   |                                                                                   | D                                                                                 |                                                                                   |                                                                                    |                                                                                     | F                                                                                   |                                                                                     |                                                                                     |                                                                                     |
| Timer                                                                | 1                                                                                 | 2                                                                                 | 3                                                                                 | 4                                                                                 | 5                                                                                 | 6                                                                                 | 7                                                                                  | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Assigned Phs                                                         |                                                                                   | 2                                                                                 |                                                                                   |                                                                                   | 5                                                                                 | 6                                                                                 |                                                                                    | 8                                                                                   |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Phs Duration (G+Y+Rc), s                                             |                                                                                   | 89.0                                                                              |                                                                                   |                                                                                   | 33.0                                                                              | 56.0                                                                              |                                                                                    | 31.0                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Change Period (Y+Rc), s                                              |                                                                                   | 5.5                                                                               |                                                                                   |                                                                                   | 4.5                                                                               | 5.5                                                                               |                                                                                    | 5.5                                                                                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Green Setting (Gmax), s                                          |                                                                                   | 83.5                                                                              |                                                                                   |                                                                                   | 28.5                                                                              | 50.5                                                                              |                                                                                    | 25.5                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Max Q Clear Time (g_c+I1), s                                         |                                                                                   | 2.0                                                                               |                                                                                   |                                                                                   | 29.1                                                                              | 44.3                                                                              |                                                                                    | 27.5                                                                                |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Green Ext Time (p_c), s                                              |                                                                                   | 78.4                                                                              |                                                                                   |                                                                                   | 0.0                                                                               | 6.2                                                                               |                                                                                    | 0.0                                                                                 |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Intersection Summary                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 Ctrl Delay                                                  | 40.9                                                                              |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| HCM 2010 LOS                                                         | D                                                                                 |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| Notes                                                                |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |
| User approved volume balancing among the lanes for turning movement. |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                   |                                                                                    |                                                                                     |                                                                                     |                                                                                     |                                                                                     |                                                                                     |

**APPENDIX 8.9:**

**HORIZON YEAR (2035) WITHOUT PROJECT CONDITIONS OFF-RAMP QUEUEING  
ANALYSIS WORKSHEETS WITH IMPROVEMENTS**

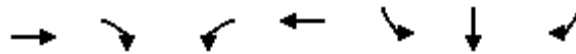
This Page Intentionally Left Blank

## Queues

Nichols Mine Expansion (JN 09599)

## 1: I-15 SB On-Ramp/I-15 SB Off-Ramp &amp; Nichols Rd

7/7/2015



| Lane Group              | EBT  | EBR  | WBL  | WBT  | SBL  | SBT  | SBR  |
|-------------------------|------|------|------|------|------|------|------|
| Lane Group Flow (vph)   | 1743 | 532  | 679  | 1238 | 507  | 407  | 406  |
| v/c Ratio               | 0.77 | 0.49 | 0.84 | 0.33 | 0.57 | 0.79 | 0.79 |
| Control Delay           | 29.3 | 3.6  | 56.8 | 10.5 | 36.7 | 40.5 | 40.4 |
| Queue Delay             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Total Delay             | 29.3 | 3.6  | 56.8 | 10.5 | 36.7 | 40.5 | 40.4 |
| Queue Length 50th (ft)  | 322  | 0    | 236  | 119  | 143  | 193  | 193  |
| Queue Length 95th (ft)  | 378  | 64   | m290 | 170  | 194  | #337 | #337 |
| Internal Link Dist (ft) | 310  |      |      | 572  |      | 1081 |      |
| Turn Bay Length (ft)    |      |      | 230  |      |      |      |      |
| Base Capacity (vph)     | 2265 | 1075 | 855  | 3733 | 893  | 514  | 514  |
| Starvation Cap Reductn  | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Spillback Cap Reductn   | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Storage Cap Reductn     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Reduced v/c Ratio       | 0.77 | 0.49 | 0.79 | 0.33 | 0.57 | 0.79 | 0.79 |

## Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

## Queues

Nichols Mine Expansion (JN 09599)

## 2: I-15 NB Off-Ramp/I-15 NB On-Ramp &amp; Nichols Rd

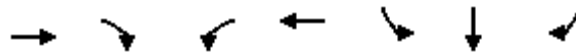
7/7/2015



| Lane Group              | EBL  | EBT  | WBT  | WBR  | NBL  | NBT  | NBR  |
|-------------------------|------|------|------|------|------|------|------|
| Lane Group Flow (vph)   | 660  | 1590 | 1599 | 602  | 159  | 159  | 1033 |
| v/c Ratio               | 0.86 | 0.47 | 0.81 | 0.57 | 0.28 | 0.28 | 0.88 |
| Control Delay           | 67.5 | 12.6 | 33.9 | 4.5  | 28.8 | 28.8 | 40.8 |
| Queue Delay             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Total Delay             | 67.5 | 12.6 | 33.9 | 4.5  | 28.8 | 28.8 | 40.8 |
| Queue Length 50th (ft)  | 229  | 155  | 310  | 0    | 78   | 78   | 292  |
| Queue Length 95th (ft)  | #293 | 212  | 365  | 72   | 132  | 132  | #399 |
| Internal Link Dist (ft) |      | 572  | 336  |      |      | 647  |      |
| Turn Bay Length (ft)    | 230  |      |      |      |      |      |      |
| Base Capacity (vph)     | 801  | 3385 | 1971 | 1050 | 562  | 562  | 1178 |
| Starvation Cap Reductn  | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Spillback Cap Reductn   | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Storage Cap Reductn     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Reduced v/c Ratio       | 0.82 | 0.47 | 0.81 | 0.57 | 0.28 | 0.28 | 0.88 |

## Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.



| Lane Group              | EBT  | EBR  | WBL  | WBT  | SBL  | SBT  | SBR  |
|-------------------------|------|------|------|------|------|------|------|
| Lane Group Flow (vph)   | 1996 | 640  | 807  | 1715 | 883  | 374  | 373  |
| v/c Ratio               | 1.06 | 0.69 | 0.83 | 0.48 | 0.82 | 0.64 | 0.64 |
| Control Delay           | 76.9 | 14.5 | 27.7 | 0.9  | 47.1 | 36.5 | 36.4 |
| Queue Delay             | 0.0  | 0.0  | 0.0  | 0.2  | 0.0  | 0.0  | 0.0  |
| Total Delay             | 76.9 | 14.5 | 27.7 | 1.1  | 47.2 | 36.5 | 36.4 |
| Queue Length 50th (ft)  | ~576 | 120  | 126  | 4    | 318  | 211  | 210  |
| Queue Length 95th (ft)  | #707 | 274  | m175 | 7    | 395  | 317  | 316  |
| Internal Link Dist (ft) | 310  |      |      | 572  |      | 1081 |      |
| Turn Bay Length (ft)    |      |      | 230  |      | 500  |      | 500  |
| Base Capacity (vph)     | 1888 | 930  | 1102 | 3553 | 1083 | 587  | 587  |
| Starvation Cap Reductn  | 0    | 0    | 0    | 793  | 0    | 0    | 0    |
| Spillback Cap Reductn   | 0    | 0    | 0    | 0    | 2    | 0    | 0    |
| Storage Cap Reductn     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Reduced v/c Ratio       | 1.06 | 0.69 | 0.73 | 0.62 | 0.82 | 0.64 | 0.64 |

#### Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

## Queues

Nichols Mine Expansion (JN 09599)

## 2: I-15 NB Off-Ramp/I-15 NB On-Ramp &amp; Nichols Rd

7/7/2015



| Lane Group              | EBL  | EBT  | WBT  | WBR  | NBL  | NBT  | NBR  |
|-------------------------|------|------|------|------|------|------|------|
| Lane Group Flow (vph)   | 837  | 2136 | 2116 | 599  | 244  | 244  | 810  |
| v/c Ratio               | 0.94 | 0.54 | 0.88 | 0.55 | 0.61 | 0.61 | 0.95 |
| Control Delay           | 27.2 | 11.0 | 36.9 | 7.0  | 50.0 | 50.0 | 63.1 |
| Queue Delay             | 0.0  | 1.5  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Total Delay             | 27.2 | 12.5 | 36.9 | 7.0  | 50.0 | 50.0 | 63.1 |
| Queue Length 50th (ft)  | 333  | 331  | 495  | 54   | 172  | 172  | 289  |
| Queue Length 95th (ft)  | m305 | m323 | 557  | 151  | 261  | 261  | #407 |
| Internal Link Dist (ft) |      | 572  | 336  |      |      | 647  |      |
| Turn Bay Length (ft)    | 230  |      |      |      | 500  |      | 500  |
| Base Capacity (vph)     | 902  | 3966 | 2415 | 1083 | 403  | 403  | 857  |
| Starvation Cap Reductn  | 0    | 1558 | 0    | 0    | 0    | 0    | 0    |
| Spillback Cap Reductn   | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Storage Cap Reductn     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Reduced v/c Ratio       | 0.93 | 0.89 | 0.88 | 0.55 | 0.61 | 0.61 | 0.95 |

## Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

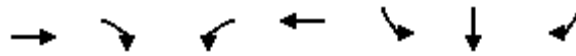
m Volume for 95th percentile queue is metered by upstream signal.



**APPENDIX 8.10:**

**HORIZON YEAR (2035) WITH PROJECT CONDITIONS OFF-RAMP QUEUEING  
ANALYSIS WORKSHEETS WITH IMPROVEMENTS**

This Page Intentionally Left Blank



| Lane Group              | EBT  | EBR  | WBL  | WBT  | SBL  | SBT  | SBR  |
|-------------------------|------|------|------|------|------|------|------|
| Lane Group Flow (vph)   | 1748 | 532  | 695  | 1242 | 522  | 407  | 406  |
| v/c Ratio               | 0.78 | 0.50 | 0.85 | 0.33 | 0.58 | 0.79 | 0.79 |
| Control Delay           | 29.5 | 3.6  | 57.1 | 10.7 | 37.0 | 40.8 | 40.6 |
| Queue Delay             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Total Delay             | 29.5 | 3.6  | 57.1 | 10.7 | 37.0 | 40.8 | 40.6 |
| Queue Length 50th (ft)  | 324  | 0    | 241  | 120  | 148  | 194  | 193  |
| Queue Length 95th (ft)  | 379  | 64   | m294 | 172  | 200  | #338 | #338 |
| Internal Link Dist (ft) | 310  |      |      | 572  |      | 1081 |      |
| Turn Bay Length (ft)    |      |      | 230  |      |      |      |      |
| Base Capacity (vph)     | 2253 | 1072 | 855  | 3733 | 893  | 513  | 513  |
| Starvation Cap Reductn  | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Spillback Cap Reductn   | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Storage Cap Reductn     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Reduced v/c Ratio       | 0.78 | 0.50 | 0.81 | 0.33 | 0.58 | 0.79 | 0.79 |

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

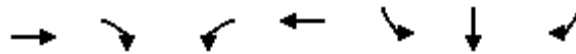
m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group              | EBL  | EBT  | WBT  | WBR  | NBL  | NBT  | NBR  |
|-------------------------|------|------|------|------|------|------|------|
| Lane Group Flow (vph)   | 660  | 1610 | 1618 | 615  | 159  | 159  | 1050 |
| v/c Ratio               | 0.86 | 0.48 | 0.82 | 0.58 | 0.28 | 0.28 | 0.89 |
| Control Delay           | 67.3 | 12.7 | 34.3 | 4.5  | 28.8 | 28.8 | 42.1 |
| Queue Delay             | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Total Delay             | 67.3 | 12.7 | 34.3 | 4.5  | 28.8 | 28.8 | 42.1 |
| Queue Length 50th (ft)  | 229  | 160  | 315  | 0    | 78   | 78   | 299  |
| Queue Length 95th (ft)  | #293 | 216  | 371  | 73   | 132  | 132  | #411 |
| Internal Link Dist (ft) |      | 572  | 336  |      |      | 647  |      |
| Turn Bay Length (ft)    | 230  |      |      |      |      |      |      |
| Base Capacity (vph)     | 801  | 3385 | 1971 | 1059 | 562  | 562  | 1178 |
| Starvation Cap Reductn  | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Spillback Cap Reductn   | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Storage Cap Reductn     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Reduced v/c Ratio       | 0.82 | 0.48 | 0.82 | 0.58 | 0.28 | 0.28 | 0.89 |

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.  
Queue shown is maximum after two cycles.



| Lane Group              | EBT  | EBR  | WBL  | WBT  | SBL  | SBT  | SBR  |
|-------------------------|------|------|------|------|------|------|------|
| Lane Group Flow (vph)   | 1999 | 640  | 821  | 1718 | 894  | 374  | 373  |
| v/c Ratio               | 1.07 | 0.69 | 0.84 | 0.48 | 0.83 | 0.64 | 0.64 |
| Control Delay           | 81.9 | 14.8 | 27.1 | 0.9  | 47.7 | 36.5 | 36.4 |
| Queue Delay             | 0.0  | 0.0  | 0.0  | 0.2  | 0.1  | 0.0  | 0.0  |
| Total Delay             | 81.9 | 14.8 | 27.1 | 1.1  | 47.8 | 36.5 | 36.4 |
| Queue Length 50th (ft)  | ~582 | 122  | 128  | 4    | 324  | 211  | 210  |
| Queue Length 95th (ft)  | #708 | 275  | m177 | 7    | 400  | 317  | 316  |
| Internal Link Dist (ft) | 310  |      |      | 572  |      | 1081 |      |
| Turn Bay Length (ft)    |      |      | 230  |      | 500  |      | 500  |
| Base Capacity (vph)     | 1866 | 924  | 1102 | 3553 | 1083 | 587  | 587  |
| Starvation Cap Reductn  | 0    | 0    | 0    | 796  | 0    | 0    | 0    |
| Spillback Cap Reductn   | 0    | 0    | 0    | 0    | 5    | 0    | 0    |
| Storage Cap Reductn     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Reduced v/c Ratio       | 1.07 | 0.69 | 0.75 | 0.62 | 0.83 | 0.64 | 0.64 |

#### Intersection Summary

~ Volume exceeds capacity, queue is theoretically infinite.

Queue shown is maximum after two cycles.

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.



| Lane Group              | EBL  | EBT  | WBT  | WBR  | NBL  | NBT  | NBR  |
|-------------------------|------|------|------|------|------|------|------|
| Lane Group Flow (vph)   | 837  | 2151 | 2134 | 611  | 244  | 244  | 823  |
| v/c Ratio               | 0.94 | 0.54 | 0.88 | 0.56 | 0.61 | 0.61 | 0.96 |
| Control Delay           | 26.4 | 10.8 | 37.4 | 7.2  | 50.0 | 50.0 | 65.8 |
| Queue Delay             | 0.0  | 1.6  | 0.0  | 0.0  | 0.0  | 0.0  | 0.0  |
| Total Delay             | 26.4 | 12.4 | 37.4 | 7.2  | 50.0 | 50.0 | 65.8 |
| Queue Length 50th (ft)  | 332  | 332  | 501  | 57   | 172  | 172  | 296  |
| Queue Length 95th (ft)  | m300 | m322 | 565  | 157  | 261  | 261  | #419 |
| Internal Link Dist (ft) |      | 572  | 336  |      |      | 647  |      |
| Turn Bay Length (ft)    | 230  |      |      |      | 500  |      | 500  |
| Base Capacity (vph)     | 902  | 3966 | 2415 | 1087 | 403  | 403  | 857  |
| Starvation Cap Reductn  | 0    | 1558 | 0    | 0    | 0    | 0    | 0    |
| Spillback Cap Reductn   | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Storage Cap Reductn     | 0    | 0    | 0    | 0    | 0    | 0    | 0    |
| Reduced v/c Ratio       | 0.93 | 0.89 | 0.88 | 0.56 | 0.61 | 0.61 | 0.96 |

#### Intersection Summary

# 95th percentile volume exceeds capacity, queue may be longer.

Queue shown is maximum after two cycles.

m Volume for 95th percentile queue is metered by upstream signal.

**APPENDIX 8.11:**

**HORIZON YEAR (2035) WITHOUT PROJECT CONDITIONS BASIC FREEWAY SEGMENT  
ANALYSIS WORKSHEETS WITH IMPROVEMENTS**

This Page Intentionally Left Blank



| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year 2035 Without Project w/ IMPROV                                                      |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 3754                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) | 1428                        | pc/h/ln                          | Design LOS                                                                                        |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| S                                                           | 69.4                        | mph                              | x f <sub>p</sub> )                                                                                |                                        |     |
| D = v <sub>p</sub> / S                                      | 20.6                        | pc/mi/ln                         | S                                                                                                 |                                        |     |
| LOS                                                         | C                           |                                  | D = v <sub>p</sub> / S                                                                            |                                        |     |
|                                                             |                             |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                             |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                                   |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                                      | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                                            | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                                               | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                                         | AM Peak Hour                |                                  | Analysis Year 2035 Without Project w/ IMPROV                                                      |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                    |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                               |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                                           |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                                    | 3654                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                                         |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                                     |     |
| Peak-Hr Prop. of AADT, K                                                     |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                                    |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                                          |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                                              |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                                            |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                               | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                               | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                                  |     |
| <b>Speed Inputs</b>                                                          |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                                   |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                                       |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                                           | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                                      |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                                               | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                                   |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                                          |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                                     |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> ) | 1390                        | pc/h/ln                          | Design LOS                                                                                        |                                        |     |
| S                                                                            | 69.6                        | mph                              | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                        |     |
| D = v <sub>p</sub> / S                                                       | 20.0                        | pc/mi/ln                         | S                                                                                                 |                                        |     |
| LOS                                                                          | C                           |                                  | D = v <sub>p</sub> / S                                                                            |                                        |     |
|                                                                              |                             |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                              |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                                          | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                            | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                                   | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                                       | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                                        |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | AM Peak Hour                |                                  | Analysis Year 2035 Without Project w/ IMPROV                                                      |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 5465                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                                     |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2089                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 60.8                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 34.3                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | D                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                             |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                                   |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                                      | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                                            | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                                               | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                                         | AM Peak Hour                |                                  | Analysis Year 2035 Without Project w/ IMPROV                                                      |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                    |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                               |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                                           |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                                    | 5547                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                                         |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                                     |     |
| Peak-Hr Prop. of AADT, K                                                     |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                                    |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                                          |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                                              |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                                            |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                               | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                               | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                                  |     |
| <b>Speed Inputs</b>                                                          |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                                   |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                                       |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                                           | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                                      |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                                               | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                                   |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                                          |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                                     |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> ) | 2120                        | pc/h/ln                          | Design LOS                                                                                        |                                        |     |
| S                                                                            | 60.2                        | mph                              | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                        |     |
| D = v <sub>p</sub> / S                                                       | 35.2                        | pc/mi/ln                         | S                                                                                                 |                                        |     |
| LOS                                                                          | E                           |                                  | D = v <sub>p</sub> / S                                                                            |                                        |     |
|                                                                              |                             |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                              |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                                          | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                            | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                                   | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                                       | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                                        |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                            |                             |                                  |                                                                                                   |                                        |     |
|-------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                  |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                     | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                           | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                              | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                        | PM Peak Hour                |                                  | Analysis Year 2035 Without Project w/ IMPROV                                                      |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)   |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)              |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                          |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                   | 5705                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                        |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 9                                      |     |
| Peak-Hr Prop. of AADT, K                                    |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                   |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                         |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                             |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                           |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                              | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                              | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.957                                  |     |
| <b>Speed Inputs</b>                                         |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                  |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                      |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                          | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                     |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                              | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                  |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                         |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                    |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> ) |                             |                                  | Design LOS                                                                                        |                                        |     |
|                                                             | 2160                        | pc/h/ln                          | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> )                                       |                                        |     |
| x f <sub>p</sub> )                                          |                             |                                  | x f <sub>p</sub> )                                                                                |                                        |     |
| S                                                           | 59.3                        | mph                              | S                                                                                                 |                                        |     |
| D = v <sub>p</sub> / S                                      | 36.4                        | pc/mi/ln                         | D = v <sub>p</sub> / S                                                                            |                                        |     |
| LOS                                                         | E                           |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                             |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                         | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                           | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                  | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                      | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                       |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                                                                       |                             |          |                                                                                                   |                                |     |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------|---------------------------------------------------------------------------------------------------|--------------------------------|-----|
| <b>General Information</b>                                                                                             |                             |          | <b>Site Information</b>                                                                           |                                |     |
| Analyst                                                                                                                | CHS                         |          | Highway/Direction of Travel I-15 Southbound                                                       |                                |     |
| Agency or Company                                                                                                      | Urban Crossroads, Inc.      |          | From/To S of Nichols Road                                                                         |                                |     |
| Date Performed                                                                                                         | 6/3/2015                    |          | Jurisdiction Caltrans                                                                             |                                |     |
| Analysis Time Period                                                                                                   | PM Peak Hour                |          | Analysis Year 2035 Without Project w/ IMPROV                                                      |                                |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                              |                             |          |                                                                                                   |                                |     |
| <input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data |                             |          |                                                                                                   |                                |     |
| <b>Flow Inputs</b>                                                                                                     |                             |          |                                                                                                   |                                |     |
| Volume, V                                                                                                              | 5531                        | veh/h    | Peak-Hour Factor, PHF                                                                             | 0.92                           |     |
| AADT                                                                                                                   |                             | veh/day  | %Trucks and Buses, P <sub>T</sub>                                                                 | 9                              |     |
| Peak-Hr Prop. of AADT, K                                                                                               |                             |          | %RVs, P <sub>R</sub>                                                                              | 0                              |     |
| Peak-Hr Direction Prop, D                                                                                              |                             |          | General Terrain:                                                                                  | Level                          |     |
| DDHV = AADT x K x D                                                                                                    |                             | veh/h    | Grade % Length                                                                                    | mi                             |     |
|                                                                                                                        |                             |          | Up/Down %                                                                                         |                                |     |
| <b>Calculate Flow Adjustments</b>                                                                                      |                             |          |                                                                                                   |                                |     |
| f <sub>p</sub>                                                                                                         | 1.00                        |          | E <sub>R</sub>                                                                                    | 1.2                            |     |
| E <sub>T</sub>                                                                                                         | 1.5                         |          | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.957                          |     |
| <b>Speed Inputs</b>                                                                                                    |                             |          | <b>Calc Speed Adj and FFS</b>                                                                     |                                |     |
| Lane Width                                                                                                             |                             | ft       |                                                                                                   |                                |     |
| Rt-Side Lat. Clearance                                                                                                 |                             | ft       | f <sub>LW</sub>                                                                                   | mph                            |     |
| Number of Lanes, N                                                                                                     | 3                           |          | f <sub>LC</sub>                                                                                   | mph                            |     |
| Total Ramp Density, TRD                                                                                                |                             | ramps/mi | TRD Adjustment                                                                                    | mph                            |     |
| FFS (measured)                                                                                                         | 70.0                        | mph      | FFS                                                                                               | 70.0                           | mph |
| Base free-flow Speed, BFFS                                                                                             |                             | mph      |                                                                                                   |                                |     |
| <b>LOS and Performance Measures</b>                                                                                    |                             |          | <b>Design (N)</b>                                                                                 |                                |     |
| <u>Operational (LOS)</u>                                                                                               |                             |          | <u>Design (N)</u>                                                                                 |                                |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                                           | 2094                        | pc/h/ln  | Design LOS                                                                                        |                                |     |
| S                                                                                                                      | 60.7                        | mph      | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                |     |
| D = v <sub>p</sub> / S                                                                                                 | 34.5                        | pc/mi/ln | S                                                                                                 |                                |     |
| LOS                                                                                                                    | D                           |          | D = v <sub>p</sub> / S                                                                            |                                |     |
|                                                                                                                        |                             |          | Required Number of Lanes, N                                                                       |                                |     |
| <b>Glossary</b>                                                                                                        |                             |          | <b>Factor Location</b>                                                                            |                                |     |
| N - Number of lanes                                                                                                    | S - Speed                   |          | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8 |     |
| V - Hourly volume                                                                                                      | D - Density                 |          | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9 |     |
| v <sub>p</sub> - Flow rate                                                                                             | FFS - Free-flow speed       |          | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11               |     |
| LOS - Level of service                                                                                                 | BFFS - Base free-flow speed |          | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                |     |
| DDHV - Directional design hour volume                                                                                  |                             |          |                                                                                                   |                                |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                             |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                                   |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                                      | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                                            | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                                               | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                                         | PM Peak Hour                |                                  | Analysis Year 2035 Without Project w/ IMPROV                                                      |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                    |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                               |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                                           |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                                    | 4981                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                                         |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 12                                     |     |
| Peak-Hr Prop. of AADT, K                                                     |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                                    |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                                          |                             | veh/h                            | Grade %                                                                                           | Length                                 | mi  |
|                                                                              |                             |                                  |                                                                                                   | Up/Down %                              |     |
| <b>Calculate Flow Adjustments</b>                                            |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                               | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                               | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.943                                  |     |
| <b>Speed Inputs</b>                                                          |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                                   |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                                       |                             | ft                               | f <sub>LW</sub>                                                                                   |                                        | mph |
| Number of Lanes, N                                                           | 3                           |                                  | f <sub>LC</sub>                                                                                   |                                        | mph |
| Total Ramp Density, TRD                                                      |                             | ramps/mi                         | TRD Adjustment                                                                                    |                                        | mph |
| FFS (measured)                                                               | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                                   |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                                          |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                                     |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> ) | 1913                        | pc/h/ln                          | Design LOS                                                                                        |                                        |     |
| S                                                                            | 64.1                        | mph                              | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                        |     |
| D = v <sub>p</sub> / S                                                       | 29.8                        | pc/mi/ln                         | S                                                                                                 |                                        |     |
| LOS                                                                          | D                           |                                  | D = v <sub>p</sub> / S                                                                            |                                        |     |
|                                                                              |                             |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                              |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                                          | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                            | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                                   | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                                       | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                                        |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                             |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                                   |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                                      | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                                            | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                                               | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                                         | PM Peak Hour                |                                  | Analysis Year 2035 Without Project w/ IMPROV                                                      |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                    |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                               |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                                           |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                                    | 4854                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                                         |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 13                                     |     |
| Peak-Hr Prop. of AADT, K                                                     |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                                    |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                                          |                             | veh/h                            | Grade %                                                                                           | Length                                 | mi  |
|                                                                              |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                                            |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                               | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                               | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.939                                  |     |
| <b>Speed Inputs</b>                                                          |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                                   |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                                       |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                                           | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                                      |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                                               | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                                   |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                                          |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                                     |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> ) | 1873                        | pc/h/ln                          | Design LOS                                                                                        |                                        |     |
| S                                                                            | 64.7                        | mph                              | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                        |     |
| D = v <sub>p</sub> / S                                                       | 28.9                        | pc/mi/ln                         | S                                                                                                 |                                        |     |
| LOS                                                                          | D                           |                                  | D = v <sub>p</sub> / S                                                                            |                                        |     |
|                                                                              |                             |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                              |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                                          | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                            | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                                   | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                                       | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                                        |                             |                                  |                                                                                                   |                                        |     |



**APPENDIX 8.12:**

**HORIZON YEAR (2035) WITH PROJECT CONDITIONS BASIC FREEWAY SEGMENT  
ANALYSIS WORKSHEETS WITH IMPROVEMENTS**

This Page Intentionally Left Blank

| BASIC FREEWAY SEGMENTS WORKSHEET                                             |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                                   |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                                      | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                                            | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                                               | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                                         | AM Peak Hour                |                                  | Analysis Year 2035 With Project w/ IMPROV                                                         |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                    |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                               |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                                           |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                                    | 3759                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                                         |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                                     |     |
| Peak-Hr Prop. of AADT, K                                                     |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                                    |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                                          |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                                              |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                                            |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                               | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                               | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                                  |     |
| <b>Speed Inputs</b>                                                          |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                                   |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                                       |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                                           | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                                      |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                                               | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                                   |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                                          |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                                     |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> ) | 1430                        | pc/h/ln                          | Design LOS                                                                                        |                                        |     |
| S                                                                            | 69.4                        | mph                              | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                        |     |
| D = v <sub>p</sub> / S                                                       | 20.6                        | pc/mi/ln                         | S                                                                                                 |                                        |     |
| LOS                                                                          | C                           |                                  | D = v <sub>p</sub> / S                                                                            |                                        |     |
|                                                                              |                             |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                              |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                                          | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                            | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                                   | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                                       | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                                        |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                             |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                                   |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                                      | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                                            | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                                               | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                                         | AM Peak Hour                |                                  | Analysis Year 2035 With Project w/ IMPROV                                                         |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                    |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                               |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                                           |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                                    | 3659                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                                         |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                                     |     |
| Peak-Hr Prop. of AADT, K                                                     |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                                    |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                                          |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                                              |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                                            |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                               | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                               | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                                  |     |
| <b>Speed Inputs</b>                                                          |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                                   |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                                       |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                                           | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                                      |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                                               | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                                   |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                                          |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                                     |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> ) | 1392                        | pc/h/ln                          | Design LOS                                                                                        |                                        |     |
| S                                                                            | 69.6                        | mph                              | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                        |     |
| D = v <sub>p</sub> / S                                                       | 20.0                        | pc/mi/ln                         | S                                                                                                 |                                        |     |
| LOS                                                                          | C                           |                                  | D = v <sub>p</sub> / S                                                                            |                                        |     |
|                                                                              |                             |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                              |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                                          | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                            | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                                   | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                                       | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                                        |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                                                                       |                             |          |                                                                                                   |                                |     |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------|---------------------------------------------------------------------------------------------------|--------------------------------|-----|
| <b>General Information</b>                                                                                             |                             |          | <b>Site Information</b>                                                                           |                                |     |
| Analyst                                                                                                                | CHS                         |          | Highway/Direction of Travel I-15 Northbound                                                       |                                |     |
| Agency or Company                                                                                                      | Urban Crossroads, Inc.      |          | From/To North of Nichols Road                                                                     |                                |     |
| Date Performed                                                                                                         | 6/3/2015                    |          | Jurisdiction Caltrans                                                                             |                                |     |
| Analysis Time Period                                                                                                   | AM Peak Hour                |          | Analysis Year 2035 With Project w/ IMPROV                                                         |                                |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                              |                             |          |                                                                                                   |                                |     |
| <input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data |                             |          |                                                                                                   |                                |     |
| <b>Flow Inputs</b>                                                                                                     |                             |          |                                                                                                   |                                |     |
| Volume, V                                                                                                              | 5469                        | veh/h    | Peak-Hour Factor, PHF                                                                             | 0.92                           |     |
| AADT                                                                                                                   |                             | veh/day  | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                             |     |
| Peak-Hr Prop. of AADT, K                                                                                               |                             |          | %RVs, P <sub>R</sub>                                                                              | 0                              |     |
| Peak-Hr Direction Prop, D                                                                                              |                             |          | General Terrain:                                                                                  | Level                          |     |
| DDHV = AADT x K x D                                                                                                    |                             | veh/h    | Grade % Length                                                                                    | mi                             |     |
|                                                                                                                        |                             |          | Up/Down %                                                                                         |                                |     |
| <b>Calculate Flow Adjustments</b>                                                                                      |                             |          |                                                                                                   |                                |     |
| f <sub>p</sub>                                                                                                         | 1.00                        |          | E <sub>R</sub>                                                                                    | 1.2                            |     |
| E <sub>T</sub>                                                                                                         | 1.5                         |          | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                          |     |
| <b>Speed Inputs</b>                                                                                                    |                             |          | <b>Calc Speed Adj and FFS</b>                                                                     |                                |     |
| Lane Width                                                                                                             |                             | ft       |                                                                                                   |                                |     |
| Rt-Side Lat. Clearance                                                                                                 |                             | ft       | f <sub>LW</sub>                                                                                   | mph                            |     |
| Number of Lanes, N                                                                                                     | 3                           |          | f <sub>LC</sub>                                                                                   | mph                            |     |
| Total Ramp Density, TRD                                                                                                |                             | ramps/mi | TRD Adjustment                                                                                    | mph                            |     |
| FFS (measured)                                                                                                         | 70.0                        | mph      | FFS                                                                                               | 70.0                           | mph |
| Base free-flow Speed, BFFS                                                                                             |                             | mph      |                                                                                                   |                                |     |
| <b>LOS and Performance Measures</b>                                                                                    |                             |          | <b>Design (N)</b>                                                                                 |                                |     |
| <u>Operational (LOS)</u>                                                                                               |                             |          | <u>Design (N)</u>                                                                                 |                                |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                                           | 2091                        | pc/h/ln  | Design LOS                                                                                        |                                |     |
| S                                                                                                                      | 60.8                        | mph      | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                |     |
| D = v <sub>p</sub> / S                                                                                                 | 34.4                        | pc/mi/ln | S                                                                                                 |                                |     |
| LOS                                                                                                                    | D                           |          | D = v <sub>p</sub> / S                                                                            |                                |     |
|                                                                                                                        |                             |          | Required Number of Lanes, N                                                                       |                                |     |
| <b>Glossary</b>                                                                                                        |                             |          | <b>Factor Location</b>                                                                            |                                |     |
| N - Number of lanes                                                                                                    | S - Speed                   |          | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8 |     |
| V - Hourly volume                                                                                                      | D - Density                 |          | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9 |     |
| v <sub>p</sub> - Flow rate                                                                                             | FFS - Free-flow speed       |          | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11               |     |
| LOS - Level of service                                                                                                 | BFFS - Base free-flow speed |          | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                |     |
| DDHV - Directional design hour volume                                                                                  |                             |          |                                                                                                   |                                |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                             |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                                   |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                                      | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                                            | Urban Crossroads, Inc.      |                                  | From/To S of Nichols Road                                                                         |                                        |     |
| Date Performed                                                               | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                                         | AM Peak Hour                |                                  | Analysis Year 2035 With Project w/ IMPROV                                                         |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                    |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                               |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                                           |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                                    | 5553                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                                         |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 11                                     |     |
| Peak-Hr Prop. of AADT, K                                                     |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                                    |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                                          |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                                              |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                                            |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                               | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                               | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.948                                  |     |
| <b>Speed Inputs</b>                                                          |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                                   |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                                       |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                                           | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                                      |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                                               | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                                   |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                                          |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                                     |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> ) | 2123                        | pc/h/ln                          | Design LOS                                                                                        |                                        |     |
| S                                                                            | 60.1                        | mph                              | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                        |     |
| D = v <sub>p</sub> / S                                                       | 35.3                        | pc/mi/ln                         | S                                                                                                 |                                        |     |
| LOS                                                                          | E                           |                                  | D = v <sub>p</sub> / S                                                                            |                                        |     |
|                                                                              |                             |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                              |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                                          | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                            | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                                   | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                                       | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                                        |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                             |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                                   |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                                      | CHS                         |                                  | Highway/Direction of Travel I-15 Southbound                                                       |                                        |     |
| Agency or Company                                                            | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                                               | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                                         | PM Peak Hour                |                                  | Analysis Year 2035 With Project w/ IMPROV                                                         |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                    |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                               |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                                           |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                                    | 5709                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                                         |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 9                                      |     |
| Peak-Hr Prop. of AADT, K                                                     |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                                    |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                                          |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                                              |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                                            |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                               | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                               | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.957                                  |     |
| <b>Speed Inputs</b>                                                          |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                                   |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                                       |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                                           | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                                      |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                                               | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                                   |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                                          |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                                     |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> ) | 2162                        | pc/h/ln                          | Design LOS                                                                                        |                                        |     |
| S                                                                            | 59.3                        | mph                              | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                        |     |
| D = v <sub>p</sub> / S                                                       | 36.5                        | pc/mi/ln                         | S                                                                                                 |                                        |     |
| LOS                                                                          | E                           |                                  | D = v <sub>p</sub> / S                                                                            |                                        |     |
|                                                                              |                             |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                              |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                                          | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                            | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                                   | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                                       | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                                        |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                                                                       |                             |          |                                                                                                   |                                |     |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------|---------------------------------------------------------------------------------------------------|--------------------------------|-----|
| <b>General Information</b>                                                                                             |                             |          | <b>Site Information</b>                                                                           |                                |     |
| Analyst                                                                                                                | CHS                         |          | Highway/Direction of Travel I-15 Southbound                                                       |                                |     |
| Agency or Company                                                                                                      | Urban Crossroads, Inc.      |          | From/To S of Nichols Road                                                                         |                                |     |
| Date Performed                                                                                                         | 6/3/2015                    |          | Jurisdiction Caltrans                                                                             |                                |     |
| Analysis Time Period                                                                                                   | PM Peak Hour                |          | Analysis Year 2035 With Project w/ IMPROV                                                         |                                |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                              |                             |          |                                                                                                   |                                |     |
| <input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data |                             |          |                                                                                                   |                                |     |
| <b>Flow Inputs</b>                                                                                                     |                             |          |                                                                                                   |                                |     |
| Volume, V                                                                                                              | 5536                        | veh/h    | Peak-Hour Factor, PHF                                                                             | 0.92                           |     |
| AADT                                                                                                                   |                             | veh/day  | %Trucks and Buses, P <sub>T</sub>                                                                 | 10                             |     |
| Peak-Hr Prop. of AADT, K                                                                                               |                             |          | %RVs, P <sub>R</sub>                                                                              | 0                              |     |
| Peak-Hr Direction Prop, D                                                                                              |                             |          | General Terrain:                                                                                  | Level                          |     |
| DDHV = AADT x K x D                                                                                                    |                             | veh/h    | Grade % Length                                                                                    | mi                             |     |
|                                                                                                                        |                             |          | Up/Down %                                                                                         |                                |     |
| <b>Calculate Flow Adjustments</b>                                                                                      |                             |          |                                                                                                   |                                |     |
| f <sub>p</sub>                                                                                                         | 1.00                        |          | E <sub>R</sub>                                                                                    | 1.2                            |     |
| E <sub>T</sub>                                                                                                         | 1.5                         |          | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.952                          |     |
| <b>Speed Inputs</b>                                                                                                    |                             |          | <b>Calc Speed Adj and FFS</b>                                                                     |                                |     |
| Lane Width                                                                                                             |                             | ft       |                                                                                                   |                                |     |
| Rt-Side Lat. Clearance                                                                                                 |                             | ft       | f <sub>LW</sub>                                                                                   | mph                            |     |
| Number of Lanes, N                                                                                                     | 3                           |          | f <sub>LC</sub>                                                                                   | mph                            |     |
| Total Ramp Density, TRD                                                                                                |                             | ramps/mi | TRD Adjustment                                                                                    | mph                            |     |
| FFS (measured)                                                                                                         | 70.0                        | mph      | FFS                                                                                               | 70.0                           | mph |
| Base free-flow Speed, BFFS                                                                                             |                             | mph      |                                                                                                   |                                |     |
| <b>LOS and Performance Measures</b>                                                                                    |                             |          | <b>Design (N)</b>                                                                                 |                                |     |
| <u>Operational (LOS)</u>                                                                                               |                             |          | <u>Design (N)</u>                                                                                 |                                |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                                           | 2106                        | pc/h/ln  | Design LOS                                                                                        |                                |     |
| S                                                                                                                      | 60.5                        | mph      | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                |     |
| D = v <sub>p</sub> / S                                                                                                 | 34.8                        | pc/mi/ln | S                                                                                                 |                                |     |
| LOS                                                                                                                    | D                           |          | D = v <sub>p</sub> / S                                                                            |                                |     |
|                                                                                                                        |                             |          | Required Number of Lanes, N                                                                       |                                |     |
| <b>Glossary</b>                                                                                                        |                             |          | <b>Factor Location</b>                                                                            |                                |     |
| N - Number of lanes                                                                                                    | S - Speed                   |          | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8 |     |
| V - Hourly volume                                                                                                      | D - Density                 |          | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9 |     |
| v <sub>p</sub> - Flow rate                                                                                             | FFS - Free-flow speed       |          | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11               |     |
| LOS - Level of service                                                                                                 | BFFS - Base free-flow speed |          | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                |     |
| DDHV - Directional design hour volume                                                                                  |                             |          |                                                                                                   |                                |     |



| BASIC FREEWAY SEGMENTS WORKSHEET                                             |                             |                                  |                                                                                                   |                                        |     |
|------------------------------------------------------------------------------|-----------------------------|----------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------------|-----|
| <b>General Information</b>                                                   |                             |                                  | <b>Site Information</b>                                                                           |                                        |     |
| Analyst                                                                      | CHS                         |                                  | Highway/Direction of Travel I-15 Northbound                                                       |                                        |     |
| Agency or Company                                                            | Urban Crossroads, Inc.      |                                  | From/To North of Nichols Road                                                                     |                                        |     |
| Date Performed                                                               | 6/3/2015                    |                                  | Jurisdiction Caltrans                                                                             |                                        |     |
| Analysis Time Period                                                         | PM Peak Hour                |                                  | Analysis Year 2035 With Project w/ IMPROV                                                         |                                        |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                    |                             |                                  |                                                                                                   |                                        |     |
| <input checked="" type="checkbox"/> Oper.(LOS)                               |                             | <input type="checkbox"/> Des.(N) |                                                                                                   | <input type="checkbox"/> Planning Data |     |
| <b>Flow Inputs</b>                                                           |                             |                                  |                                                                                                   |                                        |     |
| Volume, V                                                                    | 4985                        | veh/h                            | Peak-Hour Factor, PHF                                                                             | 0.92                                   |     |
| AADT                                                                         |                             | veh/day                          | %Trucks and Buses, P <sub>T</sub>                                                                 | 13                                     |     |
| Peak-Hr Prop. of AADT, K                                                     |                             |                                  | %RVs, P <sub>R</sub>                                                                              | 0                                      |     |
| Peak-Hr Direction Prop, D                                                    |                             |                                  | General Terrain:                                                                                  | Level                                  |     |
| DDHV = AADT x K x D                                                          |                             | veh/h                            | Grade % Length                                                                                    | mi                                     |     |
|                                                                              |                             |                                  | Up/Down %                                                                                         |                                        |     |
| <b>Calculate Flow Adjustments</b>                                            |                             |                                  |                                                                                                   |                                        |     |
| f <sub>p</sub>                                                               | 1.00                        |                                  | E <sub>R</sub>                                                                                    | 1.2                                    |     |
| E <sub>T</sub>                                                               | 1.5                         |                                  | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.939                                  |     |
| <b>Speed Inputs</b>                                                          |                             |                                  | <b>Calc Speed Adj and FFS</b>                                                                     |                                        |     |
| Lane Width                                                                   |                             | ft                               |                                                                                                   |                                        |     |
| Rt-Side Lat. Clearance                                                       |                             | ft                               | f <sub>LW</sub>                                                                                   | mph                                    |     |
| Number of Lanes, N                                                           | 3                           |                                  | f <sub>LC</sub>                                                                                   | mph                                    |     |
| Total Ramp Density, TRD                                                      |                             | ramps/mi                         | TRD Adjustment                                                                                    | mph                                    |     |
| FFS (measured)                                                               | 70.0                        | mph                              | FFS                                                                                               | 70.0                                   | mph |
| Base free-flow Speed, BFFS                                                   |                             | mph                              |                                                                                                   |                                        |     |
| <b>LOS and Performance Measures</b>                                          |                             |                                  | <b>Design (N)</b>                                                                                 |                                        |     |
| <u>Operational (LOS)</u>                                                     |                             |                                  | <u>Design (N)</u>                                                                                 |                                        |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> ) | 1924                        | pc/h/ln                          | Design LOS                                                                                        |                                        |     |
| S                                                                            | 63.9                        | mph                              | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                        |     |
| D = v <sub>p</sub> / S                                                       | 30.1                        | pc/mi/ln                         | S                                                                                                 |                                        |     |
| LOS                                                                          | D                           |                                  | D = v <sub>p</sub> / S                                                                            |                                        |     |
|                                                                              |                             |                                  | Required Number of Lanes, N                                                                       |                                        |     |
| <b>Glossary</b>                                                              |                             |                                  | <b>Factor Location</b>                                                                            |                                        |     |
| N - Number of lanes                                                          | S - Speed                   |                                  | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8         |     |
| V - Hourly volume                                                            | D - Density                 |                                  | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9         |     |
| v <sub>p</sub> - Flow rate                                                   | FFS - Free-flow speed       |                                  | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11                       |     |
| LOS - Level of service                                                       | BFFS - Base free-flow speed |                                  | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                        |     |
| DDHV - Directional design hour volume                                        |                             |                                  |                                                                                                   |                                        |     |

| BASIC FREEWAY SEGMENTS WORKSHEET                                                                                       |                             |          |                                                                                                   |                                |     |
|------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------|---------------------------------------------------------------------------------------------------|--------------------------------|-----|
| <b>General Information</b>                                                                                             |                             |          | <b>Site Information</b>                                                                           |                                |     |
| Analyst                                                                                                                | CHS                         |          | Highway/Direction of Travel I-15 Northbound                                                       |                                |     |
| Agency or Company                                                                                                      | Urban Crossroads, Inc.      |          | From/To S of Nichols Road                                                                         |                                |     |
| Date Performed                                                                                                         | 6/3/2015                    |          | Jurisdiction Caltrans                                                                             |                                |     |
| Analysis Time Period                                                                                                   | PM Peak Hour                |          | Analysis Year 2035 With Project w/ IMPROV                                                         |                                |     |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                              |                             |          |                                                                                                   |                                |     |
| <input checked="" type="checkbox"/> Oper.(LOS) <input type="checkbox"/> Des.(N) <input type="checkbox"/> Planning Data |                             |          |                                                                                                   |                                |     |
| <b>Flow Inputs</b>                                                                                                     |                             |          |                                                                                                   |                                |     |
| Volume, V                                                                                                              | 4858                        | veh/h    | Peak-Hour Factor, PHF                                                                             | 0.92                           |     |
| AADT                                                                                                                   |                             | veh/day  | %Trucks and Buses, P <sub>T</sub>                                                                 | 13                             |     |
| Peak-Hr Prop. of AADT, K                                                                                               |                             |          | %RVs, P <sub>R</sub>                                                                              | 0                              |     |
| Peak-Hr Direction Prop, D                                                                                              |                             |          | General Terrain:                                                                                  | Level                          |     |
| DDHV = AADT x K x D                                                                                                    |                             | veh/h    | Grade %                                                                                           | Length                         | mi  |
|                                                                                                                        |                             |          | Up/Down %                                                                                         |                                |     |
| <b>Calculate Flow Adjustments</b>                                                                                      |                             |          |                                                                                                   |                                |     |
| f <sub>p</sub>                                                                                                         | 1.00                        |          | E <sub>R</sub>                                                                                    | 1.2                            |     |
| E <sub>T</sub>                                                                                                         | 1.5                         |          | f <sub>HV</sub> = 1/[1+P <sub>T</sub> (E <sub>T</sub> - 1) + P <sub>R</sub> (E <sub>R</sub> - 1)] | 0.939                          |     |
| <b>Speed Inputs</b>                                                                                                    |                             |          | <b>Calc Speed Adj and FFS</b>                                                                     |                                |     |
| Lane Width                                                                                                             |                             | ft       |                                                                                                   |                                |     |
| Rt-Side Lat. Clearance                                                                                                 |                             | ft       | f <sub>LW</sub>                                                                                   | mph                            |     |
| Number of Lanes, N                                                                                                     | 3                           |          | f <sub>LC</sub>                                                                                   | mph                            |     |
| Total Ramp Density, TRD                                                                                                |                             | ramps/mi | TRD Adjustment                                                                                    | mph                            |     |
| FFS (measured)                                                                                                         | 70.0                        | mph      | FFS                                                                                               | 70.0                           | mph |
| Base free-flow Speed, BFFS                                                                                             |                             | mph      |                                                                                                   |                                |     |
| <b>LOS and Performance Measures</b>                                                                                    |                             |          | <b>Design (N)</b>                                                                                 |                                |     |
| <u>Operational (LOS)</u>                                                                                               |                             |          | <u>Design (N)</u>                                                                                 |                                |     |
| v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                                           | 1875                        | pc/h/ln  | Design LOS                                                                                        |                                |     |
| S                                                                                                                      | 64.7                        | mph      | v <sub>p</sub> = (V or DDHV) / (PHF x N x f <sub>HV</sub> x f <sub>p</sub> )                      |                                |     |
| D = v <sub>p</sub> / S                                                                                                 | 29.0                        | pc/mi/ln | S                                                                                                 |                                |     |
| LOS                                                                                                                    | D                           |          | D = v <sub>p</sub> / S                                                                            |                                |     |
|                                                                                                                        |                             |          | Required Number of Lanes, N                                                                       |                                |     |
| <b>Glossary</b>                                                                                                        |                             |          | <b>Factor Location</b>                                                                            |                                |     |
| N - Number of lanes                                                                                                    | S - Speed                   |          | E <sub>R</sub> - Exhibits 11-10, 11-12                                                            | f <sub>LW</sub> - Exhibit 11-8 |     |
| V - Hourly volume                                                                                                      | D - Density                 |          | E <sub>T</sub> - Exhibits 11-10, 11-11, 11-13                                                     | f <sub>LC</sub> - Exhibit 11-9 |     |
| v <sub>p</sub> - Flow rate                                                                                             | FFS - Free-flow speed       |          | f <sub>p</sub> - Page 11-18                                                                       | TRD - Page 11-11               |     |
| LOS - Level of service                                                                                                 | BFFS - Base free-flow speed |          | LOS, S, FFS, v <sub>p</sub> - Exhibits 11-2, 11-3                                                 |                                |     |
| DDHV - Directional design hour volume                                                                                  |                             |          |                                                                                                   |                                |     |

**APPENDIX 8.13:**

**HORIZON YEAR (2035) WITHOUT PROJECT CONDITIONS FREEWAY MERGE/DIVERGE  
ANALYSIS WORKSHEETS WITH IMPROVEMENTS**

This Page Intentionally Left Blank

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                |               |                                                                                                                                                                                                                         |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound                |               |                                                                                                                                                                                                                         |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp               |               |                                                                                                                                                                                                                         |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                       |               |                                                                                                                                                                                                                         |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 Without Project w/ IMPROV |               |                                                                                                                                                                                                                         |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                              |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 1114 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                              |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 220                            |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3754                           |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1214                           |               |                                                                                                                                                                                                                         |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                       | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                    |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3754            | 0.92                            | Level                | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.952                          | 1.00          | 4284                                                                                                                                                                                                                    |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1214            | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990                          | 1.00          | 1333                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1114            | 0.92                            | Level                | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.985                          | 1.00          | 1229                                                                                                                                                                                                                    |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                 |                      |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                |               |                                                                                                                                                                                                                         |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                |               |                                                                                                                                                                                                                         |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.592 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3079 pc/h<br>$V_3$ or $V_{av34}$ 1205 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                |               |                                                                                                                                                                                                                         |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                         | Capacity      |                                                                                                                                                                                                                         | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4284                           | Exhibit 13-8  | 7200                                                                                                                                                                                                                    | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 2951                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200                           | No            |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 1333                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100                           | No            |                                                                                                                                                                                                                         |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                         | Max Desirable |                                                                                                                                                                                                                         | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3079                           | Exhibit 13-8  | 4400:All                                                                                                                                                                                                                | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                |               |                                                                                                                                                                                                                         |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 28.8 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                                |               |                                                                                                                                                                                                                         |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |               |                                                                                                                                                                                                                         |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.418 (Exhibit 13-12)<br>$S_R =$ 58.3 mph (Exhibit 13-12)<br>$S_0 =$ 76.0 mph (Exhibit 13-12)<br>$S =$ 62.4 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                                |               |                                                                                                                                                                                                                         |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |                |                                                                                                                                                                                                            |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                                          |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                |                |                                                                                                                                                                                                            |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            | CHS                                      |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Southbound                |                |                                                                                                                                                                                                            |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            | Urban Crossroads, Inc.                   |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp                |                |                                                                                                                                                                                                            |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | 6/3/2015                                 |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans                       |                |                                                                                                                                                                                                            |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            | AM Peak Hour                             |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2035 Without Project w/ IMPROV |                |                                                                                                                                                                                                            |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |                |                                                                                                                                                                                                            |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |                |                                                                                                                                                                                                            |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2075 ft<br>V <sub>u</sub> = 1214 veh/h                                                                                                                                                                                                                                                                                                                                                                                                 |            | Freeway Number of Lanes, N               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                              |                | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | Ramp Number of Lanes, N                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                              |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | Acceleration Lane Length, L <sub>A</sub> |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 230                            |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | Deceleration Lane Length L <sub>D</sub>  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | Freeway Volume, V <sub>F</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2540                           |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | Ramp Volume, V <sub>R</sub>              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1114                           |                |                                                                                                                                                                                                            |            |
| Freeway Free-Flow Speed, S <sub>FF</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |                |                                                                                                                                                                                                            |            |
| Ramp Free-Flow Speed, S <sub>FR</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                          |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |                |                                                                                                                                                                                                            |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |                |                                                                                                                                                                                                            |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | V (Veh/hr) | PHF                                      | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub>                | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub>                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2540       | 0.92                                     | Level    | 14                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.935                          | 1.00           | 2954                                                                                                                                                                                                       |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1114       | 0.92                                     | Level    | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.985                          | 1.00           | 1229                                                                                                                                                                                                       |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1214       | 0.92                                     | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.990                          | 1.00           | 1333                                                                                                                                                                                                       |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |                |                                                                                                                                                                                                            |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                |                |                                                                                                                                                                                                            |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |                                          |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |                |                                                                                                                                                                                                            |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 948.68 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.584 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 1725 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 1229 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 1725 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                          |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                                |                |                                                                                                                                                                                                            |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                                          |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Actual     | Capacity                                 |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                         | Capacity       |                                                                                                                                                                                                            | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4183       | Exhibit 13-8                             |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                | Exhibit 13-10  |                                                                                                                                                                                                            |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Actual     | Max Desirable                            |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                         | Max Desirable  |                                                                                                                                                                                                            | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2954       | Exhibit 13-8                             | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                | Exhibit 13-8   |                                                                                                                                                                                                            |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                                          |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                |                |                                                                                                                                                                                                            |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 26.5 (pc/mi/ln)<br>LOS = C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |                |                                                                                                                                                                                                            |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                                          |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                |                |                                                                                                                                                                                                            |            |
| M <sub>S</sub> = 0.375 (Exhibit 13-11)<br>S <sub>R</sub> = 59.5 mph (Exhibit 13-11)<br>S <sub>0</sub> = 67.4 mph (Exhibit 13-11)<br>S = 61.6 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                                          |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                |                |                                                                                                                                                                                                            |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|-------------------------------------|----------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                     |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                    |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | CHS                                 |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | I-15 Northbound                                                                                                                                                                                    |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Urban Crossroads, Inc.              |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Nichols On-Ramp                                                                                                                                                                                    |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 | 6/3/2015                            |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Caltrans                                                                                                                                                                                           |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 | AM Peak Hour                        |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2035 Without Project w/ IMPROV                                                                                                                                                                     |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} =$ 2130 ft<br><br>$V_u =$ 1243 veh/h                                                                                                                                                                                                                                                                                           |                 | Freeway Number of Lanes, $N$ 3      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Ramp Number of Lanes, $N$ 1         |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Acceleration Lane Length, $L_A$ 800 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Deceleration Lane Length $L_D$      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Freeway Volume, $V_F$ 4304          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Ramp Volume, $V_R$ 1161             |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| Freeway Free-Flow Speed, $S_{FF}$ 70.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| Ramp Free-Flow Speed, $S_{FR}$ 45.0                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | $V$<br>(Veh/hr) | PHF                                 | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | $f_{HV}$                                                                                                                                                                                           | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4304            | 0.92                                | Level    | 14                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.935                                                                                                                                                                                              | 1.00          | 5006                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1161            | 0.92                                | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.995                                                                                                                                                                                              | 1.00          | 1268                                 |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1243            | 0.92                                | Level    | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.985                                                                                                                                                                                              | 1.00          | 1371                                 |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                    |               |                                      |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                     |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                     |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                    |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ 1649.24 (Equation 13-6 or 13-7)<br>$P_{FM} =$ 0.600 using Equation (Exhibit 13-6)<br>$V_{12} =$ 3003 pc/h<br>$V_3$ or $V_{av34}$ 2003 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ 3003 pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                     |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                    |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                     |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual          | Capacity                            |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual                                                                                                                                                                                             | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6274            | Exhibit 13-8                        |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                    | Exhibit 13-8  |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                     |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                    | Exhibit 13-8  |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                     |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                    | Exhibit 13-10 |                                      |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                     |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                    |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual          | Max Desirable                       |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual                                                                                                                                                                                             | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4271            | Exhibit 13-8                        | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                    | Exhibit 13-8  |                                      |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                     |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                    |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ 33.2 (pc/mi/ln)<br>LOS = D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                     |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                    |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                     |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                    |               |                                      |            |
| $M_S =$ 0.528 (Exhibit 13-11)<br>$S_R =$ 55.2 mph (Exhibit 13-11)<br>$S_0 =$ 64.6 mph (Exhibit 13-11)<br>$S =$ 57.9 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                       |                 |                                     |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                    |               |                                      |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                    |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                                |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound                                                                                                                                                                                                         |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.             |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp                                                                                                                                                                                                        |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                           |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                                                                                                                                                                                                                |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                       |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 Without Project w/ IMPROV                                                                                                                                                                                          |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      3  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 1161 veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N      1     |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$ 225 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$ 5547         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$ 1243            |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Freeway Free-Flow Speed, $S_{FF}$ 70.0                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Ramp Free-Flow Speed, $S_{FR}$ 45.0                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                                | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                                                                                                                                                                                                                | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5547            | 0.92                               | Level                | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.948                                                                                                                                                                                                                   | 1.00          | 6361                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1243            | 0.92                               | Level                | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.985                                                                                                                                                                                                                   | 1.00          | 1371                                 |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1161            | 0.92                               | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                                                                                                                                                                                                                   | 1.00          | 1268                                 |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                    |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                    |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                         |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                    |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.538 using Equation (Exhibit 13-7)<br>$V_{12} =$ 4055 pc/h<br>$V_3$ or $V_{av34}$ 2306 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                    |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                           |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                  | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                       |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6361                                                                                                                                                                                                                    | Exhibit 13-8  | 7200                                 | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    | $V_{FO} = V_F - V_R$ | 4990                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200                                                                                                                                                                                                                    | No            |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    | $V_R$                | 1371                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100                                                                                                                                                                                                                    | No            |                                      |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                    |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                      |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                  | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                       |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4055                                                                                                                                                                                                                    | Exhibit 13-8  | 4400:All                             | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                    |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                         |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                    |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 37.1 (pc/mi/ln)<br>LOS =      E (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                    |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                         |               |                                      |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                    |                      |                       | $D_S =$ 0.421 (Exhibit 13-12)<br>$S_R =$ 58.2 mph (Exhibit 13-12)<br>$S_0 =$ 71.7 mph (Exhibit 13-12)<br>$S =$ 62.5 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |               |                                      |            |



| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                |               |                                                                                                                                                                                                                         |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound                |               |                                                                                                                                                                                                                         |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp               |               |                                                                                                                                                                                                                         |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                       |               |                                                                                                                                                                                                                         |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 Without Project w/ IMPROV |               |                                                                                                                                                                                                                         |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                              |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 1375 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                              |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 220                            |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5705                           |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1549                           |               |                                                                                                                                                                                                                         |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                       | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                    |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5705            | 0.92                            | Level                | 9                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.957                          | 1.00          | 6480                                                                                                                                                                                                                    |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1549            | 0.92                            | Level                | 0                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1.000                          | 1.00          | 1684                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                |               |                                                                                                                                                                                                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1375            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                          | 1.00          | 1502                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                |               |                                                                                                                                                                                                                         |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                |               |                                                                                                                                                                                                                         |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.521 using Equation (Exhibit 13-7)<br>$V_{12} =$ 4180 pc/h<br>$V_3$ or $V_{av34}$ 2300 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                |               |                                                                                                                                                                                                                         |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                         | Capacity      |                                                                                                                                                                                                                         | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6480                           | Exhibit 13-8  | 7200                                                                                                                                                                                                                    | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 4796                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200                           | No            |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 1684                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100                           | No            |                                                                                                                                                                                                                         |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                         | Max Desirable |                                                                                                                                                                                                                         | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4180                           | Exhibit 13-8  | 4400:All                                                                                                                                                                                                                | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                |               |                                                                                                                                                                                                                         |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 38.2 (pc/mi/ln)<br>LOS =      E (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                                |               |                                                                                                                                                                                                                         |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                |               |                                                                                                                                                                                                                         |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.450 (Exhibit 13-12)<br>$S_R =$ 57.4 mph (Exhibit 13-12)<br>$S_0 =$ 71.7 mph (Exhibit 13-12)<br>$S =$ 61.8 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                                |               |                                                                                                                                                                                                                         |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |               |                       |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------|---------------|-----------------------|--------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |               |                       |                                | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                     |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | CHS                               |               | Freeway/Dir of Travel | I-15 Southbound                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Urban Crossroads, Inc.            |               | Junction              | Nichols On-Ramp                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 6/3/2015                          |               | Jurisdiction          | Caltrans                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | PM Peak Hour                      |               | Analysis Year         | 2035 Without Project w/ IMPROV |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |               |                       |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                   |               |                       |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
| Upstream Adj Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Freeway Number of Lanes, N        |               |                       | 3                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Downstream Adj Ramp                                                 |               |                                      |            |
| <input checked="" type="checkbox"/> Yes <input type="checkbox"/> On                                                                                                                                                                                                                                                                                                                                                                                                                                             | Ramp Number of Lanes, N           |               |                       | 1                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <input type="checkbox"/> Yes <input type="checkbox"/> On            |               |                                      |            |
| <input type="checkbox"/> No <input checked="" type="checkbox"/> Off                                                                                                                                                                                                                                                                                                                                                                                                                                             | Acceleration Lane Length, $L_A$   |               |                       | 230                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <input checked="" type="checkbox"/> No <input type="checkbox"/> Off |               |                                      |            |
| $L_{up} =$ 2075 ft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Deceleration Lane Length $L_D$    |               |                       |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | $L_{down} =$ ft                                                     |               |                                      |            |
| $V_u =$ 1549 veh/h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Freeway Volume, $V_F$             |               |                       | 4156                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | $V_D =$ veh/h                                                       |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Ramp Volume, $V_R$                |               |                       | 1375                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Freeway Free-Flow Speed, $S_{FF}$ |               |                       | 70.0                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Ramp Free-Flow Speed, $S_{FR}$    |               |                       | 45.0                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                   |               |                       |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | V (Veh/hr)                        | PHF           | Terrain               | %Truck                         | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$                                                            | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4156                              | 0.92          | Level                 | 12                             | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.943                                                               | 1.00          | 4788                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1375                              | 0.92          | Level                 | 1                              | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995                                                               | 1.00          | 1502                                 |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1549                              | 0.92          | Level                 | 0                              | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1.000                                                               | 1.00          | 1684                                 |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |               |                       |                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                     |               |                                      |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                   |               |                       |                                | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                     |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                   |               |                       |                                | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                     |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ 1399.58 (Equation 13-6 or 13-7)<br>$P_{FM} =$ 0.584 using Equation (Exhibit 13-6)<br>$V_{12} =$ 2796 pc/h<br>$V_3$ or $V_{av34} =$ 1992 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ 2796 pc/h (Equation 13-16, 13-18, or 13-19) |                                   |               |                       |                                | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                     |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                   |               |                       |                                | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                     |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual                            | Capacity      |                       | LOS F?                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual                                                              | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 6290                              | Exhibit 13-8  |                       | No                             | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                     | Exhibit 13-8  |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                   |               |                       |                                | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                     | Exhibit 13-8  |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                   |               |                       |                                | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                     | Exhibit 13-10 |                                      |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                   |               |                       |                                | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                     |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual                            | Max Desirable |                       | Violation?                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual                                                              | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4298                              | Exhibit 13-8  | 4600:All              | No                             | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                     | Exhibit 13-8  |                                      |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                   |               |                       |                                | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                     |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ 36.9 (pc/mi/ln)<br>LOS = E (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                  |                                   |               |                       |                                | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                                                                     |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                   |               |                       |                                | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                     |               |                                      |            |
| $M_S =$ 0.587 (Exhibit 13-11)<br>$S_R =$ 53.6 mph (Exhibit 13-11)<br>$S_0 =$ 64.6 mph (Exhibit 13-11)<br>$S =$ 56.6 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                         |                                   |               |                       |                                | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                                                                     |               |                                      |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------|----------|-----------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------|----------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                   |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                |                |                                              |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               | CHS                                               |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | I-15 Northbound                                                                                                                                                |                |                                              |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |               | Urban Crossroads, Inc.                            |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Nichols On-Ramp                                                                                                                                                |                |                                              |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               | 6/3/2015                                          |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Caltrans                                                                                                                                                       |                |                                              |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               | PM Peak Hour                                      |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 2035 Without Project w/ IMPROV                                                                                                                                 |                |                                              |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| Upstream Adj Ramp<br><br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |               | Freeway Number of Lanes, N                      3 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Downstream Adj Ramp<br><br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Ramp Number of Lanes, N                      1    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| L <sub>up</sub> =                      2130   ft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               | Acceleration Lane Length, L <sub>A</sub> 800      |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | L <sub>down</sub> =                      ft                                                                                                                    |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Deceleration Lane Length L <sub>D</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| V <sub>u</sub> =                      1194   veh/h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               | Freeway Volume, V <sub>F</sub> 3660               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | V <sub>D</sub> =                      veh/h                                                                                                                    |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Ramp Volume, V <sub>R</sub> 1321                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Freeway Free-Flow Speed, S <sub>FF</sub> 70.0     |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               | Ramp Free-Flow Speed, S <sub>FR</sub> 45.0        |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | V<br>(Veh/hr) | PHF                                               | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | f <sub>HV</sub>                                                                                                                                                | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub> |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 3660          | 0.92                                              | Level    | 17                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.922                                                                                                                                                          | 1.00           | 4316                                         |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1321          | 0.92                                              | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0.995                                                                                                                                                          | 1.00           | 1443                                         |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1194          | 0.92                                              | Level    | 0                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1.000                                                                                                                                                          | 1.00           | 1298                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                   |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                |                |                                              |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |                                                   |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                |                |                                              |            |
| V <sub>12</sub> = V <sub>F</sub> ( P <sub>FM</sub> )<br>L <sub>EQ</sub> =                      1539.03   (Equation 13-6 or 13-7)<br>P <sub>FM</sub> =                      0.600   using Equation (Exhibit 13-6)<br>V <sub>12</sub> =                      2589   pc/h<br>V <sub>3</sub> or V <sub>av34</sub> 1727   pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> =                      2589   pc/h (Equation 13-16, 13-18, or 13-19) |               |                                                   |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> =                      (Equation 13-12 or 13-13)<br>P <sub>FD</sub> =                      using Equation (Exhibit 13-7)<br>V <sub>12</sub> =                      pc/h<br>V <sub>3</sub> or V <sub>av34</sub> pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> =                      pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                |                |                                              |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                                   |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual        | Capacity                                          |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual                                                                                                                                                         | Capacity       |                                              | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 5759          | Exhibit 13-8                                      |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                                                   |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |               |                                                   |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                | Exhibit 13-10  |                                              |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                                                   |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                |                |                                              |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual        | Max Desirable                                     |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Actual                                                                                                                                                         | Max Desirable  |                                              | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4032          | Exhibit 13-8                                      | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                | Exhibit 13-8   |                                              |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                                                   |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                |                |                                              |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> =                      31.2 (pc/mi/ln)<br>LOS =                      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                                                   |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> =                      (pc/mi/ln)<br>LOS =                      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                |                |                                              |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                                   |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                |                |                                              |            |
| M <sub>S</sub> =                      0.469 (Exhibit 13-11)<br>S <sub>R</sub> =                      56.9 mph (Exhibit 13-11)<br>S <sub>0</sub> =                      65.6 mph (Exhibit 13-11)<br>S =                      59.2 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                   |          |                       | D <sub>s</sub> =                      (Exhibit 13-12)<br>S <sub>R</sub> =                      mph (Exhibit 13-12)<br>S <sub>0</sub> =                      mph (Exhibit 13-12)<br>S =                      mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                |                |                                              |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|------------------------------------|---------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                    |         |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                                |         | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound                                                                                                                                                                                                         |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.             |         | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp                                                                                                                                                                                                        |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                           |         | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                                                                                                                                                                                                                |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                       |         | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 Without Project w/ IMPROV                                                                                                                                                                                          |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      3  |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 1321 veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N      1     |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$ 225 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$ 4854         |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$ 1194            |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Freeway Free-Flow Speed, $S_{FF}$ 70.0                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Ramp Free-Flow Speed, $S_{FR}$ 45.0                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                                | Terrain | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                                                                                                                                                                                                                | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4854            | 0.92                               | Level   | 13                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.939                                                                                                                                                                                                                   | 1.00          | 5619                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1194            | 0.92                               | Level   | 0                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1.000                                                                                                                                                                                                                   | 1.00          | 1298                                 |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1321            | 0.92                               | Level   | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                                                                                                                                                                                                                   | 1.00          | 1443                                 |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                    |         |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                    |         |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                         |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                    |         |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.560 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3717 pc/h<br>$V_3$ or $V_{av34}$ 1902 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                    |         |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                           |         | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                  | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                       |         |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5619                                                                                                                                                                                                                    | Exhibit 13-8  | 7200                                 | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |         | $V_{FO} = V_F - V_R$  | 4321                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-8                                                                                                                                                                                                            | 7200          | No                                   |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                    |         | $V_R$                 | 1298                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-10                                                                                                                                                                                                           | 2100          | No                                   |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                    |         |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                      |         | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                  | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                       |         |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3717                                                                                                                                                                                                                    | Exhibit 13-8  | 4400:All                             | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                    |         |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                         |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                    |         |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 34.2 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                    |         |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                         |               |                                      |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                    |         |                       | $D_S =$ 0.415 (Exhibit 13-12)<br>$S_R =$ 58.4 mph (Exhibit 13-12)<br>$S_0 =$ 73.3 mph (Exhibit 13-12)<br>$S =$ 62.7 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |               |                                      |            |

**APPENDIX 8.14:**

**HORIZON YEAR (2035) WITH PROJECT CONDITIONS FREEWAY MERGE/DIVERGE  
ANALYSIS WORKSHEETS WITH IMPROVEMENTS**

This Page Intentionally Left Blank

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |               |                                                                                                                                                                                                                         |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound             |               |                                                                                                                                                                                                                         |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp            |               |                                                                                                                                                                                                                         |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                    |               |                                                                                                                                                                                                                         |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 With Project w/ IMPROV |               |                                                                                                                                                                                                                         |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, N      |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                           |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 1119 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, N         |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                           |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 220                         |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3759                        |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1219                        |               |                                                                                                                                                                                                                         |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                    | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                    |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 3759            | 0.92                            | Level                | 10                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.952                       | 1.00          | 4290                                                                                                                                                                                                                    |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1219            | 0.92                            | Level                | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990                       | 1.00          | 1338                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1119            | 0.92                            | Level                | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.980                       | 1.00          | 1241                                                                                                                                                                                                                    |            |
| Merge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                           |                 |                                 |                      |                       | Diverge Areas                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             |               |                                                                                                                                                                                                                         |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |               |                                                                                                                                                                                                                         |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.591 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3083 pc/h<br>$V_3$ or $V_{av34}$ 1207 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                             |               |                                                                                                                                                                                                                         |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                      | Capacity      |                                                                                                                                                                                                                         | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4290                        | Exhibit 13-8  | 7200                                                                                                                                                                                                                    | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 2952                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200                        | No            |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 1338                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100                        | No            |                                                                                                                                                                                                                         |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                      | Max Desirable |                                                                                                                                                                                                                         | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3083                        | Exhibit 13-8  | 4400:All                                                                                                                                                                                                                | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |               |                                                                                                                                                                                                                         |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 28.8 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                             |               |                                                                                                                                                                                                                         |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |               |                                                                                                                                                                                                                         |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.418 (Exhibit 13-12)<br>$S_R =$ 58.3 mph (Exhibit 13-12)<br>$S_0 =$ 76.0 mph (Exhibit 13-12)<br>$S =$ 62.4 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                             |               |                                                                                                                                                                                                                         |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                                          |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |                |                                                                                                                                                                                                            |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            | CHS                                      |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Southbound             |                |                                                                                                                                                                                                            |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            | Urban Crossroads, Inc.                   |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp             |                |                                                                                                                                                                                                            |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | 6/3/2015                                 |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans                    |                |                                                                                                                                                                                                            |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            | AM Peak Hour                             |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2035 With Project w/ IMPROV |                |                                                                                                                                                                                                            |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2075 ft<br>V <sub>u</sub> = 1219 veh/h                                                                                                                                                                                                                                                                                                                                                                                                 |            | Freeway Number of Lanes, N               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                           |                | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | Ramp Number of Lanes, N                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                           |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | Acceleration Lane Length, L <sub>A</sub> |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 230                         |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | Deceleration Lane Length L <sub>D</sub>  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | Freeway Volume, V <sub>F</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2540                        |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            | Ramp Volume, V <sub>R</sub>              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1119                        |                |                                                                                                                                                                                                            |            |
| Freeway Free-Flow Speed, S <sub>FF</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| Ramp Free-Flow Speed, S <sub>FR</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                          |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | V (Veh/hr) | PHF                                      | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub>             | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub>                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 2540       | 0.92                                     | Level    | 14                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.935                       | 1.00           | 2954                                                                                                                                                                                                       |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1119       | 0.92                                     | Level    | 4                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.980                       | 1.00           | 1241                                                                                                                                                                                                       |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1219       | 0.92                                     | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.990                       | 1.00           | 1338                                                                                                                                                                                                       |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |                |                                                                                                                                                                                                            |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            |                                          |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |                |                                                                                                                                                                                                            |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 951.25 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.584 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 1725 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 1229 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 1725 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                          |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                             |                |                                                                                                                                                                                                            |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                                          |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Actual     | Capacity                                 |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                      | Capacity       |                                                                                                                                                                                                            | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4195       | Exhibit 13-8                             |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             | Exhibit 13-10  |                                                                                                                                                                                                            |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Actual     | Max Desirable                            |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                      | Max Desirable  |                                                                                                                                                                                                            | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2966       | Exhibit 13-8                             | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             | Exhibit 13-8   |                                                                                                                                                                                                            |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                                          |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |                |                                                                                                                                                                                                            |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 26.6 (pc/mi/ln)<br>LOS = C (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                             |                |                                                                                                                                                                                                            |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |            |                                          |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                |                                                                                                                                                                                                            |            |
| M <sub>S</sub> = 0.376 (Exhibit 13-11)<br>S <sub>R</sub> = 59.5 mph (Exhibit 13-11)<br>S <sub>0</sub> = 67.4 mph (Exhibit 13-11)<br>S = 61.6 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            |                                          |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |                |                                                                                                                                                                                                            |            |



| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|------------------------------------------|----------|-----------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|----------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |                |                                                                                                                                                                                                            |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            | CHS                                      |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | I-15 Northbound             |                |                                                                                                                                                                                                            |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |            | Urban Crossroads, Inc.                   |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Nichols On-Ramp             |                |                                                                                                                                                                                                            |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |            | 6/3/2015                                 |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Caltrans                    |                |                                                                                                                                                                                                            |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |            | AM Peak Hour                             |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2035 With Project w/ IMPROV |                |                                                                                                                                                                                                            |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br>L <sub>up</sub> = 2130 ft<br>V <sub>u</sub> = 1249 veh/h                                                                                                                                                                                                                                                                                                                                                                                                  |            | Freeway Number of Lanes, N               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3                           |                | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br>L <sub>down</sub> = ft<br>V <sub>D</sub> = veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Number of Lanes, N                  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                           |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Acceleration Lane Length, L <sub>A</sub> |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 800                         |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Deceleration Lane Length L <sub>D</sub>  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Freeway Volume, V <sub>F</sub>           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4304                        |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | Ramp Volume, V <sub>R</sub>              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1165                        |                |                                                                                                                                                                                                            |            |
| Freeway Free-Flow Speed, S <sub>FF</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |            |                                          |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| Ramp Free-Flow Speed, S <sub>FR</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                          |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | V (Veh/hr) | PHF                                      | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | f <sub>HV</sub>             | f <sub>p</sub> | v = V/PHF x f <sub>HV</sub> x f <sub>p</sub>                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4304       | 0.92                                     | Level    | 14                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.935                       | 1.00           | 5006                                                                                                                                                                                                       |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1165       | 0.92                                     | Level    | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.990                       | 1.00           | 1279                                                                                                                                                                                                       |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 1249       | 0.92                                     | Level    | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 0.985                       | 1.00           | 1378                                                                                                                                                                                                       |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |                |                                                                                                                                                                                                            |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |            |                                          |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |                |                                                                                                                                                                                                            |            |
| <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |            |                                          |          |                       | <b>Estimation of v<sub>12</sub></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |                |                                                                                                                                                                                                            |            |
| V <sub>12</sub> = V <sub>F</sub> (P <sub>FM</sub> )<br>L <sub>EQ</sub> = 1651.59 (Equation 13-6 or 13-7)<br>P <sub>FM</sub> = 0.600 using Equation (Exhibit 13-6)<br>V <sub>12</sub> = 3003 pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = 2003 pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = 3003 pc/h (Equation 13-16, 13-18, or 13-19) |            |                                          |          |                       | V <sub>12</sub> = V <sub>R</sub> + (V <sub>F</sub> - V <sub>R</sub> )P <sub>FD</sub><br>L <sub>EQ</sub> = (Equation 13-12 or 13-13)<br>P <sub>FD</sub> = using Equation (Exhibit 13-7)<br>V <sub>12</sub> = pc/h<br>V <sub>3</sub> or V <sub>av34</sub> = pc/h (Equation 13-14 or 13-17)<br>Is V <sub>3</sub> or V <sub>av34</sub> > 2,700 pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is V <sub>3</sub> or V <sub>av34</sub> > 1.5 * V <sub>12</sub> /2 <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, V <sub>12a</sub> = pc/h (Equation 13-16, 13-18, or 13-19) |                             |                |                                                                                                                                                                                                            |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            |                                          |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                             |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Capacity                                 |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                      | Capacity       |                                                                                                                                                                                                            | LOS F?     |
| V <sub>FO</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 6285       | Exhibit 13-8                             |          | No                    | V <sub>F</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>FO</sub> = V <sub>F</sub> - V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                             | Exhibit 13-8   |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | V <sub>R</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             | Exhibit 13-10  |                                                                                                                                                                                                            |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |            |                                          |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |                |                                                                                                                                                                                                            |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual     | Max Desirable                            |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Actual                      | Max Desirable  |                                                                                                                                                                                                            | Violation? |
| V <sub>R12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4282       | Exhibit 13-8                             | 4600:All | No                    | V <sub>12</sub>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             | Exhibit 13-8   |                                                                                                                                                                                                            |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                             |                |                                                                                                                                                                                                            |            |
| D <sub>R</sub> = 5.475 + 0.00734 v <sub>R</sub> + 0.0078 V <sub>12</sub> - 0.00627 L <sub>A</sub><br>D <sub>R</sub> = 33.3 (pc/mi/ln)<br>LOS = D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            |                                          |          |                       | D <sub>R</sub> = 4.252 + 0.0086 V <sub>12</sub> - 0.009 L <sub>D</sub><br>D <sub>R</sub> = (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                             |                |                                                                                                                                                                                                            |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |            |                                          |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |                |                                                                                                                                                                                                            |            |
| M <sub>S</sub> = 0.531 (Exhibit 13-11)<br>S <sub>R</sub> = 55.1 mph (Exhibit 13-11)<br>S <sub>0</sub> = 64.6 mph (Exhibit 13-11)<br>S = 57.8 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                          |          |                       | D <sub>s</sub> = (Exhibit 13-12)<br>S <sub>R</sub> = mph (Exhibit 13-12)<br>S <sub>0</sub> = mph (Exhibit 13-12)<br>S = mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |                |                                                                                                                                                                                                            |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|---------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |         |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |               |                                                                                                                                                                                                                         |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |         | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound             |               |                                                                                                                                                                                                                         |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |         | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp            |               |                                                                                                                                                                                                                         |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |         | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                    |               |                                                                                                                                                                                                                         |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | AM Peak Hour                    |         | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 With Project w/ IMPROV |               |                                                                                                                                                                                                                         |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                           |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 1165 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                           |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 225                         |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5553                        |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1249                        |               |                                                                                                                                                                                                                         |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |         | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |         | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                    | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                    |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5553            | 0.92                            | Level   | 11                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.948                       | 1.00          | 6368                                                                                                                                                                                                                    |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1249            | 0.92                            | Level   | 3                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.985                       | 1.00          | 1378                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1165            | 0.92                            | Level   | 2                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.990                       | 1.00          | 1279                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |         |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |               |                                                                                                                                                                                                                         |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |         |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |               |                                                                                                                                                                                                                         |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |         |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.537 using Equation (Exhibit 13-7)<br>$V_{12} =$ 4060 pc/h<br>$V_3$ or $V_{av34}$ 2308 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                             |               |                                                                                                                                                                                                                         |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |         |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |         | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                      | Capacity      |                                                                                                                                                                                                                         | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |         |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6368                        | Exhibit 13-8  | 7200                                                                                                                                                                                                                    | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         | $V_{FO} = V_F - V_R$  | 4990                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-8                | 7200          | No                                                                                                                                                                                                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |         | $V_R$                 | 1378                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-10               | 2100          | No                                                                                                                                                                                                                      |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |         |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |         | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                      | Max Desirable |                                                                                                                                                                                                                         | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |         |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4060                        | Exhibit 13-8  | 4400:All                                                                                                                                                                                                                | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |         |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |               |                                                                                                                                                                                                                         |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |         |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 37.1 (pc/mi/ln)<br>LOS =      E (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                             |               |                                                                                                                                                                                                                         |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |         |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |               |                                                                                                                                                                                                                         |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |         |                       | $D_S =$ 0.422 (Exhibit 13-12)<br>$S_R =$ 58.2 mph (Exhibit 13-12)<br>$S_0 =$ 71.7 mph (Exhibit 13-12)<br>$S =$ 62.4 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                             |               |                                                                                                                                                                                                                         |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------------------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |               |                                                                                                                                                                                                                         |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | CHS                             |                      | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Southbound             |               |                                                                                                                                                                                                                         |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |                 | Urban Crossroads, Inc.          |                      | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp            |               |                                                                                                                                                                                                                         |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 | 6/3/2015                        |                      | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                    |               |                                                                                                                                                                                                                         |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | PM Peak Hour                    |                      | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 With Project w/ IMPROV |               |                                                                                                                                                                                                                         |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |                 | Freeway Number of Lanes, $N$    |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 3                           |               | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2075 ft<br><br>$V_D =$ 1380 veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Number of Lanes, $N$       |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1                           |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Acceleration Lane Length, $L_A$ |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Deceleration Lane Length $L_D$  |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 220                         |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Freeway Volume, $V_F$           |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 5709                        |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 | Ramp Volume, $V_R$              |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1553                        |               |                                                                                                                                                                                                                         |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                     |                 |                                 |                      | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |                      | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | $V$<br>(Veh/hr) | PHF                             | Terrain              | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                    | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                                                    |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 5709            | 0.92                            | Level                | 9                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.957                       | 1.00          | 6485                                                                                                                                                                                                                    |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1553            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                       | 1.00          | 1696                                                                                                                                                                                                                    |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                                         |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1380            | 0.92                            | Level                | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                       | 1.00          | 1507                                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             |               |                                                                                                                                                                                                                         |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |                      |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                             |               |                                                                                                                                                                                                                         |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |                      |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.520 using Equation (Exhibit 13-7)<br>$V_{12} =$ 4186 pc/h<br>$V_3$ or $V_{av34}$ 2299 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                             |               |                                                                                                                                                                                                                         |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |                      |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Capacity                        |                      | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                      | Capacity      |                                                                                                                                                                                                                         | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 | Exhibit 13-8                    |                      |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 6485                        | Exhibit 13-8  | 7200                                                                                                                                                                                                                    | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_{FO} = V_F - V_R$ | 4789                  | Exhibit 13-8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 7200                        | No            |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 | $V_R$                | 1696                  | Exhibit 13-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2100                        | No            |                                                                                                                                                                                                                         |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |                 |                                 |                      |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                             |               |                                                                                                                                                                                                                         |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual          | Max Desirable                   |                      | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                      | Max Desirable |                                                                                                                                                                                                                         | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |                 | Exhibit 13-8                    |                      |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4186                        | Exhibit 13-8  | 4400:All                                                                                                                                                                                                                | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |                      |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                             |               |                                                                                                                                                                                                                         |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |                 |                                 |                      |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 38.3 (pc/mi/ln)<br>LOS =      E (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                             |               |                                                                                                                                                                                                                         |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |                 |                                 |                      |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |               |                                                                                                                                                                                                                         |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |                 |                                 |                      |                       | $D_S =$ 0.451 (Exhibit 13-12)<br>$S_R =$ 57.4 mph (Exhibit 13-12)<br>$S_0 =$ 71.7 mph (Exhibit 13-12)<br>$S =$ 61.8 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                             |               |                                                                                                                                                                                                                         |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |               |                                      |            |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|---------------------------------------------------|----------|-----------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                                   |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                            |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | CHS                                               |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | I-15 Southbound                                                                                                                                                                                            |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | Urban Crossroads, Inc.                            |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Nichols On-Ramp                                                                                                                                                                                            |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               | 6/3/2015                                          |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Caltrans                                                                                                                                                                                                   |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               | PM Peak Hour                                      |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 2035 With Project w/ IMPROV                                                                                                                                                                                |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |               |                                      |            |
| Upstream Adj Ramp<br><br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off                                                                                                                                                                                                                                                                                                                                       |               | Freeway Number of Lanes, N                      3 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Downstream Adj Ramp<br><br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               | Ramp Number of Lanes, N                      1    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |               |                                      |            |
| $L_{up} =$ 2075 ft                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               | Acceleration Lane Length, $L_A$ 230               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | $L_{down} =$ ft                                                                                                                                                                                            |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               | Deceleration Lane Length $L_D$                    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |               |                                      |            |
| $V_u =$ 1553 veh/h                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               | Freeway Volume, $V_F$ 4156                        |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | $V_D =$ veh/h                                                                                                                                                                                              |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               | Ramp Volume, $V_R$ 1380                           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               | Freeway Free-Flow Speed, $S_{FF}$ 70.0            |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               | Ramp Free-Flow Speed, $S_{FR}$ 45.0               |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | V<br>(Veh/hr) | PHF                                               | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | $f_{HV}$                                                                                                                                                                                                   | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4156          | 0.92                                              | Level    | 12                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.943                                                                                                                                                                                                      | 1.00          | 4788                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1380          | 0.92                                              | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.995                                                                                                                                                                                                      | 1.00          | 1507                                 |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1553          | 0.92                                              | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 0.995                                                                                                                                                                                                      | 1.00          | 1696                                 |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                                   |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                            |               |                                      |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                                   |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                            |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                                   |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                            |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ 1400.65 (Equation 13-6 or 13-7)<br>$P_{FM} =$ 0.584 using Equation (Exhibit 13-6)<br>$V_{12} =$ 2796 pc/h<br>$V_3$ or $V_{av34}$ 1992 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ 2796 pc/h (Equation 13-16, 13-18, or 13-19) |               |                                                   |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                            |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |               |                                                   |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                            |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual        | Capacity                                          |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual                                                                                                                                                                                                     | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 6295          | Exhibit 13-8                                      |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                            | Exhibit 13-8  |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |                                                   |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                            | Exhibit 13-8  |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |               |                                                   |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                            | Exhibit 13-10 |                                      |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |               |                                                   |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                            |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Actual        | Max Desirable                                     |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Actual                                                                                                                                                                                                     | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4303          | Exhibit 13-8                                      | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                            | Exhibit 13-8  |                                      |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                                   |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                            |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ 36.9 (pc/mi/ln)<br>LOS =                      E (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                           |               |                                                   |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS =                      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                            |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                                   |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                            |               |                                      |            |
| $M_S =$ 0.589 (Exhibit 13-11)<br>$S_R =$ 53.5 mph (Exhibit 13-11)<br>$S_0 =$ 64.6 mph (Exhibit 13-11)<br>$S =$ 56.6 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                       |               |                                                   |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                            |               |                                      |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |               |                                                                                                                                                                                                    |            |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------------------------------|----------|-----------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------|---------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                             |               |                                                                                                                                                                                                    |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                 | CHS                             |          | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | I-15 Northbound             |               |                                                                                                                                                                                                    |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 | Urban Crossroads, Inc.          |          | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Nichols On-Ramp             |               |                                                                                                                                                                                                    |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 | 6/3/2015                        |          | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Caltrans                    |               |                                                                                                                                                                                                    |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                 | PM Peak Hour                    |          | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2035 With Project w/ IMPROV |               |                                                                                                                                                                                                    |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |               |                                                                                                                                                                                                    |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |               |                                                                                                                                                                                                    |            |
| Upstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input type="checkbox"/> On<br><input type="checkbox"/> No <input checked="" type="checkbox"/> Off<br><br>$L_{up} = 2130$ ft<br><br>$V_u = 1198$ veh/h                                                                                                                                                                                                                                                                                             |                 | Freeway Number of Lanes, $N$    |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3                           |               | Downstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ ft<br><br>$V_D =$ veh/h |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Number of Lanes, $N$       |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1                           |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Acceleration Lane Length, $L_A$ |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 800                         |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Deceleration Lane Length $L_D$  |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Freeway Volume, $V_F$           |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 3660                        |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 | Ramp Volume, $V_R$              |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1325                        |               |                                                                                                                                                                                                    |            |
| Freeway Free-Flow Speed, $S_{FF}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                 |                                 |          | 70.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |               |                                                                                                                                                                                                    |            |
| Ramp Free-Flow Speed, $S_{FR}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          | 45.0                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |               |                                                                                                                                                                                                    |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |               |                                                                                                                                                                                                    |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | $V$<br>(Veh/hr) | PHF                             | Terrain  | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | $f_{HV}$                    | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$                                                                                                                                                               |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 3660            | 0.92                            | Level    | 17                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.922                       | 1.00          | 4316                                                                                                                                                                                               |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1325            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995                       | 1.00          | 1447                                                                                                                                                                                               |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 1198            | 0.92                            | Level    | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0.995                       | 1.00          | 1309                                                                                                                                                                                               |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                             |               |                                                                                                                                                                                                    |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                 |                                 |          |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             |               |                                                                                                                                                                                                    |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                 |                                 |          |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             |               |                                                                                                                                                                                                    |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} = 1539.88$ (Equation 13-6 or 13-7)<br>$P_{FM} = 0.600$ using Equation (Exhibit 13-6)<br>$V_{12} = 2589$ pc/h<br>$V_3$ or $V_{av34} = 1727$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} = 2589$ pc/h (Equation 13-16, 13-18, or 13-19) |                 |                                 |          |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ using Equation (Exhibit 13-7)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34} =$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 \times V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                             |               |                                                                                                                                                                                                    |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                 |                                 |          |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Capacity                        |          | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual                      | Capacity      |                                                                                                                                                                                                    | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 5763            | Exhibit 13-8                    |          | No                    | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_{FO} = V_F - V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                             | Exhibit 13-8  |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                 |                                 |          |                       | $V_R$                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                             | Exhibit 13-10 |                                                                                                                                                                                                    |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                 |                                 |          |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                               |                             |               |                                                                                                                                                                                                    |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | Actual          | Max Desirable                   |          | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Actual                      | Max Desirable |                                                                                                                                                                                                    | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4036            | Exhibit 13-8                    | 4600:All | No                    | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                             | Exhibit 13-8  |                                                                                                                                                                                                    |            |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |                                 |          |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                          |                             |               |                                                                                                                                                                                                    |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R = 31.3$ (pc/mi/ln)<br>LOS = D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                  |                 |                                 |          |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ (pc/mi/ln)<br>LOS = (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                   |                             |               |                                                                                                                                                                                                    |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |                                 |          |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                |                             |               |                                                                                                                                                                                                    |            |
| $M_S = 0.470$ (Exhibit 13-11)<br>$S_R = 56.8$ mph (Exhibit 13-11)<br>$S_0 = 65.6$ mph (Exhibit 13-11)<br>$S = 59.2$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                         |                 |                                 |          |                       | $D_s =$ (Exhibit 13-12)<br>$S_R =$ mph (Exhibit 13-12)<br>$S_0 =$ mph (Exhibit 13-12)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                        |                             |               |                                                                                                                                                                                                    |            |

| RAMPS AND RAMP JUNCTIONS WORKSHEET                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|------------------------------------|---------|-----------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------------------------|------------|
| <b>General Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                    |         |                       | <b>Site Information</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |               |                                      |            |
| Analyst                                                                                                                                                                                                                                                                                                                                                                                                                                               |               | CHS                                |         | Freeway/Dir of Travel |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | I-15 Northbound                                                                                                                                                                                                         |               |                                      |            |
| Agency or Company                                                                                                                                                                                                                                                                                                                                                                                                                                     |               | Urban Crossroads, Inc.             |         | Junction              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Nichols Off-Ramp                                                                                                                                                                                                        |               |                                      |            |
| Date Performed                                                                                                                                                                                                                                                                                                                                                                                                                                        |               | 6/3/2015                           |         | Jurisdiction          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Caltrans                                                                                                                                                                                                                |               |                                      |            |
| Analysis Time Period                                                                                                                                                                                                                                                                                                                                                                                                                                  |               | PM Peak Hour                       |         | Analysis Year         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2035 With Project w/ IMPROV                                                                                                                                                                                             |               |                                      |            |
| Project Description Nichols Mine Expansion TIA (JN 09599)                                                                                                                                                                                                                                                                                                                                                                                             |               |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Inputs</b>                                                                                                                                                                                                                                                                                                                                                                                                                                         |               |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Upstream Adj Ramp<br><input type="checkbox"/> Yes <input type="checkbox"/> On<br><input checked="" type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{up} =$ ft<br><br>$V_u =$ veh/h                                                                                                                                                                                                                                                        |               | Freeway Number of Lanes, N      3  |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Downstream Adj Ramp<br><input checked="" type="checkbox"/> Yes <input checked="" type="checkbox"/> On<br><input type="checkbox"/> No <input type="checkbox"/> Off<br><br>$L_{down} =$ 2130 ft<br><br>$V_D =$ 1325 veh/h |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | Ramp Number of Lanes, N      1     |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | Acceleration Lane Length, $L_A$    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | Deceleration Lane Length $L_D$ 225 |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | Freeway Volume, $V_F$ 4858         |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               | Ramp Volume, $V_R$ 1198            |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Freeway Free-Flow Speed, $S_{FF}$ 70.0                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| Ramp Free-Flow Speed, $S_{FR}$ 45.0                                                                                                                                                                                                                                                                                                                                                                                                                   |               |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Conversion to pc/h Under Base Conditions</b>                                                                                                                                                                                                                                                                                                                                                                                                       |               |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| (pc/h)                                                                                                                                                                                                                                                                                                                                                                                                                                                | V<br>(Veh/hr) | PHF                                | Terrain | %Truck                | %Rv                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | $f_{HV}$                                                                                                                                                                                                                | $f_p$         | $v = V/PHF \times f_{HV} \times f_p$ |            |
| Freeway                                                                                                                                                                                                                                                                                                                                                                                                                                               | 4858          | 0.92                               | Level   | 13                    | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.939                                                                                                                                                                                                                   | 1.00          | 5624                                 |            |
| Ramp                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1198          | 0.92                               | Level   | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                                                                                                                                                                                                                   | 1.00          | 1309                                 |            |
| UpStream                                                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                    |         |                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                         |               |                                      |            |
| DownStream                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1325          | 0.92                               | Level   | 1                     | 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0.995                                                                                                                                                                                                                   | 1.00          | 1447                                 |            |
| <b>Merge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                    |               |                                    |         |                       | <b>Diverge Areas</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                              |               |                                    |         |                       | <b>Estimation of <math>v_{12}</math></b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                                                                                         |               |                                      |            |
| $V_{12} = V_F (P_{FM})$<br>$L_{EQ} =$ (Equation 13-6 or 13-7)<br>$P_{FM} =$ using Equation (Exhibit 13-6)<br>$V_{12} =$ pc/h<br>$V_3$ or $V_{av34}$ pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |               |                                    |         |                       | $V_{12} = V_R + (V_F - V_R)P_{FD}$<br>$L_{EQ} =$ (Equation 13-12 or 13-13)<br>$P_{FD} =$ 0.559 using Equation (Exhibit 13-7)<br>$V_{12} =$ 3722 pc/h<br>$V_3$ or $V_{av34}$ 1902 pc/h (Equation 13-14 or 13-17)<br>Is $V_3$ or $V_{av34} > 2,700$ pc/h? <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>Is $V_3$ or $V_{av34} > 1.5 * V_{12}/2$ <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No<br>If Yes, $V_{12a} =$ pc/h (Equation 13-16, 13-18, or 13-19) |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                                    |         |                       | <b>Capacity Checks</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual        | Capacity                           |         | LOS F?                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                  | Capacity      |                                      | LOS F?     |
| $V_{FO}$                                                                                                                                                                                                                                                                                                                                                                                                                                              |               | Exhibit 13-8                       |         |                       | $V_F$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 5624                                                                                                                                                                                                                    | Exhibit 13-8  | 7200                                 | No         |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |                                    |         | $V_{FO} = V_F - V_R$  | 4315                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-8                                                                                                                                                                                                            | 7200          | No                                   |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       |               |                                    |         | $V_R$                 | 1309                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Exhibit 13-10                                                                                                                                                                                                           | 2100          | No                                   |            |
| <b>Flow Entering Merge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                             |               |                                    |         |                       | <b>Flow Entering Diverge Influence Area</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                         |               |                                      |            |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Actual        | Max Desirable                      |         | Violation?            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Actual                                                                                                                                                                                                                  | Max Desirable |                                      | Violation? |
| $V_{R12}$                                                                                                                                                                                                                                                                                                                                                                                                                                             |               | Exhibit 13-8                       |         |                       | $V_{12}$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 3722                                                                                                                                                                                                                    | Exhibit 13-8  | 4400:All                             | No         |
| <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                      |               |                                    |         |                       | <b>Level of Service Determination (if not F)</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                         |               |                                      |            |
| $D_R = 5.475 + 0.00734 v_R + 0.0078 V_{12} - 0.00627 L_A$<br>$D_R =$ (pc/mi/ln)<br>LOS =      (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                          |               |                                    |         |                       | $D_R = 4.252 + 0.0086 V_{12} - 0.009 L_D$<br>$D_R =$ 34.2 (pc/mi/ln)<br>LOS =      D (Exhibit 13-2)                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                         |               |                                      |            |
| <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                            |               |                                    |         |                       | <b>Speed Determination</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                         |               |                                      |            |
| $M_S =$ (Exhibit 13-11)<br>$S_R =$ mph (Exhibit 13-11)<br>$S_0 =$ mph (Exhibit 13-11)<br>$S =$ mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                    |               |                                    |         |                       | $D_S =$ 0.416 (Exhibit 13-12)<br>$S_R =$ 58.4 mph (Exhibit 13-12)<br>$S_0 =$ 73.3 mph (Exhibit 13-12)<br>$S =$ 62.7 mph (Exhibit 13-13)                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                         |               |                                      |            |