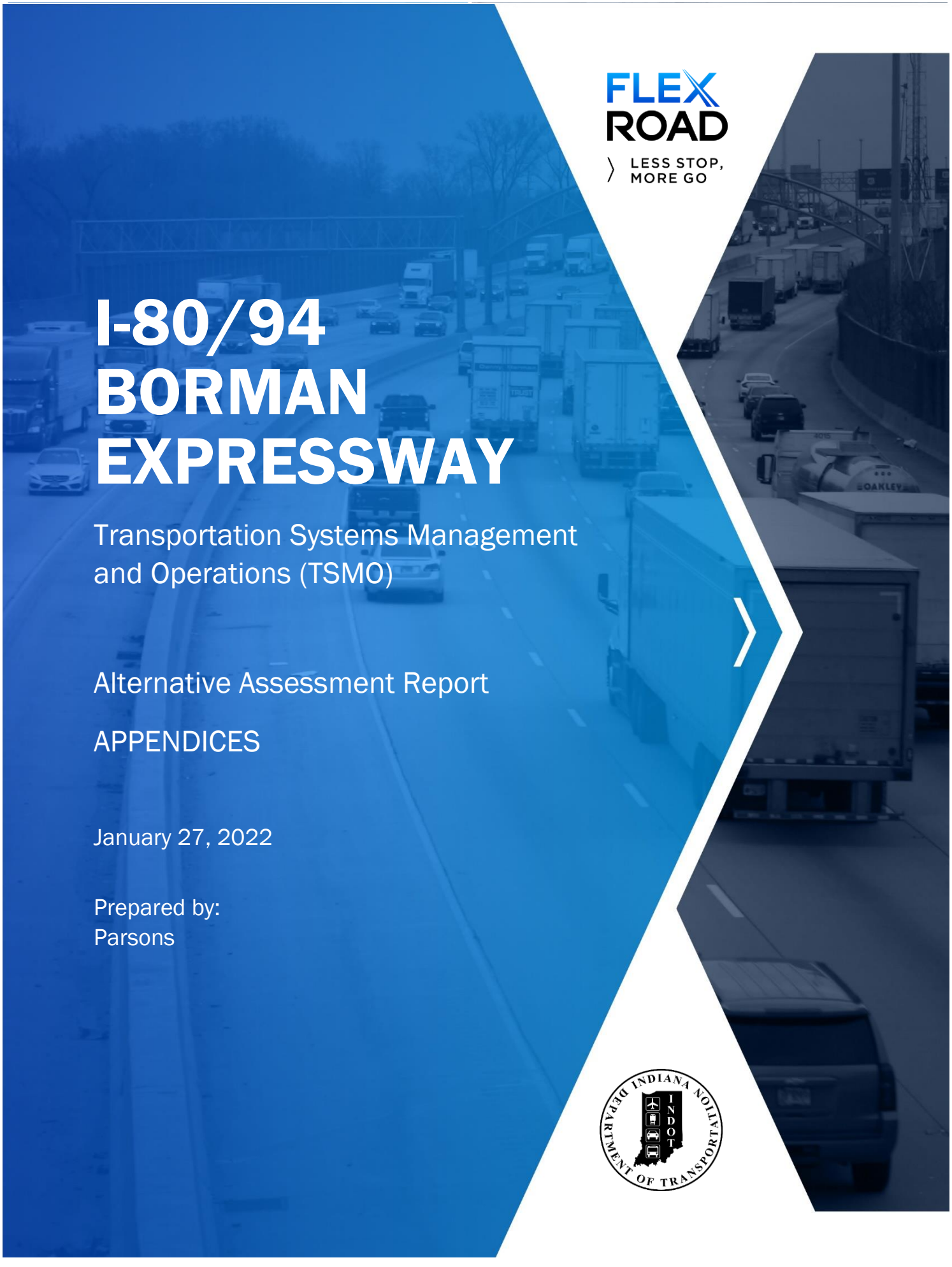


FLEX ROAD

LESS STOP, MORE GO

# I-80/94 BORMAN EXPRESSWAY

## Transportation Systems Management and Operations (TSMO)

## Alternative Assessment Report

## APPENDICES

January 27, 2022

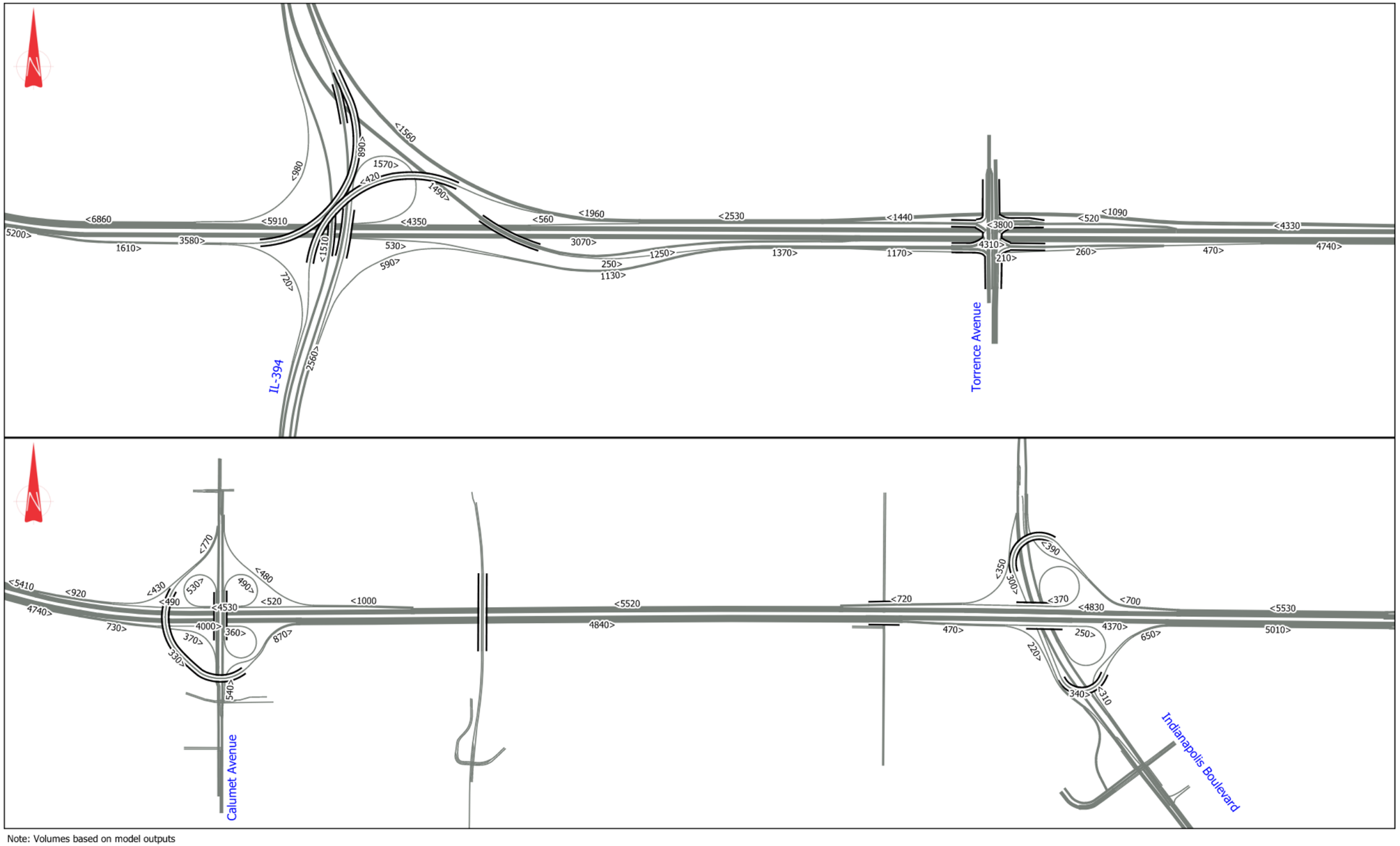
Prepared by:
Parsons

INDIANA DEPARTMENT OF TRANSPORTATION
INDOT

# APPENDIX A

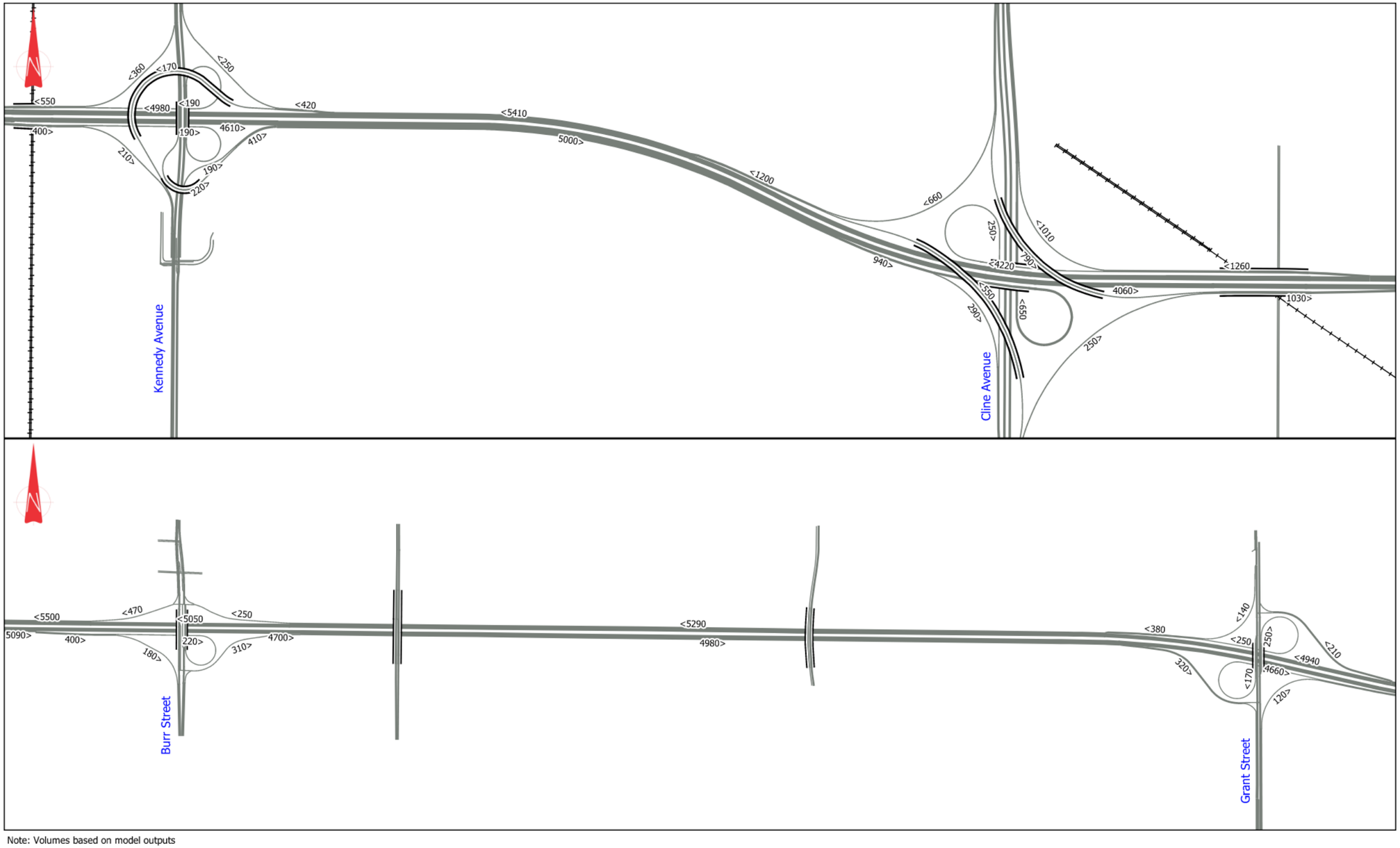
## Corridor Traffic Volumes

# EXISTING TRAFFIC CONDITIONS



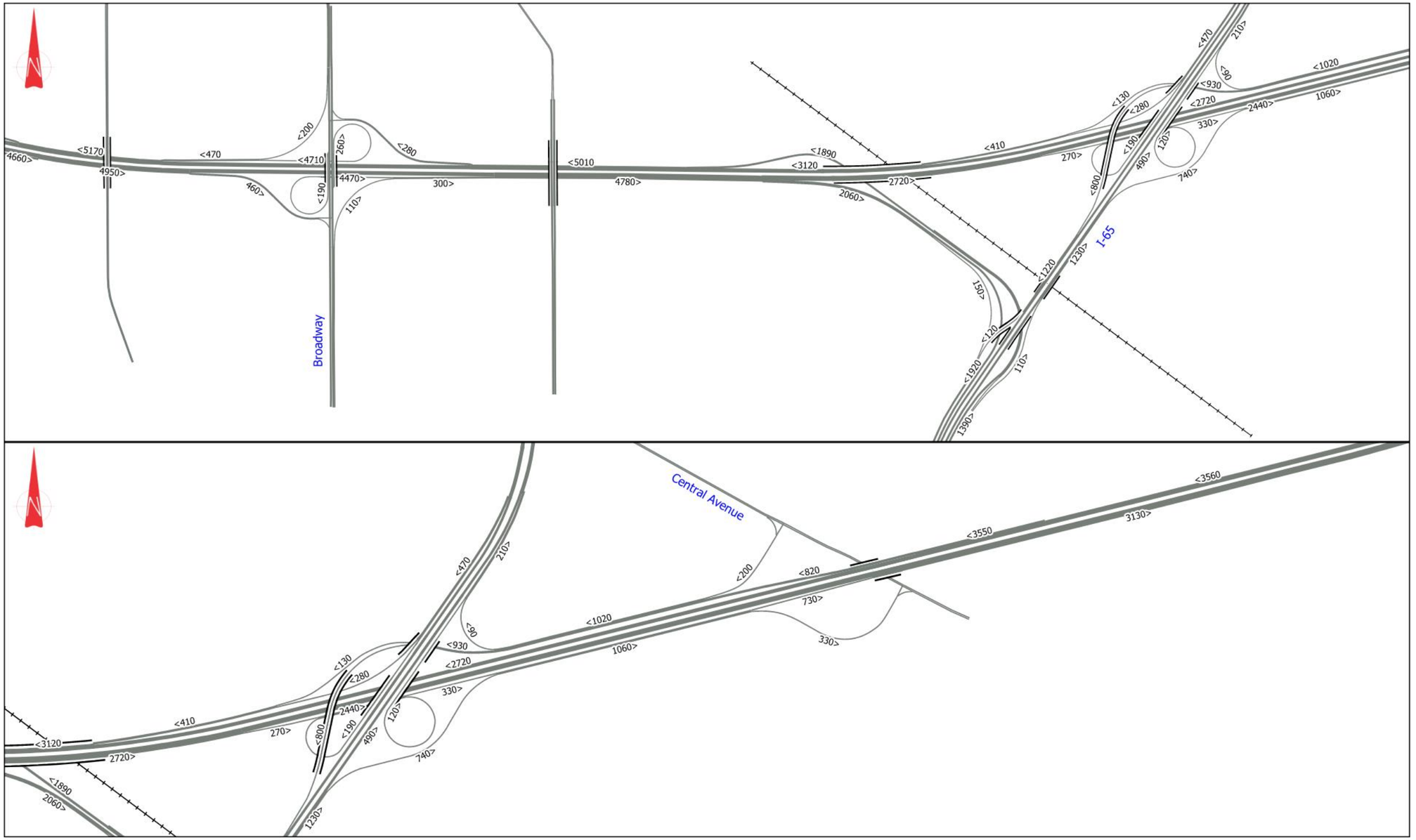

Note: Volumes based on model outputs

**Figure A.1a: Modelled Typical Weekday AM Peak Hour Volumes**



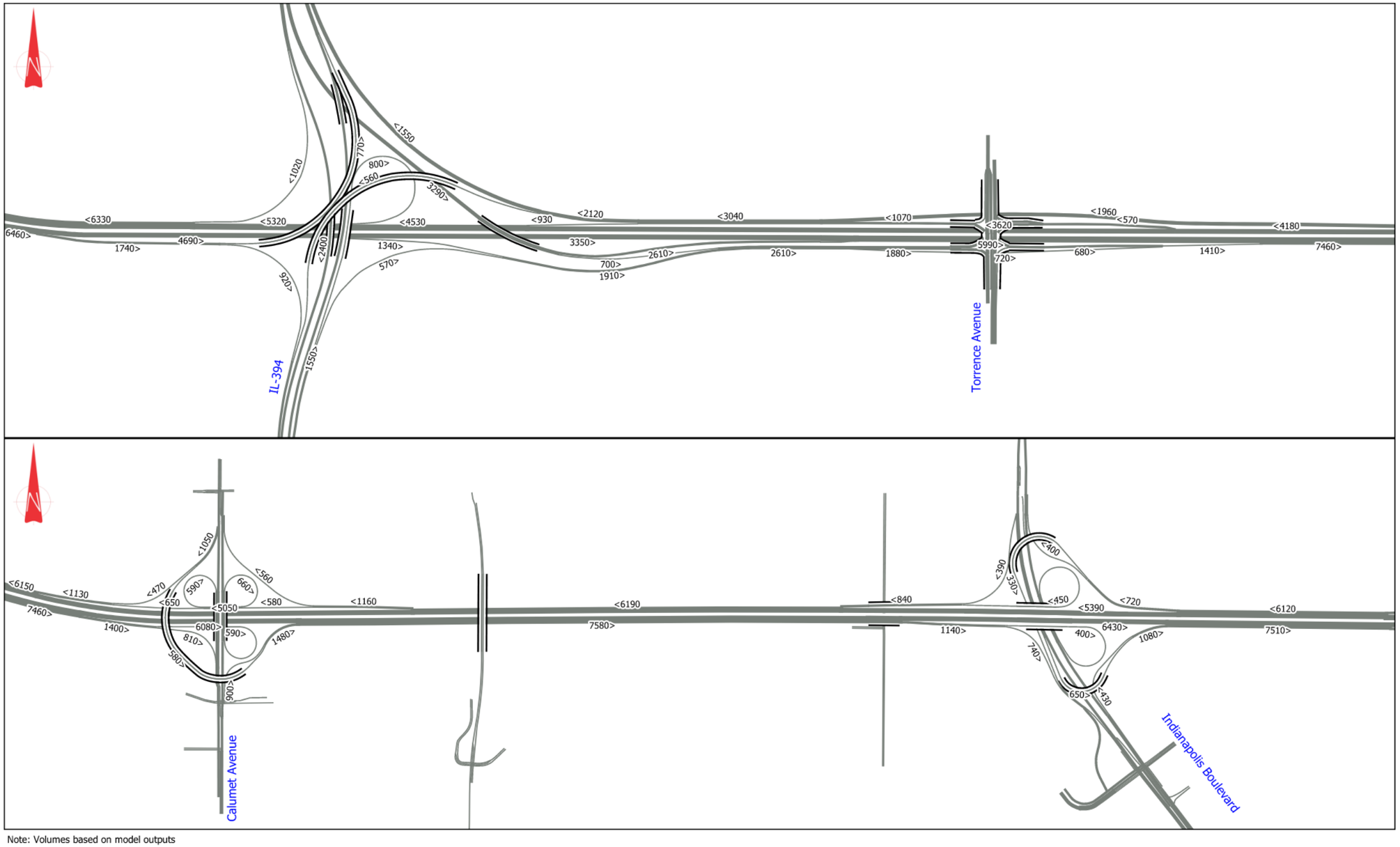

Note: Volumes based on model outputs

**Figure A.1b: Modelled Typical Weekday AM Peak Hour Volumes**



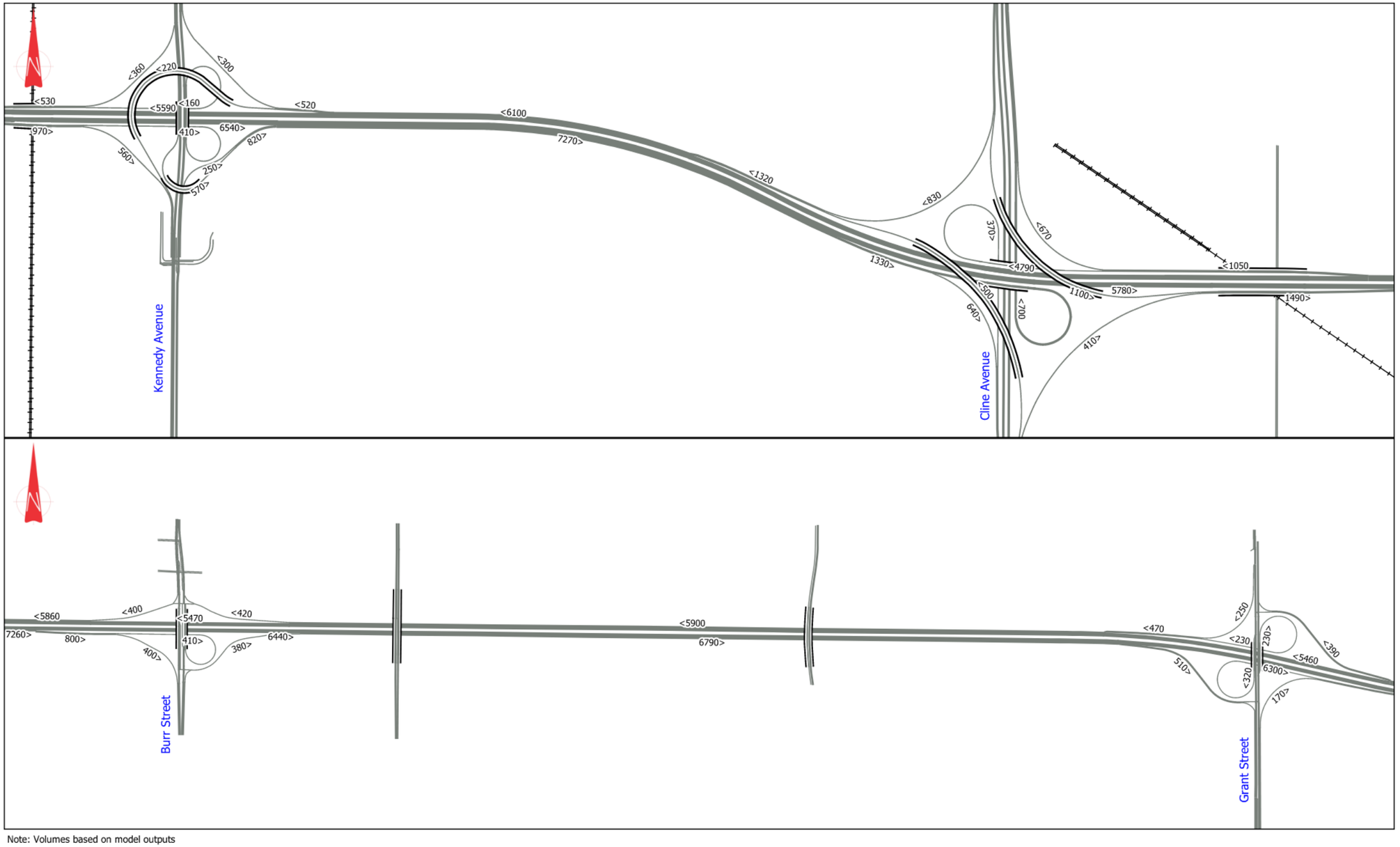

Note: Volumes based on model outputs

**Figure A.1c: Modelled Typical Weekday AM Peak Hour Volumes**



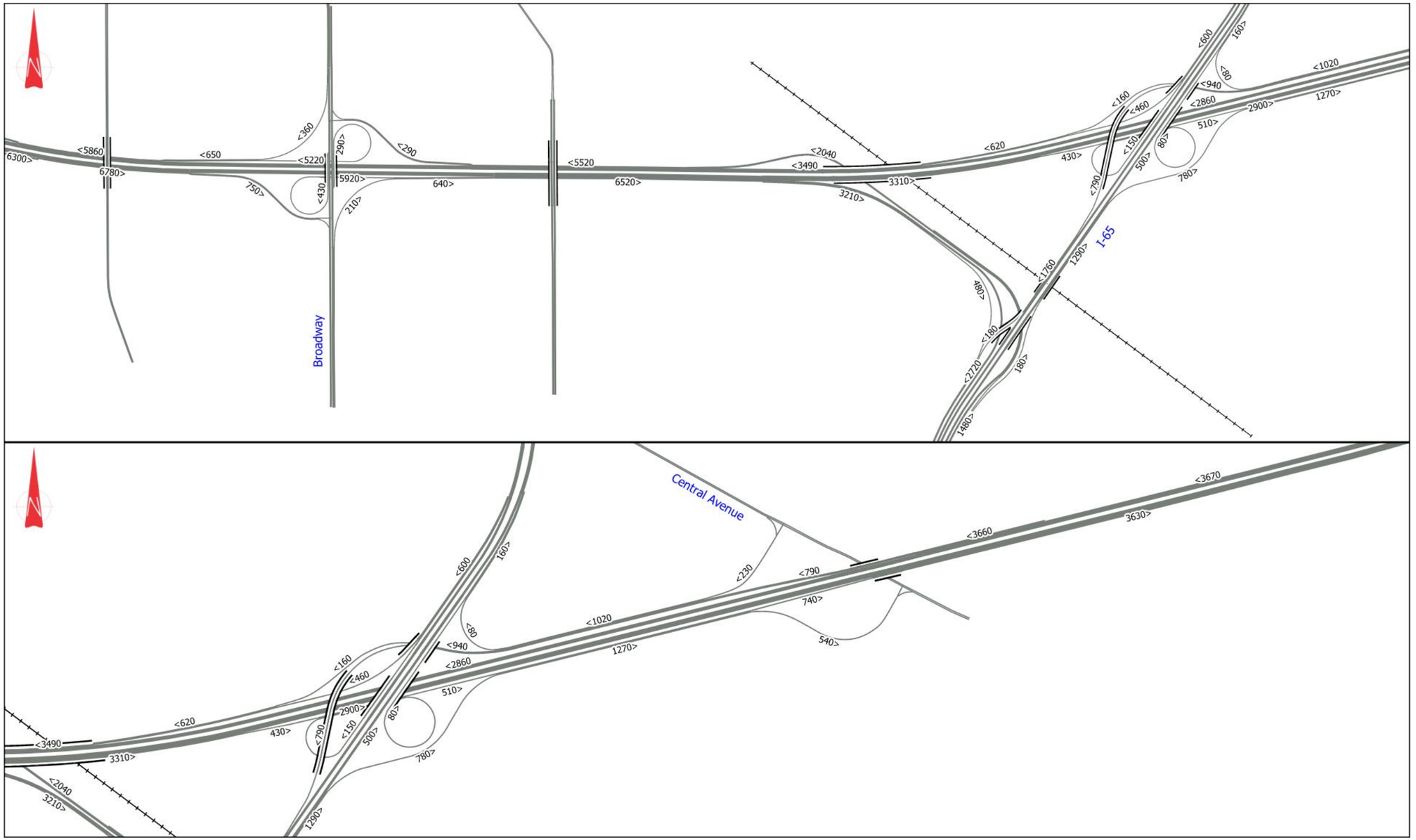

Note: Volumes based on model outputs

**Figure A.2a: Modelled Typical Weekday PM Peak Hour Volumes**




Note: Volumes based on model outputs

**Figure A.2b: Modelled Typical Weekday PM Peak Hour Volumes**




Note: Volumes based on model outputs

**Figure A.2c: Modelled Typical Weekday PM Peak Hour Volumes**

Table A.1: HCS Analysis Results – AM Peak Hour Eastbound

| SEGMENT | NAME | TYPE | LENGTH | LANES | FLOW RATE (PC/H) | | CAPACITY (PC/H) | | SPEED (MI/H) | | DENSITY (PC/MI/IN) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | |
| 1 | West of I-294 Interchange - 4 Lane Section | Basic | 1630 | 4 | 6641 | - | 9176 | - | 59.4 | - | 28.0 | - | D |
| 2 | Weaving Section from Oasis to Il-394 exit ramp | Weave | 2040 | 5 | 6641 | - | 8541 | - | 41.9 | - | 31.7 | - | D |
| 3 | Il-394 exit ramp to Torrence Ave exit ramp | Basic | 1140 | 4 | 4534 | - | 9180 | - | 58.2 | - | 19.1 | - | C |
| 4 | Torrence Ave exit ramp | Diverge | 1500 | 4 | 4534 | 559 | 9200 | 2000 | 59.2 | 52.6 | 19.1 | 21.9 | C |
| 5 | Torrence Off-ramp to IL-394 entrance ramp | Basic | 4850 | 4 | 3975 | - | 9224 | - | 60.6 | - | 16.4 | - | B |
| 6 | Il-394 entrance ramp | Merge | 1500 | 5 | 5598 | 1623 | 11500 | 4000 | 59.0 | 57.3 | 19.0 | 17.7 | B |
| 7 | I-94 entrance ramp to Torrence Ave entrance ramp | Basic | 2380 | 5 | 5598 | - | 11480 | - | 59.6 | - | 18.8 | - | C |
| 8 | Torrence Ave entrance ramp | Merge | 1500 | 6 | 6043 | 445 | 13800 | 2000 | 59.4 | 59.4 | 17.0 | 17.0 | B |
| 9 | Torrence Ave entrance ramp to Lane Drop | Basic | 920 | 6 | 6043 | - | 13752 | - | 59.2 | - | 17.0 | - | B |
| 10 | Lane Drop to Calumet Ave exit ramp | Basic | 5770 | 5 | 6043 | - | 11460 | - | 59.2 | - | 20.4 | - | C |
| 11 | Calumet Ave exit ramp | Diverge | 1500 | 4 | 6043 | 795 | 9200 | 2000 | 59.0 | 52.6 | 25.6 | 17.3 | B |
| 12 | Calumet Ave exit ramp to Calumet entrance ramp | Basic | 2150 | 4 | 5248 | - | 9056 | - | 56.4 | - | 23.3 | - | C |
| 13 | Calumet Ave entrance ramp | Merge | 1500 | 5 | 6173 | 955 | 11500 | 4000 | 57.0 | 55.8 | 21.7 | 15.9 | B |
| 14 | Calumet Ave entrance ramp to Indianapolis Blvd exit ramp | Basic | 2790 | 5 | 6173 | - | 11340 | - | 56.8 | - | 21.7 | - | C |
| 15 | Indianapolis Blvd exit ramp | Diverge | 1500 | 5 | 6173 | 543 | 11500 | 2000 | 58.0 | 58.0 | 21.3 | 21.3 | C |
| 16 | Indianapolis Blvd exit ramp to Indianapolis Blvd entrance ramp | Basic | 2050 | 4 | 5630 | - | 9124 | - | 58.1 | - | 24.2 | - | C |
| 17 | Indianapolis Blvd entrance ramp to Kennedy Ave exit ramp | Weave | 3090 | 5 | 6377 | - | 10900 | - | 50.3 | - | 25.4 | - | C |
| 18 | Kennedy exit ramp to Kennedy entrance ramp | Basic | 2180 | 4 | 5900 | - | 9104 | - | 57.5 | - | 25.6 | - | C |
| 19 | Kennedy entrance amp | Merge | 1500 | 5 | 6345 | 445 | 11500 | 4000 | 57.7 | 56.6 | 22.0 | 13.4 | B |
| 20 | Kennedy entrance ramp to Cline Ave exit ramp | Basic | 2630 | 5 | 6345 | - | 11355 | - | 57.1 | - | 22.2 | - | C |
| 21 | Cline Ave exit amp | Diverge | 1500 | 5 | 6345 | 1112 | 11500 | 4000 | 58.7 | 51.3 | 21.6 | 9.9 | A |
| 22 | Cline Ave exit ramp to Cline Ave entrance ramp | Basic | 5140 | 4 | 5233 | - | 9120 | - | 58.0 | - | 22.6 | - | C |
| 23 | Cline Ave entrance ramp to Burr Street exit ramp | Weave | 3200 | 5 | 6568 | - | 9639 | - | 45.8 | - | 28.7 | - | D |
| 24 | Burr St exit ramp to Burr St entrance ramp | Basic | 2630 | 4 | 6071 | - | 9148 | - | 58.6 | - | 25.9 | - | C |
| 25 | Burr St entrance ramp | Merge | 1500 | 5 | 6397 | 326 | 11500 | 2000 | 57.7 | 57.7 | 22.2 | 22.2 | C |
| 26 | Burr St entrance ramp to Grant St exit ramp | Basic | 6900 | 5 | 6397 | - | 11380 | - | 57.6 | - | 22.2 | - | C |
| 27 | Grant St exit ramp | Diverge | 1500 | 5 | 6397 | 333 | 11500 | 2000 | 59.0 | 59.0 | 21.7 | 21.7 | C |
| 28 | Grant St exit ramp to Grant St entrance ramp | Basic | 3030 | 4 | 6064 | - | 9072 | - | 56.8 | - | 26.7 | - | D |
| 29 | Grant St entrance ramp to Broadway exit ramp | Weave | 2840 | 5 | 6064 | - | 10640 | - | 46.4 | - | 26.1 | - | C |
| 30 | Broadway exit ramp to Broadway entrance ramp | Basic | 2550 | 4 | 4764 | - | 9112 | - | 13.8 | - | 86.1 | - | F |
| 31 | Broadway entrance ramp to I-65 SB exit ramp | Weave | 4250 | 5 | 5080 | - | 5455 | - | 43.2 | - | 23.8 | - | F |
| 32 | I-65 SB exit ramp to NB exit ramp | Basic | 1310 | 4 | 2446 | - | 9152 | - | 58.6 | - | 10.4 | - | A |
| 33 | I-65 NB exit ramp | Diverge | 1500 | 4 | 2446 | 277 | 9200 | 2000 | 60.1 | 53.3 | 10.2 | 9.3 | A |
| 34 | I-65 NB exit ramp to I-65 entrance ramp | Basic | 6150 | 4 | 2169 | - | 9244 | - | 61.1 | - | 8.9 | - | A |
| 35 | I-65 entrance ramp | Merge | 1500 | 4 | 2965 | 796 | 9200 | 2000 | 58.5 | 56.5 | 12.7 | 12.5 | B |
| 36 | East of I-65 - 4 lane | Basic | 1800 | 4 | 2965 | - | 9188 | - | 59.6 | - | 12.4 | - | B |
| 37 | East of I-65 - 3 lane | Basic | 6800 | 3 | 2965 | - | 6891 | - | 59.7 | - | 16.6 | - | B |

Table A.2: HCS Analysis Results – AM Peak Hour Westbound

| SEGMENT | NAME | TYPE | LENGTH | LANES | FLOW RATE (PC/H) | | CAPACITY (PC/H) | | SPEED (MI/H) | | DENSITY (PC/MI/IN) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | |
| 1 | East of I-65 - 3 Lanes | Basic | 8000 | 3 | 4659 | - | 6861 | - | 58.7 | - | 26.5 | - | D |
| 2 | East of I-65 - 4 Lanes | Basic | 130 | 4 | 4659 | - | 9148 | - | 58.7 | - | 19.8 | - | C |
| 3 | I-65 exit ramp | Diverge | 1500 | 5 | 4659 | 920 | 11500 | 4000 | 58.9 | 51.3 | 15.8 | 6.0 | A |
| 4 | I-65 exit ramp to I-65 SB and Central Ave entrance ramp | Basic | 7520 | 3 | 3721 | - | 6855 | - | 58.5 | - | 21.2 | - | C |
| 5 | I-65 SB and Central Ave entrance ramp | Merge | 1500 | 3 | 4162 | 441 | 6900 | 2000 | 56.2 | 55.3 | 24.7 | 20.3 | C |
| 6 | I-65 SB Central Ave entrance ramp to I-65 NB entrance ramp | Basic | 600 | 3 | 4190 | - | 6855 | - | 58.1 | - | 23.9 | - | C |
| 7 | I-65 NB entrance ramp to Broadway exit ramp | Weave | 3900 | 5 | 6292 | - | 6799 | - | 51.1 | - | 24.6 | - | C |
| 8 | Broadway exit ramp to Broadway entrance ramp | Basic | 2700 | 4 | 6028 | - | 9100 | - | 57.5 | - | 26.2 | - | D |
| 9 | Broadway entrance ramp to Grant St exit ramp | Weave | 2750 | 5 | 6444 | - | 10870 | - | 49.9 | - | 25.8 | - | C |
| 10 | Grant St exit ramp to Grant St entrance ramp | Basic | 2900 | 4 | 6180 | - | 9012 | - | 55.2 | - | 27.9 | - | D |
| 11 | Grant St entrance ramp | Merge | 1500 | 5 | 6578 | 398 | 11440 | 2000 | 58.7 | 58.8 | 22.4 | 22.4 | C |
| 12 | Grant St entrance ramp to Burr St exit ramp | Basic | 6850 | 5 | 6594 | - | 11235 | - | 54.7 | - | 24.1 | - | C |
| 13 | Burr St exit ramp | Diverge | 1500 | 5 | 6594 | 241 | 11440 | 2000 | 58.8 | 58.8 | 22.4 | 22.4 | C |
| 14 | Burr St exit ramp to Burr St entrance ramp | Basic | 1850 | 4 | 6318 | - | 9092 | - | 57.3 | - | 27.6 | - | D |
| 15 | Burr St entrance ramp to Cline Ave exit ramp | Weave | 4500 | 5 | 6663 | - | 9230 | - | 51.4 | - | 25.9 | - | C |
| 16 | Cline Ave exit ramp to Cline Ave entrance ramp | Basic | 5650 | 4 | 5396 | - | 9100 | - | 57.5 | - | 23.5 | - | C |
| 17 | Cline Ave entrance ramp to Kennedy Ave exit ramp | Weave | 4500 | 5 | 6752 | - | 10573 | - | 45.3 | - | 29.8 | - | D |
| 18 | Kennedy Ave exit ramp to Kennedy Ave entrance ramp | Basic | 2300 | 4 | 6296 | - | 9032 | - | 55.8 | - | 28.2 | - | D |
| 19 | Kennedy Ave entrance ramp to Indianapolis Blvd exit ramp | Weave | 3000 | 5 | 6761 | - | 10690 | - | 46.5 | - | 29.1 | - | D |
| 20 | Indianapolis Blvd exit ramp to Indianapolis Blvd entrance ramp | Basic | 2200 | 4 | 6105 | - | 9100 | - | 57.3 | - | 26.5 | - | D |
| 21 | Indianapolis Blvd entrance ramp to Clement Ave exit ramp | Weave | 5150 | 5 | 6653 | - | 11400 | - | 46.3 | - | 28.7 | - | D |
| 22 | Clement Ave exit ramp to Clement Ave entrance ramp | Basic | 3050 | 4 | 5799 | - | 9112 | - | 57.8 | - | 25.1 | - | C |
| 23 | Clement Ave entrance ramp | Merge | 1500 | 5 | 6745 | 946 | 11545 | 2000 | 60.8 | 60.9 | 22.2 | 22.2 | C |
| 24 | Clement Ave entrance ramp to II-394 exit ramp - 5 Lane | Basic | 3080 | 5 | 6833 | - | 11320 | - | 56.4 | - | 24.2 | - | C |
| 25 | Clement Ave entrance ramp to II-394 exit ramp - 6 Lane | Basic | 1400 | 6 | 6833 | - | 13560 | - | 56.0 | - | 20.3 | - | C |
| 26 | II-394 exit ramp | Diverge | 1500 | 6 | 6833 | 1162 | 13800 | 4000 | 57.1 | 57.1 | 19.9 | 19.9 | B |
| 27 | II-394 exit ramp to Torrence Ave exit ramp | Basic | 1400 | 4 | 5553 | - | 9076 | - | 56.9 | - | 24.4 | - | C |
| 28 | Torrence Ave exit ramp | Diverge | 1500 | 4 | 5553 | 608 | 9200 | 2000 | 57.8 | 51.8 | 24.0 | 25.5 | C |
| 29 | Torrence Ave exit ramp to Torrence Ave entrance ramp | Basic | 6100 | 4 | 4947 | - | 9112 | - | 57.8 | - | 21.4 | - | C |
| 30 | Torrence Ave entrance ramp | Merge | 1500 | 4 | 5549 | 602 | 9200 | 2000 | 56.7 | 55.2 | 24.5 | 20.9 | C |
| 31 | Torrence Ave entrance ramp to II-394 NB entrance ramp | Basic | 700 | 4 | 5600 | - | 9060 | - | 56.5 | - | 24.8 | - | C |
| 32 | II-394 NB entrance ramp | Merge | 1000 | 5 | 7304 | 1704 | 11465 | 2000 | 58.6 | 59.3 | 24.6 | 24.6 | C |
| 33 | II-394 SB entrance ramp | Merge | 1500 | 5 | 8422 | 1074 | 11250 | 2000 | 54.3 | 52.9 | 31.0 | 27.0 | C |
| 34 | West of II-394 | Basic | 3310 | 5 | 8498 | - | 11355 | - | 57.0 | - | 29.8 | - | D |

Table A.3: HCS Analysis Results – PM Peak Hour Eastbound

| SEGMENT | NAME | TYPE | LENGTH | LANES | FLOW RATE (PC/H) | | CAPACITY (PC/H) | | SPEED (MI/H) | | DENSITY (PC/MI/IN) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | |
| 1 | West of I-294 Interchange - 4 Lane Section | Basic | 1630 | 4 | 8320 | - | 9176 | - | 55.5 | - | 37.5 | - | E |
| 2 | Weaving Section from Oasis to II-394 exit ramp | Weave | 2040 | 5 | 8320 | - | 9195 | - | 40.9 | - | 45.0 | - | F |
| 3 | II-394 exit ramp to Torrence Ave exit ramp | Basic | 1140 | 4 | 5938 | - | 9180 | - | 58.1 | - | 24.9 | - | C |
| 4 | Torrence Ave exit ramp | Diverge | 1500 | 4 | 5938 | 1495 | 9200 | 2000 | 56.8 | 50.9 | 26.1 | 31.7 | D |
| 5 | Torrence Off-ramp to IL-394 entrance ramp | Basic | 4850 | 4 | 4443 | - | 9224 | - | 60.6 | - | 18.3 | - | C |
| 6 | II-394 entrance ramp | Merge | 1500 | 5 | 7193 | 2750 | 11500 | 4000 | 55.9 | 53.5 | 25.7 | 27.1 | C |
| 7 | I-94 entrance ramp to Torrence Ave entrance ramp | Basic | 2380 | 5 | 7193 | - | 11505 | - | 59.9 | - | 23.9 | - | C |
| 8 | Torrence Ave entrance ramp | Merge | 1500 | 6 | 8945 | 1752 | 13800 | 2000 | 56.6 | 56.6 | 26.3 | 26.3 | D |
| 9 | Torrence Ave entrance ramp to Lane Drop | Basic | 920 | 6 | 8945 | - | 13806 | - | 59.6 | - | 24.8 | - | C |
| 10 | Lane Drop to Calumet Ave exit ramp | Basic | 5770 | 5 | 8945 | - | 11550 | - | 60.1 | - | 29.8 | - | D |
| 11 | Calumet Ave exit ramp | Diverge | 1500 | 4 | 8945 | 1422 | 9200 | 2000 | 57.2 | 51.5 | 39.1 | 31.2 | D |
| 12 | Calumet Ave exit ramp to Calumet entrance ramp | Basic | 2150 | 4 | 7523 | - | 9148 | - | 57.7 | - | 32.6 | - | D |
| 13 | Calumet Ave entrance ramp | Merge | 1500 | 5 | 9200 | 1564 | 11500 | 4000 | 55.1 | 53.7 | 33.4 | 24.7 | C |
| 14 | Calumet Ave entrance ramp to Indianapolis Blvd exit ramp | Basic | 2790 | 5 | 9200 | - | 11385 | - | 57.2 | - | 32.2 | - | D |
| 15 | Indianapolis Blvd exit ramp | Diverge | 1500 | 5 | 9200 | 1247 | 11500 | 2000 | 56.2 | 56.2 | 32.7 | 32.7 | D |
| 16 | Indianapolis Blvd exit ramp to Indianapolis Blvd entrance ramp | Basic | 2050 | 4 | 7953 | - | 9144 | - | 56.4 | - | 35.3 | - | E |
| 17 | Indianapolis Blvd entrance ramp to Kennedy Ave exit ramp | Weave | 3090 | 5 | 9347 | - | 10695 | - | 41.8 | - | 44.7 | - | F |
| 18 | Kennedy exit ramp to Kennedy entrance ramp | Basic | 2180 | 4 | 8015 | - | 9120 | - | 55.9 | - | 35.8 | - | E |
| 19 | Kennedy entrance amp | Merge | 1500 | 5 | 8859 | 844 | 11500 | 4000 | 56.4 | 55.6 | 31.4 | 20.2 | C |
| 20 | Kennedy entrance ramp to Cline Ave exit ramp | Basic | 2630 | 5 | 8859 | - | 11355 | - | 57.0 | - | 31.1 | - | D |
| 21 | Cline Ave exit amp | Diverge | 1500 | 5 | 8859 | 1397 | 11500 | 4000 | 57.5 | 50.7 | 30.8 | 15.5 | B |
| 22 | Cline Ave exit ramp to Cline Ave entrance ramp | Basic | 5140 | 4 | 7462 | - | 9120 | - | 57.3 | - | 32.6 | - | D |
| 23 | Cline Ave entrance ramp to Burr Street exit ramp | Weave | 3200 | 5 | 9338 | - | 10257 | - | 39.7 | - | 47.0 | - | F |
| 24 | Burr St exit ramp to Burr St entrance ramp | Basic | 2630 | 4 | 8289 | - | 9148 | - | 55.2 | - | 37.5 | - | E |
| 25 | Burr St entrance ramp | Merge | 1500 | 5 | 8778 | 489 | 11500 | 2000 | 56.6 | 56.6 | 31.0 | 31.0 | D |
| 26 | Burr St entrance ramp to Grant St exit ramp | Basic | 6900 | 5 | 8181 | - | 11380 | - | 57.6 | - | 28.4 | - | D |
| 27 | Grant St exit ramp | Diverge | 1500 | 5 | 7655 | 562 | 11585 | 2000 | 28.7 | 28.7 | 53.3 | 53.3 | F |
| 28 | Grant St exit ramp to Grant St entrance ramp | Basic | 3030 | 4 | 6414 | - | 9072 | - | 22.8 | - | 70.2 | - | F |
| 29 | Grant St entrance ramp to Broadway exit ramp | Weave | 2840 | 5 | 6175 | - | 10575 | - | 13.4 | - | 92.0 | - | F |
| 30 | Broadway exit ramp to Broadway entrance ramp | Basic | 2550 | 4 | 4590 | - | 9112 | - | 10.5 | - | 109.7 | - | F |
| 31 | Broadway entrance ramp to I-65 SB exit ramp | Weave | 4250 | 5 | 5103 | - | 5742 | - | 43.7 | - | 23.4 | - | F |
| 32 | I-65 SB exit ramp to NB exit ramp | Basic | 1310 | 4 | 1104 | - | 9152 | - | 58.6 | - | 4.7 | - | A |
| 33 | I-65 NB exit ramp | Diverge | 1500 | 4 | 1104 | 467 | 9200 | 2000 | 57.3 | 53.0 | 4.8 | 5.2 | A |
| 34 | I-65 NB exit ramp to I-65 entrance ramp | Basic | 6150 | 4 | 637 | - | 9244 | - | 61.1 | - | 2.6 | - | A |
| 35 | I-65 entrance ramp | Merge | 1500 | 4 | 1437 | 800 | 9200 | 2000 | 58.0 | 56.8 | 6.2 | 7.3 | A |
| 36 | East of I-65 - 4 lane | Basic | 1800 | 4 | 1437 | - | 9188 | - | 59.6 | - | 6.0 | - | A |
| 37 | East of I-65 - 3 lane | Basic | 6800 | 3 | 1437 | - | 6891 | - | 59.7 | - | 8.0 | - | A |

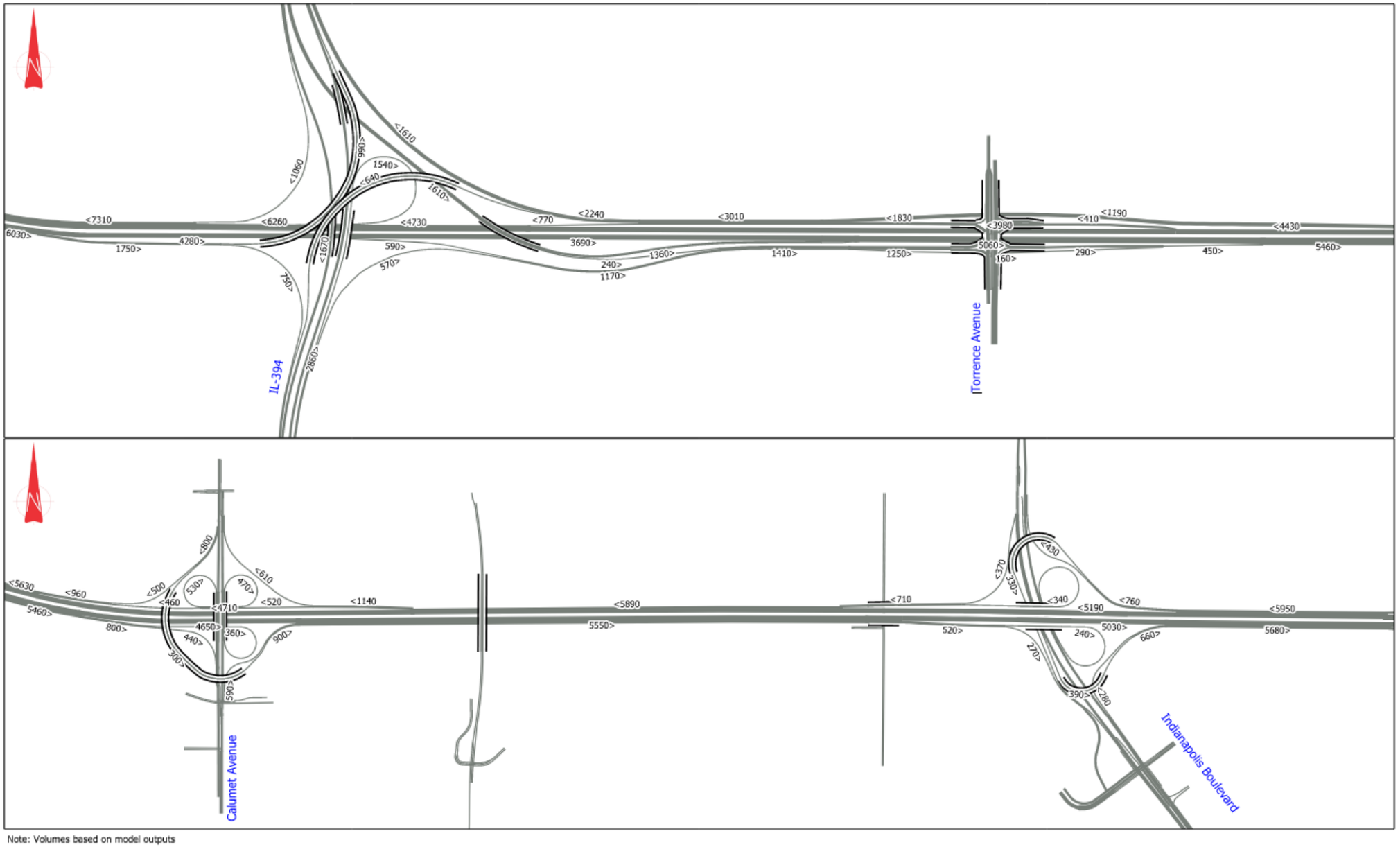
Table A.4: HCS Analysis Results – PM Peak Hour Westbound

| SEGMENT | NAME | TYPE | LENGTH | LANES | FLOW RATE (PC/H) | | CAPACITY (PC/H) | | SPEED (MI/H) | | DENSITY (PC/MI/IN) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | |
| 1 | East of I-65 - 3 Lanes | Basic | 8000 | 3 | 4716 | - | 6861 | - | 58.7 | - | 26.8 | - | D |
| 2 | East of I-65 - 4 Lanes | Basic | 130 | 4 | 4716 | - | 9148 | - | 58.7 | - | 20.1 | - | C |
| 3 | I-65 exit ramp | Diverge | 1500 | 5 | 4716 | 928 | 11500 | 4000 | 58.9 | 51.3 | 16.0 | 6.1 | A |
| 4 | I-65 exit ramp to I-65 SB and Central Ave entrance ramp | Basic | 7520 | 3 | 3788 | - | 6855 | - | 58.5 | - | 21.6 | - | C |
| 5 | I-65 SB and Central Ave entrance ramp | Merge | 1500 | 3 | 4465 | 677 | 6900 | 2000 | 55.9 | 55.0 | 26.6 | 22.3 | C |
| 6 | I-65 SB Central Ave entrance ramp to I-65 NB entrance ramp | Basic | 600 | 3 | 4465 | - | 6855 | - | 58.0 | - | 25.4 | - | C |
| 7 | I-65 NB entrance ramp to Broadway exit ramp | Weave | 3900 | 5 | 6219 | - | 7894 | - | 50.3 | - | 24.7 | - | F |
| 8 | Broadway exit ramp to Broadway entrance ramp | Basic | 2700 | 4 | 5837 | - | 9100 | - | 57.5 | - | 25.4 | - | C |
| 9 | Broadway entrance ramp to Grant St exit ramp | Weave | 2750 | 5 | 6670 | - | 10605 | - | 46.6 | - | 28.6 | - | D |
| 10 | Grant St exit ramp to Grant St entrance ramp | Basic | 2900 | 4 | 6198 | - | 9012 | - | 55.2 | - | 28.0 | - | D |
| 11 | Grant St entrance ramp | Merge | 1500 | 5 | 6676 | 478 | 11250 | 2000 | 55.0 | 55.0 | 24.3 | 24.3 | C |
| 12 | Grant St entrance ramp to Burr St exit ramp | Basic | 6850 | 5 | 6676 | - | 11235 | - | 54.7 | - | 24.4 | - | C |
| 13 | Burr St exit ramp | Diverge | 1500 | 5 | 6676 | 482 | 11250 | 2000 | 56.4 | 56.4 | 23.7 | 23.7 | C |
| 14 | Burr St exit ramp to Burr St entrance ramp | Basic | 1850 | 4 | 6194 | - | 9092 | - | 57.2 | - | 27.0 | - | D |
| 15 | Burr St entrance ramp to Cline Ave exit ramp | Weave | 4500 | 5 | 6712 | - | 11100 | - | 51.1 | - | 26.3 | - | C |
| 16 | Cline Ave exit ramp to Cline Ave entrance ramp | Basic | 5650 | 4 | 5441 | - | 9100 | - | 57.5 | - | 23.7 | - | C |
| 17 | Cline Ave entrance ramp to Kennedy Ave exit ramp | Weave | 4500 | 5 | 7111 | - | 9231 | - | 43.3 | - | 32.8 | - | D |
| 18 | Kennedy Ave exit ramp to Kennedy Ave entrance ramp | Basic | 2300 | 4 | 6358 | - | 9048 | - | 56.1 | - | 28.3 | - | D |
| 19 | Kennedy Ave entrance ramp to Indianapolis Blvd exit ramp | Weave | 3000 | 5 | 6938 | - | 10810 | - | 47.5 | - | 29.2 | - | D |
| 20 | Indianapolis Blvd exit ramp to Indianapolis Blvd entrance ramp | Basic | 2200 | 4 | 6062 | - | 9136 | - | 58.2 | - | 26.0 | - | C |
| 21 | Indianapolis Blvd entrance ramp to Clement Ave exit ramp | Weave | 5150 | 5 | 7032 | - | 10526 | - | 44.9 | - | 31.3 | - | D |
| 22 | Clement Ave exit ramp to Clement Ave entrance ramp | Basic | 3050 | 4 | 5651 | - | 9164 | - | 59.1 | - | 23.9 | - | C |
| 23 | Clement Ave entrance ramp | Merge | 1500 | 5 | 7577 | 1107 | 11545 | 2000 | 60.9 | 60.9 | 24.9 | 24.9 | C |
| 24 | Clement Ave entrance ramp to II-394 exit ramp - 5 Lane | Basic | 3080 | 5 | 7557 | - | 11405 | - | 58.1 | - | 26.0 | - | C |
| 25 | Clement Ave entrance ramp to II-394 exit ramp - 6 Lane | Basic | 1400 | 6 | 7557 | - | 13662 | - | 57.7 | - | 21.8 | - | C |
| 26 | II-394 exit ramp | Diverge | 1500 | 6 | 7557 | 2264 | 13800 | 4000 | 57.1 | 57.1 | 22.0 | 22.0 | C |
| 27 | II-394 exit ramp to Torrence Ave exit ramp | Basic | 1400 | 4 | 5325 | - | 9112 | - | 57.7 | - | 23.0 | - | C |
| 28 | Torrence Ave exit ramp | Diverge | 1500 | 4 | 5325 | 509 | 9200 | 2000 | 58.1 | 52.0 | 22.9 | 24.2 | C |
| 29 | Torrence Ave exit ramp to Torrence Ave entrance ramp | Basic | 6100 | 4 | 4868 | - | 9112 | - | 57.8 | - | 21.1 | - | C |
| 30 | Torrence Ave entrance ramp | Merge | 1500 | 4 | 5867 | 999 | 9200 | 2000 | 56.3 | 54.8 | 26.1 | 23.6 | C |
| 31 | Torrence Ave entrance ramp to II-394 NB entrance ramp | Basic | 700 | 4 | 5916 | - | 9060 | - | 56.5 | - | 26.2 | - | D |
| 32 | II-394 NB entrance ramp | Merge | 1000 | 5 | 6878 | 962 | 11465 | 2000 | 58.6 | 59.3 | 23.2 | 23.2 | C |
| 33 | II-394 SB entrance ramp | Merge | 1500 | 5 | 7952 | 1096 | 11250 | 2000 | 54.5 | 53.1 | 29.2 | 26.1 | C |
| 34 | West of II-394 | Basic | 3310 | 5 | 7985 | - | 11355 | - | 57.0 | - | 28.0 | - | D |

**Table A.5: Synchro Intersection Capacity Analysis Results – AM and PM Peak Hour**

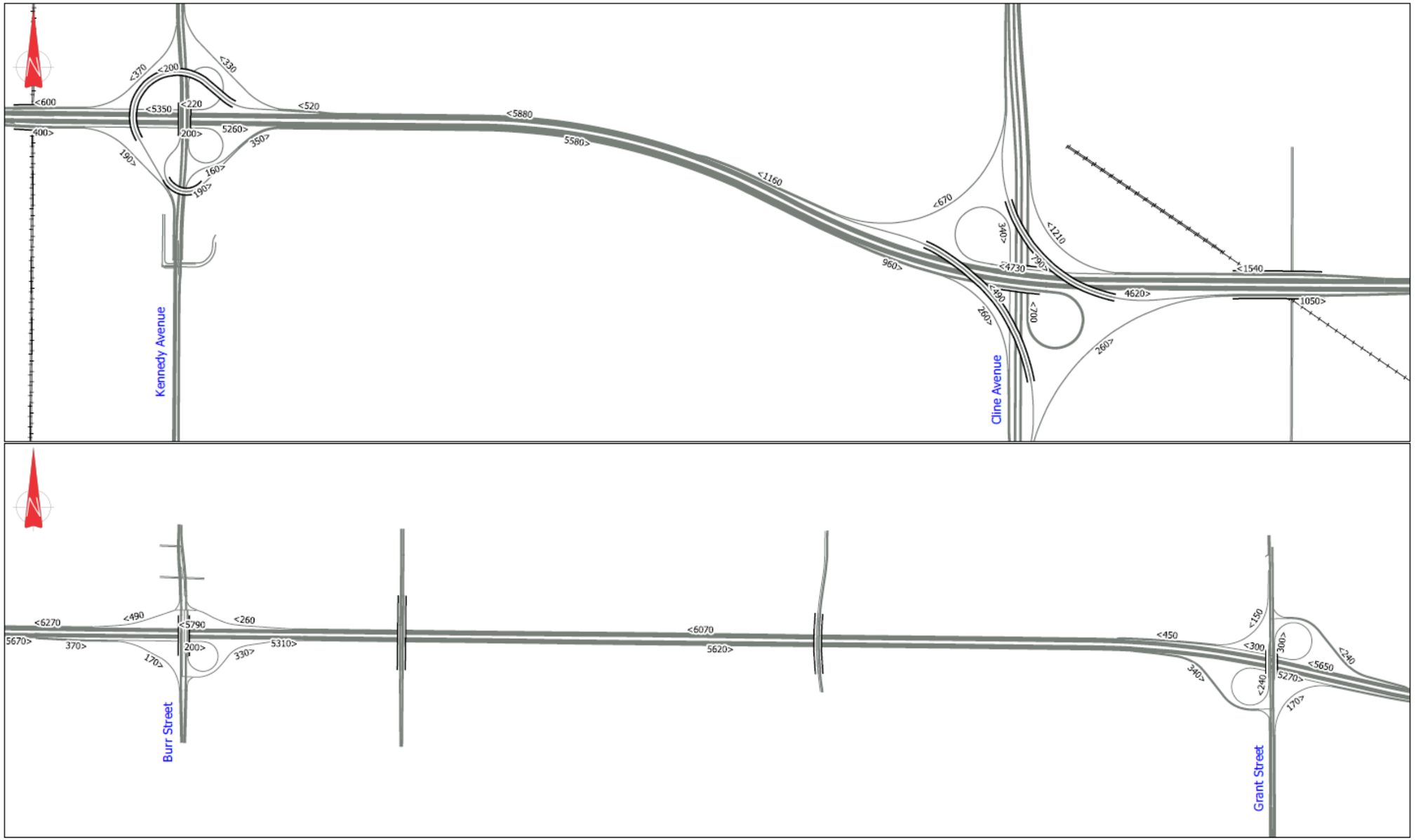
| LOCATION | TYPE | EBL | EBR | EBR2 | NBL | NBR | NBR2 | NBT | SBL | SBR | SBR2 | SBT | WBL | WBR | WBR2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM | | | | | | | | | | | | | | | |
| Torrence Avenue – single point intersection | Control Delay | 74.3 | | 20.6 | 72.8 | | 1.5 | 25.9 | 76.9 | | 16.1 | 46.9 | 64.2 | | 23.8 |
| | LOS | E | | C | E | | A | C | E | | B | D | E | | C |
| | v/c Ratio | 0.91 | | 0.46 | 0.99 | | 0.07 | 0.37 | 0.71 | | 0.54 | 0.41 | 0.66 | | 0.38 |
| Burr Street I/C – south ramp terminal | Control Delay | | | | | 0.2 | | 4.4 | 31.2 | | | 0 | | | |
| | LOS | | | | | A | | A | C | | | A | | | |
| | v/c Ratio | | | | | 0.13 | | 0.11 | 0.39 | | | 0.05 | | | |
| Burr Street I/C – north ramp terminal | Control Delay | | | | 4.8 | | | 4.5 | | 1.3 | | 12.7 | 29.4 | 5.2 | |
| | LOS | | | | A | | | A | | A | | B | C | A | |
| | v/c Ratio | | | | 0.23 | | | 0.12 | | 0.26 | | 0.11 | 0.43 | 0.31 | |
| Grant Street I/C – south ramp terminal | Control Delay | 31.6 | 7.6 | | | | | 5.9 | | | | 4.6 | | | |
| | LOS | C | A | | | | | A | | | | A | | | |
| | v/c Ratio | 0.39 | 0.45 | | | | | 0.22 | | | | 0.11 | | | |
| Grant Street I/C – north ramp terminal | Control Delay | | | | | | | 2.9 | | | | 3.9 | 33.4 | 10 | |
| | LOS | | | | | | | A | | | | A | C | A | |
| | v/c Ratio | | | | | | | 0.14 | | | | 0.15 | 0.25 | 0.44 | |
| Broadway I/C – south ramp terminal | Control Delay | 24.4 | 5.5 | | | | | 8.2 | | | | 9.8 | | | |
| | LOS | C | A | | | | | A | | | | A | | | |
| | v/c Ratio | 0.51 | 0.48 | | | | | 0.28 | | | | 0.18 | | | |
| Broadway I/C – north ramp terminal | Control Delay | | | | | | | 4.6 | | | | 6.3 | 27.1 | 6.7 | |
| | LOS | | | | | | | A | | | | A | C | A | |
| | v/c Ratio | | | | | | | 0.24 | | | | 0.19 | 0.49 | 0.36 | |
| PM | | | | | | | | | | | | | | | |
| Torrence Avenue – single point intersection | Control Delay | 159.4 | | 40.8 | 69.9 | | 6.4 | 40.2 | 64.4 | | 10.7 | 42.4 | 74.3 | | 23.6 |
| | LOS | F | | D | E | | A | D | E | | B | D | E | | C |
| | v/c Ratio | 1.23 | | 0.88 | 0.88 | | 0.21 | 0.48 | 0.79 | | 0.50 | 0.56 | 0.72 | | 0.39 |
| Burr Street I/C – south ramp terminal | Control Delay | | | | | 0.2 | | 8 | 25 | | | 0.1 | | | |
| | LOS | | | | | A | | A | C | | | A | | | |
| | v/c Ratio | | | | | 0.14 | | 0.16 | 0.58 | | | 0.14 | | | |
| Burr Street I/C – north ramp terminal | Control Delay | | | | 6.8 | | | 7.5 | | 1.5 | | 16.3 | 81 | 4 | |
| | LOS | | | | A | | | A | | A | | B | F | A | |
| | v/c Ratio | | | | 0.29 | | | 0.3 | | 0.25 | | 0.35 | 1.01 | 0.28 | |
| Grant Street I/C – south ramp terminal | Control Delay | 33.4 | 27 | | | | | 10 | | | | 8.8 | | | |
| | LOS | C | C | | | | | A | | | | A | | | |
| | v/c Ratio | 0.46 | 0.71 | | | | | 0.26 | | | | 0.21 | | | |
| Grant Street I/C – north ramp terminal | Control Delay | | | | | | | 4.4 | | | | 6.9 | 34.2 | 24.7 | |
| | LOS | | | | | | | A | | | | A | C | C | |
| | v/c Ratio | | | | | | | 0.22 | | | | 0.32 | 0.22 | 0.74 | |
| Broadway I/C – south ramp terminal | Control Delay | 28.3 | 16.1 | | | | | 11.3 | | | | 13.5 | | | |
| | LOS | C | B | | | | | B | | | | B | | | |
| | v/c Ratio | 0.7 | 0.7 | | | | | 0.44 | | | | 0.37 | | | |
| Broadway I/C – north ramp terminal | Control Delay | | | | | | | 4.5 | | | | 7.5 | 28.7 | 7.6 | |
| | LOS | | | | | | | A | | | | A | C | A | |
| | v/c Ratio | | | | | | | 0.37 | | | | 0.4 | 0.55 | 0.39 | |

# FUTURE TRAFFIC CONDITIONS



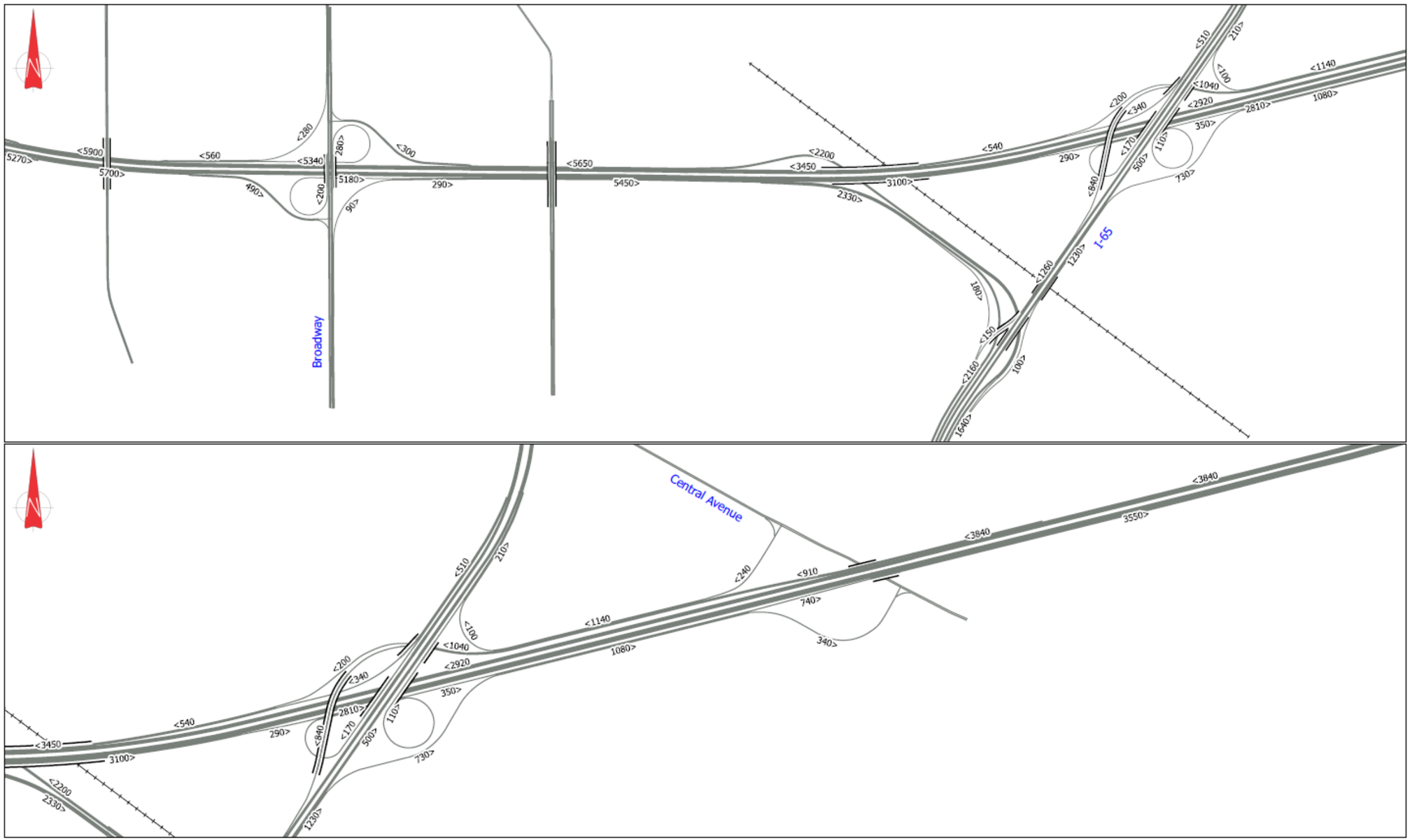

Note: Volumes based on model outputs

**Figure A.3a: Modeled Typical Weekday AM Peak Hour Volumes – Future Base Case (2040)**



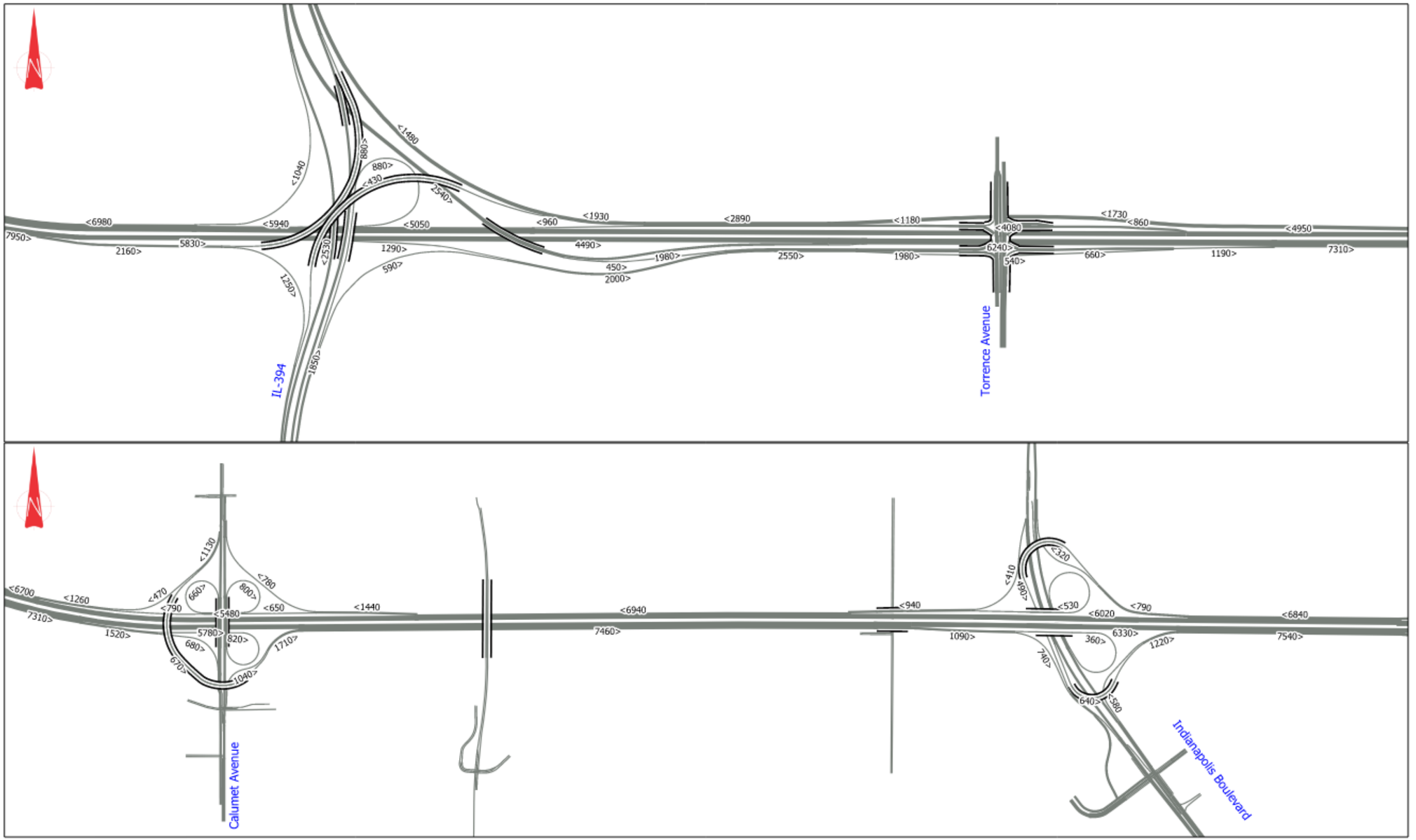

Note: Volumes based on model outputs

Figure A.3b: Modeled Typical Weekday AM Peak Hour Volumes – Future Base Case (2040)



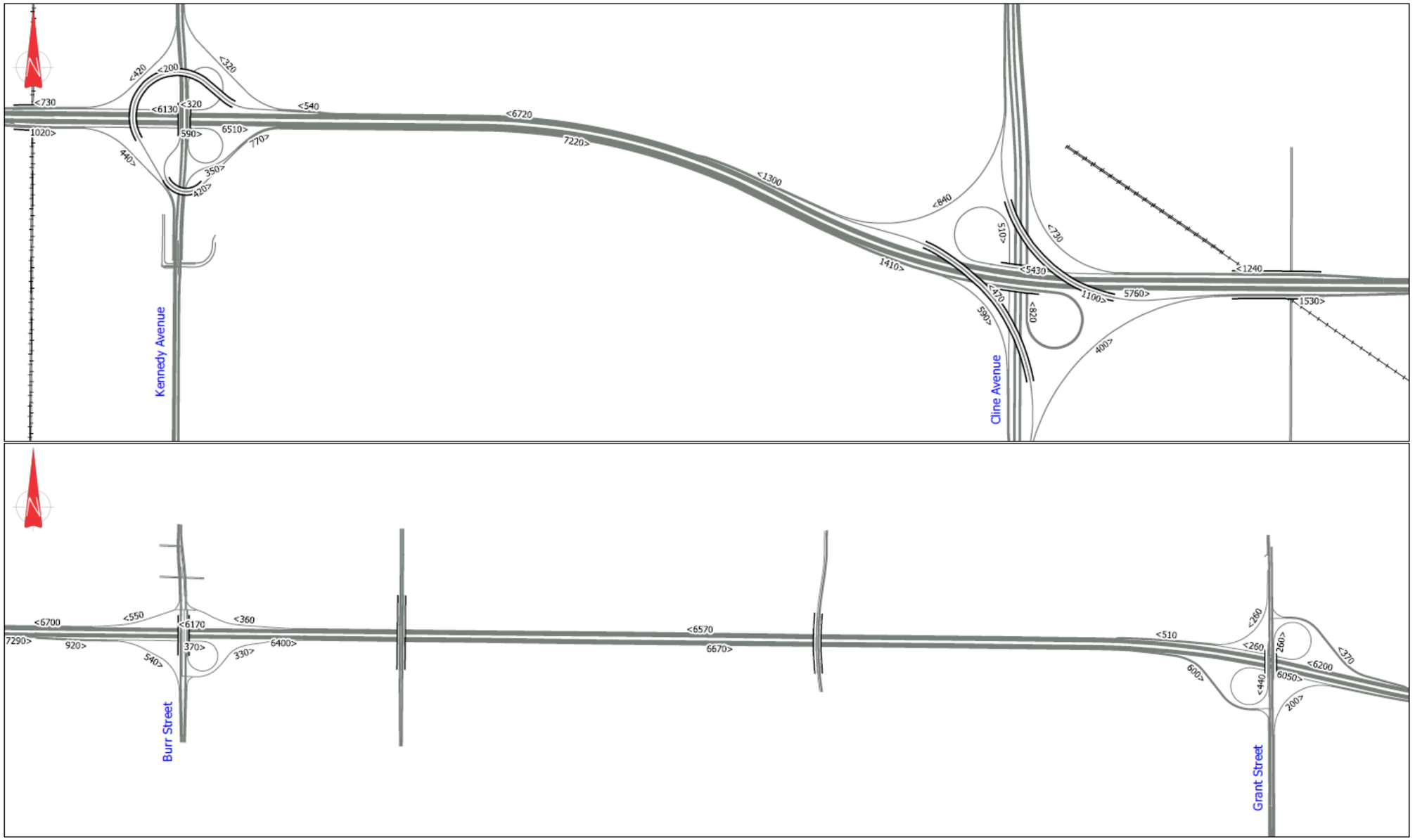

Note: Volumes based on model outputs

**Figure A.3c: Modeled Typical Weekday AM Peak Hour Volumes Future Base Case (2040)**



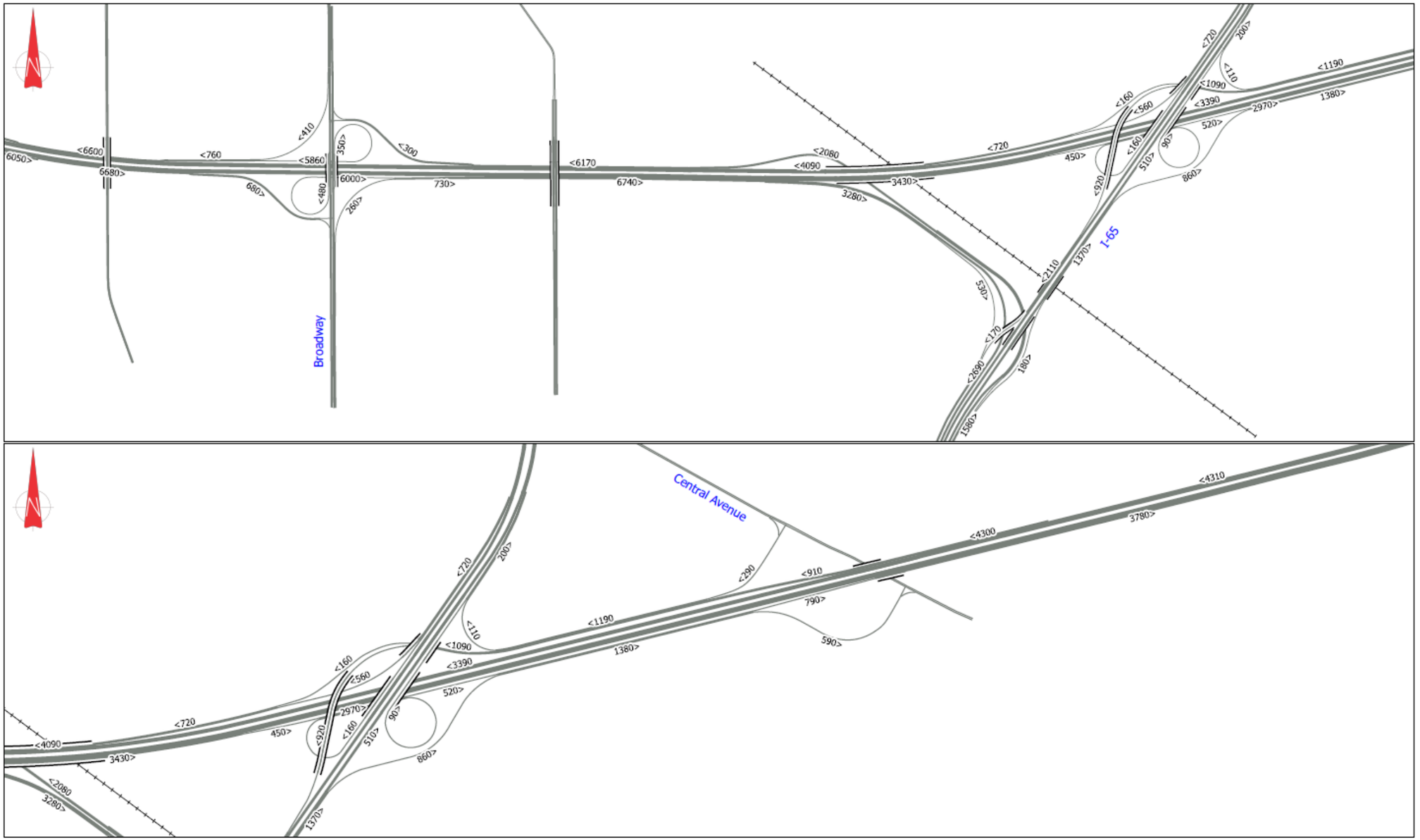

Note: Volumes based on model outputs

**Figure A.4a: Modeled Typical Weekday PM Peak Hour Volumes – Future Base Case (2040)**




Note: Volumes based on model outputs

Figure A.4b: Modeled Typical Weekday PM Peak Hour Volumes – Future Base Case (2040)




Note: Volumes based on model outputs

**Figure A.4c: Modeled Typical Weekday PM Peak Hour Volumes – Future Base Case (2040**

Table A.6: HCS Analysis Results – AM Peak Hour Eastbound (Future 2040 Base Case)

| SEGMENT | NAME | TYPE | LENGTH | LANES | FLOW RATE (PC/H) | | CAPACITY (PC/H) | | SPEED (MI/H) | | DENSITY (PC/MI/IN) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | |
| 1 | West of I-94 Interchange - 4 Lane Section | Basic | 1630 | 4 | 7804 | - | 9176 | - | 57.4 | - | 34.0 | - | D |
| 2 | Weaving Section from Oasis to IL-394 exit ramp | Weave | 2040 | 5 | 7804 | - | 9023 | - | 39.6 | - | 39.4 | - | E |
| 3 | IL-394 exit ramp to Torrence Ave exit ramp | Basic | 1140 | 4 | 5539 | - | 9180 | - | 58.0 | - | 23.3 | - | C |
| 4 | Torrence Ave exit ramp | Diverge | 1500 | 4 | 5539 | 645 | 9200 | 2000 | 58.7 | 52.4 | 23.6 | 26.1 | C |
| 5 | Torrence Off-ramp to IL-394 entrance ramp | Basic | 4850 | 4 | 4894 | - | 9224 | - | 60.6 | - | 20.2 | - | C |
| 6 | IL-394 entrance ramp | Merge | 1500 | 5 | 6644 | 1750 | 11500 | 4000 | 58.3 | 56.5 | 22.8 | 20.9 | C |
| 7 | I-94 entrance ramp to Torrence Ave entrance ramp | Basic | 2380 | 5 | 6644 | - | 11480 | - | 59.5 | - | 22.3 | - | C |
| 8 | Torrence Ave entrance ramp | Merge | 1500 | 6 | 7086 | 442 | 13800 | 2000 | 58.8 | 58.8 | 20.1 | 20.1 | C |
| 9 | Torrence Ave entrance ramp to Lane Drop | Basic | 920 | 6 | 7086 | - | 13752 | - | 59.1 | - | 19.9 | - | C |
| 10 | Lane Drop to Calumet Ave exit ramp | Basic | 5770 | 5 | 7086 | - | 11460 | - | 59.2 | - | 23.9 | - | C |
| 11 | Calumet Ave exit ramp | Diverge | 1500 | 4 | 7086 | 870 | 9200 | 2000 | 58.6 | 52.5 | 30.2 | 21.5 | C |
| 12 | Calumet Ave exit ramp to Calumet entrance ramp | Basic | 2150 | 4 | 6216 | - | 9056 | - | 56.4 | - | 27.6 | - | D |
| 13 | Calumet Ave entrance ramp | Merge | 1500 | 5 | 7183 | 967 | 11500 | 4000 | 56.5 | 55.5 | 25.4 | 18.0 | B |
| 14 | Calumet Ave entrance ramp to Indianapolis Blvd exit ramp | Basic | 2790 | 5 | 7183 | - | 11340 | - | 56.8 | - | 25.3 | - | C |
| 15 | Indianapolis Blvd exit ramp | Diverge | 1500 | 5 | 7183 | 564 | 11000 | 2000 | 57.8 | 57.8 | 24.9 | 24.9 | C |
| 16 | Indianapolis Blvd exit ramp to Indianapolis Blvd entrance ramp | Basic | 2050 | 4 | 6619 | - | 9124 | - | 58.1 | - | 28.5 | - | D |
| 17 | Indianapolis Blvd entrance ramp to Kennedy Ave exit ramp | Weave | 3090 | 5 | 7463 | - | 10915 | - | 48.3 | - | 30.9 | - | D |
| 18 | Kennedy exit ramp to Kennedy entrance ramp | Basic | 2180 | 4 | 6918 | - | 9104 | - | 57.5 | - | 30.0 | - | D |
| 19 | Kennedy entrance amp | Merge | 1500 | 5 | 7269 | 351 | 11500 | 4000 | 57.3 | 56.5 | 25.4 | 14.5 | B |
| 20 | Kennedy entrance ramp to Cline Ave exit ramp | Basic | 2630 | 5 | 7269 | - | 11355 | - | 57.1 | - | 25.5 | - | C |
| 21 | Cline Ave exit amp | Diverge | 1500 | 5 | 7269 | 1124 | 11500 | 4000 | 58.5 | 51.2 | 24.9 | 10.9 | B |
| 22 | Cline Ave exit ramp to Cline Ave entrance ramp | Basic | 5140 | 4 | 6145 | - | 9120 | - | 58.0 | - | 26.5 | - | D |
| 23 | Cline Ave entrance ramp to Burr Street exit ramp | Weave | 3200 | 5 | 7531 | - | 10655 | - | 44.4 | - | 33.9 | - | D |
| 24 | Burr St exit ramp to Burr St entrance ramp | Basic | 2630 | 4 | 7055 | - | 9148 | - | 58.5 | - | 30.1 | - | D |
| 25 | Burr St entrance ramp | Merge | 1500 | 5 | 7388 | 333 | 11500 | 2000 | 57.3 | 57.3 | 25.8 | 25.8 | C |
| 26 | Burr St entrance ramp to Grant St exit ramp | Basic | 6900 | 5 | 7388 | - | 11380 | - | 57.6 | - | 25.7 | - | C |
| 27 | Grant St exit ramp | Diverge | 1500 | 5 | 7388 | 376 | 11500 | 2000 | 58.7 | 58.7 | 25.2 | 25.2 | C |
| 28 | Grant St exit ramp to Grant St entrance ramp | Basic | 3030 | 4 | 6550 | - | 9072 | - | 56.8 | - | 28.8 | - | D |
| 29 | Grant St entrance ramp to Broadway exit ramp | Weave | 2840 | 5 | 6204 | - | 10675 | - | 17.7 | - | 70.0 | - | F |
| 30 | Broadway exit ramp to Broadway entrance ramp | Basic | 2550 | 4 | 4898 | - | 9112 | - | 12.3 | - | 99.3 | - | F |
| 31 | Broadway entrance ramp to I-65 SB exit ramp | Weave | 4250 | 5 | 5173 | - | 5555 | - | 43.0 | - | 24.4 | - | F |
| 32 | I-65 SB exit ramp to NB exit ramp | Basic | 1310 | 4 | 2220 | - | 9152 | - | 58.6 | - | 9.4 | - | A |
| 33 | I-65 NB exit ramp | Diverge | 1500 | 4 | 2220 | 315 | 9200 | 2000 | 59.8 | 53.3 | 9.3 | 8.6 | A |
| 34 | I-65 NB exit ramp to I-65 entrance ramp | Basic | 6150 | 4 | 1905 | - | 9244 | - | 61.1 | - | 7.8 | - | A |
| 35 | I-65 entrance ramp | Merge | 1500 | 4 | 2716 | 811 | 9200 | 2000 | 58.6 | 56.6 | 11.6 | 11.7 | B |
| 36 | East of I-65 - 4 lane | Basic | 1800 | 4 | 2716 | - | 9188 | - | 59.6 | - | 11.4 | - | B |
| 37 | East of I-65 - 3 lane | Basic | 6800 | 3 | 2716 | - | 6891 | - | 59.7 | - | 15.2 | - | B |

Table A.7: HCS Analysis Results – AM Peak Hour Westbound (Future 2040 Base Case)

| SEGMENT | NAME | TYPE | LENGTH | LANES | FLOW RATE (PC/H) | | CAPACITY (PC/H) | | SPEED (MI/H) | | DENSITY (PC/MI/IN) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | |
| 1 | East of I-65 - 3 Lanes | Basic | 8000 | 3 | 5068 | - | 6930 | - | 60.7 | - | 27.8 | - | D |
| 2 | East of I-65 - 4 Lanes | Basic | 130 | 4 | 5068 | - | 9148 | - | 58.7 | - | 21.6 | - | C |
| 3 | I-65 exit ramp | Diverge | 1500 | 5 | 5068 | 1038 | 11500 | 4000 | 58.5 | 51.1 | 17.3 | 7.6 | A |
| 4 | I-65 exit ramp to I-65 SB and Central Ave entrance ramp | Basic | 7520 | 3 | 4030 | - | 6855 | - | 58.5 | - | 23.0 | - | C |
| 5 | I-65 SB and Central Ave entrance ramp | Merge | 1500 | 3 | 4611 | 581 | 6900 | 2000 | 55.7 | 54.9 | 27.6 | 22.7 | C |
| 6 | I-65 SB Central Ave entrance ramp to I-65 NB entrance ramp | Basic | 600 | 3 | 4611 | - | 6855 | - | 58.0 | - | 26.3 | - | D |
| 7 | I-65 NB entrance ramp to Broadway exit ramp | Weave | 3900 | 5 | 6507 | - | 8000 | - | 50.6 | - | 25.7 | - | F |
| 8 | Broadway exit ramp to Broadway entrance ramp | Basic | 2700 | 4 | 6095 | - | 9100 | - | 57.5 | - | 26.5 | - | D |
| 9 | Broadway entrance ramp to Grant St exit ramp | Weave | 2750 | 5 | 6810 | - | 10740 | - | 47.8 | - | 28.5 | - | D |
| 10 | Grant St exit ramp to Grant St entrance ramp | Basic | 2900 | 4 | 6490 | - | 9012 | - | 55.2 | - | 29.3 | - | D |
| 11 | Grant St entrance ramp | Merge | 1500 | 5 | 6950 | 460 | 11250 | 2000 | 54.9 | 54.9 | 25.3 | 25.3 | C |
| 12 | Grant St entrance ramp to Burr St exit ramp | Basic | 6850 | 5 | 6950 | - | 11235 | - | 54.7 | - | 25.4 | - | C |
| 13 | Burr St exit ramp | Diverge | 1500 | 5 | 6950 | 304 | 11250 | 2000 | 56.6 | 56.6 | 24.6 | 24.6 | C |
| 14 | Burr St exit ramp to Burr St entrance ramp | Basic | 1850 | 4 | 6646 | - | 9092 | - | 57.3 | - | 29.0 | - | D |
| 15 | Burr St entrance ramp to Cline Ave exit ramp | Weave | 4500 | 5 | 7249 | - | 8760 | - | 50.5 | - | 28.7 | - | D |
| 16 | Cline Ave exit ramp to Cline Ave entrance ramp | Basic | 5650 | 4 | 5315 | - | 9100 | - | 57.5 | - | 23.1 | - | C |
| 17 | Cline Ave entrance ramp to Kennedy Ave exit ramp | Weave | 4500 | 5 | 6796 | - | 9836 | - | 44.5 | - | 30.5 | - | D |
| 18 | Kennedy Ave exit ramp to Kennedy Ave entrance ramp | Basic | 2300 | 4 | 6114 | - | 9032 | - | 55.8 | - | 27.4 | - | D |
| 19 | Kennedy Ave entrance ramp to Indianapolis Blvd exit ramp | Weave | 3000 | 5 | 6886 | - | 10610 | - | 45.4 | - | 30.3 | - | D |
| 20 | Indianapolis Blvd exit ramp to Indianapolis Blvd entrance ramp | Basic | 2200 | 4 | 5908 | - | 9100 | - | 57.3 | - | 25.7 | - | C |
| 21 | Indianapolis Blvd entrance ramp to Calumet Ave exit ramp | Weave | 5150 | 5 | 6816 | - | 9717 | - | 44.7 | - | 30.5 | - | D |
| 22 | Calumet Ave exit ramp to Calumet Ave entrance ramp | Basic | 3050 | 4 | 5285 | - | 9112 | - | 57.8 | - | 22.9 | - | C |
| 23 | Calumet Ave entrance ramp | Merge | 1500 | 5 | 6273 | 988 | 11500 | 2000 | 56.9 | 56.9 | 22.0 | 22.0 | C |
| 24 | Calumet Ave entrance ramp to IL-394 exit ramp - 5 Lane | Basic | 3080 | 5 | 6273 | - | 11320 | - | 56.4 | - | 22.2 | - | C |
| 25 | Calumet Ave entrance ramp to IL-394 exit ramp - 6 Lane | Basic | 1400 | 6 | 6273 | - | 13560 | - | 56.0 | - | 18.7 | - | C |
| 26 | IL-394 exit ramp | Diverge | 1500 | 6 | 6273 | 1292 | 13800 | 4000 | 57.1 | 57.1 | 18.3 | 18.3 | B |
| 27 | IL-394 exit ramp to Torrence Ave exit ramp | Basic | 1400 | 4 | 4981 | - | 9076 | - | 56.9 | - | 21.9 | - | C |
| 28 | Torrence Ave exit ramp | Diverge | 1500 | 4 | 4981 | 493 | 9200 | 2000 | 58.2 | 52.0 | 21.4 | 22.8 | C |
| 29 | Torrence Ave exit ramp to Torrence Ave entrance ramp | Basic | 6100 | 4 | 4488 | - | 9112 | - | 57.8 | - | 19.4 | - | C |
| 30 | Torrence Ave entrance ramp | Merge | 1500 | 4 | 5324 | 836 | 9200 | 2000 | 56.8 | 55.2 | 23.4 | 21.2 | C |
| 31 | Torrence Ave entrance ramp to IL-394 NB entrance ramp | Basic | 700 | 4 | 5324 | - | 9060 | - | 56.5 | - | 23.6 | - | C |
| 32 | IL-394 NB entrance ramp | Merge | 1000 | 5 | 7061 | 1737 | 11250 | 2000 | 54.4 | 54.4 | 26.0 | 26.0 | C |
| 33 | IL-394 SB entrance ramp | Merge | 1500 | 5 | 8212 | 1151 | 11250 | 2000 | 54.3 | 52.9 | 30.2 | 26.9 | C |
| 34 | West of I-94 | Basic | 3310 | 5 | 8212 | - | 11355 | - | 57.0 | - | 28.8 | - | D |

Table A.8: HCS Analysis Results – PM Peak Hour Eastbound (Future 2040 Base Case)

| SEGMENT | NAME | TYPE | LENGTH | LANES | FLOW RATE (PC/H) | | CAPACITY (PC/H) | | SPEED (MI/H) | | DENSITY (PC/MI/IN) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | |
| 1 | West of I-94 Interchange - 4 Lane Section | Basic | 1630 | 4 | 9176 | - | 9176 | - | 51.0 | - | 45.0 | - | F |
| 2 | Weaving Section from Oasis to IL-394 exit ramp | Weave | 2040 | 5 | 9176 | - | 9449 | - | 36.8 | - | 49.9 | - | F |
| 3 | IL-394 exit ramp to Torrence Ave exit ramp | Basic | 1140 | 4 | 6381 | - | 9180 | - | 57.8 | - | 26.8 | - | D |
| 4 | Torrence Ave exit ramp | Diverge | 1500 | 4 | 6381 | 1413 | 9200 | 2000 | 56.9 | 51.0 | 28.0 | 33.0 | D |
| 5 | Torrence Off-ramp to IL-394 entrance ramp | Basic | 4850 | 4 | 4968 | - | 9224 | - | 60.6 | - | 20.5 | - | C |
| 6 | IL-394 entrance ramp | Merge | 1500 | 5 | 6885 | 1917 | 11500 | 4000 | 57.9 | 56.0 | 23.8 | 22.3 | C |
| 7 | I-94 entrance ramp to Torrence Ave entrance ramp | Basic | 2380 | 5 | 6885 | - | 11480 | - | 59.5 | - | 23.1 | - | C |
| 8 | Torrence Ave entrance ramp | Merge | 1500 | 6 | 8057 | 1172 | 13800 | 2000 | 58.0 | 58.0 | 23.2 | 23.2 | C |
| 9 | Torrence Ave entrance ramp to Lane Drop | Basic | 920 | 6 | 8057 | - | 13752 | - | 59.0 | - | 22.7 | - | C |
| 10 | Lane Drop to Calumet Ave exit ramp | Basic | 5770 | 5 | 8057 | - | 11460 | - | 59.2 | - | 27.2 | - | D |
| 11 | Calumet Ave exit ramp | Diverge | 1500 | 4 | 8057 | 1676 | 9200 | 2000 | 56.9 | 51.0 | 35.4 | 29.1 | D |
| 12 | Calumet Ave exit ramp to Calumet entrance ramp | Basic | 2150 | 4 | 6381 | - | 9056 | - | 56.4 | - | 28.3 | - | D |
| 13 | Calumet Ave entrance ramp | Merge | 1500 | 5 | 8186 | 1805 | 11500 | 4000 | 55.3 | 53.7 | 29.6 | 24.5 | C |
| 14 | Calumet Ave entrance ramp to Indianapolis Blvd exit ramp | Basic | 2790 | 5 | 8186 | - | 11340 | - | 56.8 | - | 28.8 | - | D |
| 15 | Indianapolis Blvd exit ramp | Diverge | 1500 | 5 | 8186 | 1214 | 11500 | 2000 | 56.4 | 56.4 | 29.0 | 29.0 | D |
| 16 | Indianapolis Blvd exit ramp to Indianapolis Blvd entrance ramp | Basic | 2050 | 4 | 6972 | - | 9124 | - | 58.0 | - | 30.1 | - | D |
| 17 | Indianapolis Blvd entrance ramp to Kennedy Ave exit ramp | Weave | 3090 | 5 | 8505 | - | 10645 | - | 42.9 | - | 39.7 | - | E |
| 18 | Kennedy exit ramp to Kennedy entrance ramp | Basic | 2180 | 4 | 7200 | - | 9104 | - | 57.4 | - | 31.4 | - | D |
| 19 | Kennedy entrance amp | Merge | 1500 | 5 | 7971 | 771 | 11500 | 4000 | 56.9 | 56.0 | 28.0 | 18.2 | B |
| 20 | Kennedy entrance ramp to Cline Ave exit ramp | Basic | 2630 | 5 | 7971 | - | 11355 | - | 57.1 | - | 27.9 | - | D |
| 21 | Cline Ave exit amp | Diverge | 1500 | 5 | 7971 | 1724 | 11500 | 4000 | 57.2 | 50.2 | 27.9 | 16.0 | B |
| 22 | Cline Ave exit ramp to Cline Ave entrance ramp | Basic | 5140 | 4 | 6247 | - | 9120 | - | 58.0 | - | 26.9 | - | D |
| 23 | Cline Ave entrance ramp to Burr Street exit ramp | Weave | 3200 | 5 | 8151 | - | 9125 | - | 41.2 | - | 39.6 | - | E |
| 24 | Burr St exit ramp to Burr St entrance ramp | Basic | 2630 | 4 | 7044 | - | 9148 | - | 58.5 | - | 30.1 | - | D |
| 25 | Burr St entrance ramp | Merge | 1500 | 5 | 7380 | 336 | 11500 | 2000 | 57.3 | 57.3 | 25.8 | 25.8 | C |
| 26 | Burr St entrance ramp to Grant St exit ramp | Basic | 6900 | 5 | 7380 | - | 11380 | - | 57.6 | - | 25.6 | - | C |
| 27 | Grant St exit ramp | Diverge | 1500 | 5 | 7380 | 739 | 11500 | 2000 | 58.0 | 58.0 | 25.4 | 25.4 | C |
| 28 | Grant St exit ramp to Grant St entrance ramp | Basic | 3030 | 4 | 6262 | - | 9072 | - | 56.8 | - | 27.6 | - | D |
| 29 | Grant St entrance ramp to Broadway exit ramp | Weave | 2840 | 5 | 5982 | - | 10630 | - | 16.2 | - | 73.7 | - | F |
| 30 | Broadway exit ramp to Broadway entrance ramp | Basic | 2550 | 4 | 4483 | - | 9112 | - | 10.6 | - | 105.4 | - | F |
| 31 | Broadway entrance ramp to I-65 SB exit ramp | Weave | 4250 | 5 | 4988 | - | 5797 | - | 44.1 | - | 22.6 | - | F |
| 32 | I-65 SB exit ramp to NB exit ramp | Basic | 1310 | 4 | 903 | - | 9152 | - | 58.6 | - | 3.8 | - | A |
| 33 | I-65 NB exit ramp | Diverge | 1500 | 4 | 903 | 499 | 9200 | 2000 | 56.2 | 52.9 | 4.0 | 4.6 | A |
| 34 | I-65 NB exit ramp to I-65 entrance ramp | Basic | 6150 | 4 | 404 | - | 9244 | - | 61.1 | - | 1.7 | - | A |
| 35 | I-65 entrance ramp | Merge | 1500 | 4 | 1283 | 879 | 9200 | 2000 | 57.7 | 56.8 | 5.6 | 7.1 | A |
| 36 | East of I-65 - 4 lane | Basic | 1800 | 4 | 1283 | - | 9188 | - | 59.6 | - | 5.4 | - | A |
| 37 | East of I-65 - 3 lane | Basic | 6800 | 3 | 1283 | - | 6891 | - | 59.7 | - | 7.2 | - | A |

Table A.9: HCS Analysis Results – PM Peak Hour Westbound (Future 2040 Base Case)

| SEGMENT | NAME | TYPE | LENGTH | LANES | FLOW RATE (PC/H) | | CAPACITY (PC/H) | | SPEED (MI/H) | | DENSITY (PC/MI/IN) | | LOS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | Freeway | Ramp | |
| 1 | East of I-65 - 3 Lanes | Basic | 8000 | 3 | 5350 | - | 6930 | - | 60.1 | - | 29.7 | - | D |
| 2 | East of I-65 - 4 Lanes | Basic | 130 | 4 | 5350 | - | 9148 | - | 58.7 | - | 22.8 | - | C |
| 3 | I-65 exit ramp | Diverge | 1500 | 5 | 5350 | 1056 | 11500 | 4000 | 58.5 | 51.1 | 18.3 | 8.2 | A |
| 4 | I-65 exit ramp to I-65 SB and Central Ave entrance ramp | Basic | 7520 | 3 | 4294 | - | 6855 | - | 58.5 | - | 24.5 | - | C |
| 5 | I-65 SB and Central Ave entrance ramp | Merge | 1500 | 3 | 5054 | 760 | 6900 | 2000 | 55.2 | 54.3 | 30.5 | 25.3 | C |
| 6 | I-65 SB Central Ave entrance ramp to I-65 NB entrance ramp | Basic | 600 | 3 | 5054 | - | 6855 | - | 57.9 | - | 28.8 | - | D |
| 7 | I-65 NB entrance ramp to Broadway exit ramp | Weave | 3900 | 5 | 6651 | - | 9267 | - | 49.9 | - | 26.7 | - | F |
| 8 | Broadway exit ramp to Broadway entrance ramp | Basic | 2700 | 4 | 6269 | - | 9100 | - | 57.5 | - | 27.3 | - | D |
| 9 | Broadway entrance ramp to Grant St exit ramp | Weave | 2750 | 5 | 7198 | - | 10590 | - | 45.4 | - | 31.7 | - | D |
| 10 | Grant St exit ramp to Grant St entrance ramp | Basic | 2900 | 4 | 6696 | - | 9012 | - | 55.2 | - | 30.3 | - | D |
| 11 | Grant St entrance ramp | Merge | 1500 | 5 | 7098 | 402 | 11250 | 2000 | 54.9 | 54.9 | 25.9 | 25.9 | C |
| 12 | Grant St entrance ramp to Burr St exit ramp | Basic | 6850 | 5 | 7098 | - | 11235 | - | 54.7 | - | 26.0 | - | C |
| 13 | Burr St exit ramp | Diverge | 1500 | 5 | 7098 | 447 | 11250 | 2000 | 56.4 | 56.4 | 25.2 | 25.2 | C |
| 14 | Burr St exit ramp to Burr St entrance ramp | Basic | 1850 | 4 | 6651 | - | 9092 | - | 57.2 | - | 29.0 | - | D |
| 15 | Burr St entrance ramp to Cline Ave exit ramp | Weave | 4500 | 5 | 7299 | - | 10213 | - | 49.9 | - | 29.3 | - | D |
| 16 | Cline Ave exit ramp to Cline Ave entrance ramp | Basic | 5650 | 4 | 5746 | - | 9100 | - | 57.5 | - | 25.0 | - | C |
| 17 | Cline Ave entrance ramp to Kennedy Ave exit ramp | Weave | 4500 | 5 | 7366 | - | 9836 | - | 43.2 | - | 34.1 | - | D |
| 18 | Kennedy Ave exit ramp to Kennedy Ave entrance ramp | Basic | 2300 | 4 | 6625 | - | 9032 | - | 55.7 | - | 29.7 | - | D |
| 19 | Kennedy Ave entrance ramp to Indianapolis Blvd exit ramp | Weave | 3000 | 5 | 7509 | - | 10725 | - | 45.2 | - | 33.2 | - | D |
| 20 | Indianapolis Blvd exit ramp to Indianapolis Blvd entrance ramp | Basic | 2200 | 4 | 6488 | - | 9100 | - | 57.3 | - | 28.2 | - | D |
| 21 | Indianapolis Blvd entrance ramp to Calumet Ave exit ramp | Weave | 5150 | 5 | 7633 | - | 9091 | - | 42.2 | - | 36.2 | - | E |
| 22 | Calumet Ave exit ramp to Calumet Ave entrance ramp | Basic | 3050 | 4 | 5817 | - | 9112 | - | 57.8 | - | 25.2 | - | C |
| 23 | Calumet Ave entrance ramp | Merge | 1500 | 5 | 7171 | 1354 | 11500 | 2000 | 56.4 | 56.4 | 25.4 | 25.4 | C |
| 24 | Calumet Ave entrance ramp to IL-394 exit ramp - 5 Lane | Basic | 3080 | 5 | 7171 | - | 11320 | - | 56.4 | - | 25.4 | - | C |
| 25 | Calumet Ave entrance ramp to IL-394 exit ramp - 6 Lane | Basic | 1400 | 6 | 7171 | - | 13560 | - | 56.0 | - | 21.3 | - | C |
| 26 | IL-394 exit ramp | Diverge | 1500 | 6 | 7171 | 2019 | 13800 | 4000 | 57.1 | 57.1 | 20.9 | 20.9 | C |
| 27 | IL-394 exit ramp to Torrence Ave exit ramp | Basic | 1400 | 4 | 5152 | - | 9076 | - | 56.9 | - | 22.6 | - | C |
| 28 | Torrence Ave exit ramp | Diverge | 1500 | 4 | 5152 | 935 | 9200 | 2000 | 57.2 | 51.3 | 22.5 | 25.6 | C |
| 29 | Torrence Ave exit ramp to Torrence Ave entrance ramp | Basic | 6100 | 4 | 4217 | - | 9112 | - | 57.8 | - | 18.2 | - | C |
| 30 | Torrence Ave entrance ramp | Merge | 1500 | 4 | 5249 | 1032 | 9200 | 2000 | 56.8 | 55.1 | 23.1 | 21.8 | C |
| 31 | Torrence Ave entrance ramp to IL-394 NB entrance ramp | Basic | 700 | 4 | 5249 | - | 9060 | - | 56.5 | - | 23.2 | - | C |
| 32 | IL-394 NB entrance ramp | Merge | 1000 | 5 | 6242 | 993 | 11250 | 2000 | 55.3 | 55.3 | 22.6 | 22.6 | C |
| 33 | IL-394 SB entrance ramp | Merge | 1500 | 5 | 7371 | 1129 | 11250 | 2000 | 54.7 | 53.2 | 27.0 | 25.5 | C |
| 34 | West of I-94 | Basic | 3310 | 5 | 7371 | - | 11355 | - | 57.1 | - | 25.8 | - | C |

Table A.10: Synchro Intersection Capacity Analysis Results – Future Base Case (2040) AM and PM Peak Hour

| LOCATION | TYPE | EBL | EBR | EBR2 | NBL | NBR | NBR2 | NBT | SBL | SBR | SBR2 | SBT | WBL | WBR | WBR2 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| AM | | | | | | | | | | | | | | | |
| Torrence Avenue – single point intersection | Control Delay | 71.6 | | 18.3 | 92.8 | | 1.8 | 27.2 | 77.5 | | 32.7 | 47.0 | 63.6 | | 17.2 |
| | LOS | E | | B | F | | A | C | E | | C | D | E | | B |
| | v/c Ratio | 0.89 | | 0.47 | 1.07 | | 0.09 | 0.45 | 0.72 | | 0.87 | 0.42 | 0.57 | | 0.30 |
| Burr Street I/C – south ramp terminal | Control Delay | | | | | 0.2 | | 4.1 | 34.3 | | | 0 | | | |
| | LOS | | | | | A | | A | C | | | A | | | |
| | v/c Ratio | | | | | 0.16 | | 0.11 | 0.34 | | | 0.06 | | | |
| Burr Street I/C – north ramp terminal | Control Delay | | | | 5.2 | | | 4.9 | | 1.4 | | 13.4 | 33 | 5.1 | |
| | LOS | | | | A | | | A | | A | | B | C | A | |
| | v/c Ratio | | | | 0.26 | | | 0.13 | | 0.28 | | 0.11 | 0.57 | 0.3 | |
| Grant Street I/C – south ramp terminal | Control Delay | 31.6 | 7.7 | | | | | 6.2 | | | | 4.7 | | | |
| | LOS | C | A | | | | | A | | | | A | | | |
| | v/c Ratio | 0.39 | 0.5 | | | | | 0.25 | | | | 0.13 | | | |
| Grant Street I/C – north ramp terminal | Control Delay | | | | | | | 3.1 | | | | 4.3 | 32.9 | 9.9 | |
| | LOS | | | | | | | A | | | | A | C | A | |
| | v/c Ratio | | | | | | | 0.16 | | | | 0.2 | 0.25 | 0.52 | |
| Broadway I/C – south ramp terminal | Control Delay | 24.5 | 4.8 | | | | | 9.5 | | | | 10.8 | | | |
| | LOS | C | A | | | | | A | | | | B | | | |
| | v/c Ratio | 0.57 | 0.44 | | | | | 0.34 | | | | 0.22 | | | |
| Broadway I/C – north ramp terminal | Control Delay | | | | | | | 5.1 | | | | 7.1 | 26.7 | 6.1 | |
| | LOS | | | | | | | A | | | | A | C | A | |
| | v/c Ratio | | | | | | | 0.29 | | | | 0.22 | 0.52 | 0.31 | |
| PM | | | | | | | | | | | | | | | |
| Torrence Avenue – single point intersection | Control Delay | 162.5 | | 46.7 | 88.1 | | 6 | 40.2 | 62.9 | | 11.2 | 43.4 | 153.5 | | 31.2 |
| | LOS | F | | D | F | | A | D | E | | B | D | F | | C |
| | v/c Ratio | 1.23 | | 0.93 | 0.99 | | 0.21 | 0.5 | 0.76 | | 0.52 | 0.6 | 1.16 | | 0.57 |
| Burr Street I/C – south ramp terminal | Control Delay | | | | | 0.2 | | 5.6 | 25 | | | 0.1 | | | |
| | LOS | | | | | A | | A | | | | A | | | |
| | v/c Ratio | | | | | 0.14 | | 0.15 | 0.45 | | | 0.13 | | | |
| Burr Street I/C – north ramp terminal | Control Delay | | | | 7.8 | | | 8.2 | | 2 | | 18.6 | 33.6 | 0.8 | |
| | LOS | | | | A | | | A | | A | | B | C | A | |
| | v/c Ratio | | | | 0.32 | | | 0.3 | | 0.35 | | 0.28 | 0.72 | 0.15 | |
| Grant Street I/C – south ramp terminal | Control Delay | 33.6 | 25.7 | | | | | 13.6 | | | | 13.7 | | | |
| | LOS | C | C | | | | | B | | | | B | | | |
| | v/c Ratio | 0.63 | 0.65 | | | | | 0.33 | | | | 0.27 | | | |
| Grant Street I/C – north ramp terminal | Control Delay | | | | | | | 5.8 | | | | 8.6 | 33.6 | 30.8 | |
| | LOS | | | | | | | A | | | | A | C | C | |
| | v/c Ratio | | | | | | | 0.29 | | | | 0.39 | 0.29 | 0.73 | |
| Broadway I/C – south ramp terminal | Control Delay | 29 | 19.4 | | | | | 9.8 | | | | 10.4 | | | |
| | LOS | C | B | | | | | A | | | | B | | | |
| | v/c Ratio | 0.68 | 0.74 | | | | | 0.45 | | | | 0.36 | | | |
| Broadway I/C – north ramp terminal | Control Delay | | | | | | | 4.4 | | | | 8.1 | 31.3 | 7.6 | |
| | LOS | | | | | | | A | | | | A | C | A | |
| | v/c Ratio | | | | | | | 0.37 | | | | 0.48 | 0.62 | 0.37 | |

# APPENDIX B

## TSMO Strategy Cost Estimates

**Table B.1a: Ramp Metering Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Miscellaneous (guardrail, pavement patching, etc) | 350,000 | 1 | 350,000 |
| Cantilevers | 125,000 | 3 | 375,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 750,000 | 1 | 750,000 |
| Civil Infrastructure - Subtotal | | | 1,480,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Signal poles, heads, loops, cabling | 10,300 | 7 | 280,000 |
| Cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Ramp metering software | 150,000 | 1 | 150,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Integration and testing (5% of construction cost) | 74,500 | 1 | 74,500 |
| Systems Subtotal | | | 1,570,000 |
| Design (15%) | | | 456,000 |
| Project Management (5%) | | | 152,000 |
| **Subtotal** | | | **3,650,000** |
| Contingency (30%) | | | 1,100,000 |
| **Total** | | | **4,750,000** |
| Yearly operations and maintenance | | | 172,000 |

**Table B.1b: Ramp Metering Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Miscellaneous (guardrail, pavement patching, etc.) | | | |
| Cantilevers | | | |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | | | |
| Civil Infrastructure - Subtotal | | | 0 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Signal poles, heads, loops, cabling | | | |
| Cabinets, controllers, handholes, power service, communications | | | |
| Ramp metering software | | | |
| Communications redundancy and protection of existing equipment | | | |
| Integration and testing (5% of construction cost) | | | |
| Systems Subtotal | | | 0 |
| Design (15%) | | | |
| Project Management (5%) | | | |
| **Subtotal** | | | **0** |
| Contingency (30%) | | | |
| **Total** | | | **0** |
| Yearly operations and maintenance | | | |

**Table B.1c: Ramp Metering Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Miscellaneous (guardrail, pavement patching, etc) | 350,000 | 1 | 350,000 |
| Cantilevers | 125,000 | 3 | 375,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 750,000 | 1 | 750,000 |
| **Civil Infrastructure - Subtotal** | | | **1,480,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Signal poles, heads, loops, cabling | 10,300 | 7 | 280,000 |
| Cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Ramp metering software | 150,000 | 1 | 150,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Integration and testing (5% of construction cost) | 74,500 | 1 | 74,500 |
| **Systems Subtotal** | | | **1,570,000** |
| Design (15%) | | | 456,000 |
| Project Management (5%) | | | 152,000 |
| **Subtotal** | | | **3,650,000** |
| Contingency (30%) | | | 1,100,000 |
| **Total** | | | **4,750,000** |
| Yearly operations and maintenance | | | 172,000 |

**Table B.2a: Lane Control Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 3,680,000 |
| Pavement Replacement | 20 | 13,400 | 268,000 |
| Pavement Removal | 150 | 13,400 | 2,010,000 |
| Barrier Wall, Concrete, Remove | 25 | 10,000 | 250,000 |
| Concrete Median Barrier, Modified | 100 | 10,000 | 1,000,000 |
| Lighting, Markings, ITS | 100,000 | 1 | 100,000 |
| Casting, Adjust to Grade | 50,000 | 1 | 50,000 |
| Pavement Improvements (Alternative 3) | | | 1,780,000 |
| Joint Repair (inside and outside shoulders) | 60 | 29,600 | 1,780,000 |
| Drainage Improvements (Alternative 5) | | | 1,800,000 |
| Pavement Removal | 50 | 3,200 | 160,000 |
| Pavement Patching | 350 | 3,200 | 1,120,000 |
| Casting, Adjust to Grade | 250,000 | 1 | 250,000 |
| Clean Inlet | 250,000 | 1 | 250,000 |
| Inlet, Patching | 125 | 100 | 12,500 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 13,000,000 | 1 | 13,000,000 |
| **Civil Infrastructure - Subtotal** | | | **20,300,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Gantry structures and foundations | 220,000 | 58 | 12,800,000 |
| Gantry equipment/cabling | 25,000 | 58 | 1,450,000 |
| Lane control signs | 105,000 | 58 | 6,090,000 |
| Gantry mounted CCTV cameras | 8,000 | 58 | 464,000 |
| Cabinets, handholes, power service, communications | 61,750 | 58 | 3,590,000 |
| Central ATM software | 350,000 | 1 | 350,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Integration and testing (2% of construction cost) | 503,910 | 1 | 504,000 |
| **Systems Subtotal** | | | **25,700,000** |
| Design (10%) | | | 4,600,000 |
| Project Management (5%) | | | 2,300,000 |
| **Subtotal** | | | **52,900,000** |
| Contingency (30%) | | | 15,900,000 |
| **Total** | | | **68,700,000** |
| Yearly operations and maintenance | | | 724,000 |

**Table B.2b: Lane Control Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | |
| Pavement Replacement | | | |
| Pavement Removal | | | |
| Barrier Wall, Concrete, Remove | | | |
| Concrete Median Barrier, Modified | | | |
| Lighting, Markings, ITS | | | |
| Casting, Adjust to Grade | | | |
| Pavement Improvements (Alternative 3) | | | |
| Joint Repair (inside and outside shoulders) | | | |
| Drainage Improvements (Alternative 5) | | | |
| Pavement Removal | | | |
| Pavement Patching | | | |
| Casting, Adjust to Grade | | | |
| Clean Inlet | | | |
| Inlet, Patching | | | |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 1,750,000 | 1 | 1,750,000 |
| Civil Infrastructure - Subtotal | | | 1,750,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Gantry structures and foundations | 220,000 | 5 | 1,100,000 |
| Gantry equipment/cabling | 25,000 | 5 | 125,000 |
| Lane control signs | 105,000 | 5 | 525,000 |
| CCTV cameras | 8,000 | 6 | 48,000 |
| Cabinets, handholes, power service, communications | 61,750 | 6 | 371,000 |
| Cantilever Structures and Foundations (Wentworth) | 170,000 | 1 | 170,000 |
| Cantilever equipment/cabling | 16,000 | 1 | 16,000 |
| Lane control signs (Inside shoulder only) | 30,000 | 1 | 30,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 61,090 | 1 | 61,100 |
| Systems Subtotal | | | 3,120,000 |
| Design (10%) | | | 487,000 |
| Project Management (5%) | | | 244,000 |
| **Subtotal** | | | **5,600,000** |
| Contingency (30%) | | | 1,680,000 |
| **Total** | | | **7,280,000** |
| Yearly operations and maintenance | | | 203,000 |

**Table B.2c: Lane Control Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 3,680,000 |
| Pavement Replacement | 20 | 13,400 | 268,000 |
| Pavement Removal | 150 | 13,400 | 2,010,000 |
| Barrier Wall, Concrete, Remove | 25 | 10,000 | 250,000 |
| Concrete Median Barrier, Modified | 100 | 10,000 | 1,000,000 |
| Lighting, Markings, ITS | 100,000 | 1 | 100,000 |
| Casting, Adjust to Grade | 50,000 | 1 | 50,000 |
| Pavement Improvements (Alternative 3) | | | 1,780,000 |
| Joint Repair (inside and outside shoulders) | 60 | 29,600 | 1,780,000 |
| Drainage Improvements (Alternative 5) | | | 1,800,000 |
| Pavement Removal | 50 | 3,200 | 160,000 |
| Pavement Patching | 350 | 3,200 | 1,120,000 |
| Casting, Adjust to Grade | 250,000 | 1 | 250,000 |
| Clean Inlet | 250,000 | 1 | 250,000 |
| Inlet, Patching | 125 | 100 | 12,500 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 14,750,000 | 1 | 14,800,000 |
| **Civil Infrastructure - Subtotal** | | | **22,000,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Gantry structures and foundations | 220,000 | 63 | 13,900,000 |
| Gantry equipment/cabling | 25,000 | 63 | 1,580,000 |
| Lane control signs | 105,000 | 63 | 6,620,000 |
| CCTV cameras | 8,000 | 64 | 512,000 |
| Cabinets, handholes, power service, communications | 61,750 | 64 | 3,960,000 |
| Central ATM software | 350,000 | 1 | 350,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Cantilever Structures and Foundations (Wentworth) | 170,000 | 1 | 170,000 |
| Cantilever equipment/cabling | 16,000 | 1 | 16,000 |
| Lane control signs (Inside shoulder only) | 30,000 | 1 | 30,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 565,000 | 1 | 565,000 |
| **Systems Subtotal** | | | **28,900,000** |
| Design (10%) | | | 5,090,000 |
| Project Management (5%) | | | 2,550,000 |
| **Subtotal** | | | **58,500,000** |
| Contingency (30%) | | | 17,600,000 |
| **Total** | | | **76,000,000** |
| Yearly operations and maintenance | | | 787,000 |

**Table B.3a: Dynamic Shoulder Lanes Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 3,680,000 |
| Pavement Replacement | 20 | 13,400 | 268,000 |
| Pavement Removal | 150 | 13,400 | 2,010,000 |
| Barrier Wall, Concrete, Remove | 25 | 10,000 | 250,000 |
| Concrete Median Barrier, Modified | 100 | 10,000 | 1,000,000 |
| Lighting, Markings, ITS | 100,000 | 1 | 100,000 |
| Casting, Adjust to Grade | 50,000 | 1 | 50,000 |
| Pavement Improvements (Alternative 3) | | | 1,780,000 |
| Joint Repair (inside and outside shoulders) | 60 | 29,600 | 1,780,000 |
| Drainage Improvements (Alternative 5) | | | 1,800,000 |
| Pavement Removal | 50 | 3,200 | 160,000 |
| Pavement Patching | 350 | 3,200 | 1,120,000 |
| Casting, Adjust to Grade | 250,000 | 1 | 250,000 |
| Clean Inlet | 250,000 | 1 | 250,000 |
| Inlet, Patching | 125 | 100 | 12,500 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 13,000,000 | 1 | 13,000,000 |
| Noise Barrier Modifications (Provision) | 2,358,000 | 1 | 2,360,000 |
| **Civil Infrastructure - Subtotal** | | | **22,700,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 58 | 9,860,000 |
| Cantilever equipment/cabling | 16,000 | 58 | 928,000 |
| Lane control signs | 30,000 | 58 | 1,740,000 |
| CCTV cameras | 8,000 | 58 | 464,000 |
| Cabinets, handholes, power service, communications | 61,750 | 58 | 3,590,000 |
| Central ATM software | 350,000 | 1 | 350,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Integration and testing (2% of construction cost) | 348,470 | 1 | 349,000 |
| **Systems Subtotal** | | | **17,800,000** |
| Design (10%) | | | 4,040,000 |
| Project Management (5%) | | | 2,020,000 |
| **Subtotal** | | | **46,500,000** |
| Contingency (30%) | | | 14,000,000 |
| **Total** | | | **60,400,000** |
| Yearly operations and maintenance | | | 566,000 |

**Table B.3b: Dynamic Shoulder Lanes Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 956,000 |
| Pavement Replacement | 20 | 3,400 | 68,000 |
| Pavement Removal | 150 | 3,400 | 510,000 |
| Barrier Wall, Concrete, Remove | 25 | 2,500 | 62,500 |
| Concrete Median Barrier, Modified | 100 | 2,500 | 250,000 |
| Lighting, Markings, ITS | 50,000 | 1 | 50,000 |
| Casting, Adjust to Grade | 15,000 | 1 | 15,000 |
| Pavement Improvements (Alternative 3) | | | 159,000 |
| Joint Repair (inside and outside shoulders) | 60 | 2,640 | 159,000 |
| Drainage Improvements (Alternative 5) | | | 102,000 |
| Pavement Removal | 50 | 200 | 10,000 |
| Pavement Patching | 350 | 200 | 70,000 |
| Casting, Adjust to Grade | 10,000 | 1 | 10,000 |
| Clean Inlet | 10,000 | 1 | 10,000 |
| Inlet, Patching | 125 | 10 | 1,250 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 2,500,000 | 1 | 2,500,000 |
| Noise Barrier Modifications (Provision) | 1,305,000 | 1 | 1,310,000 |
| **Civil Infrastructure - Subtotal** | | | **5,030,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 6 | 1,020,000 |
| Cantilever equipment/cabling | 16,000 | 6 | 96,000 |
| Lane control signs | 30,000 | 6 | 180,000 |
| CCTV cameras | 8,000 | 6 | 48,000 |
| Cabinets, handholes, power service, communications | 61,750 | 6 | 371,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 47,690 | 1 | 47,700 |
| **Systems Subtotal** | | | **2,440,000** |
| Design (10%) | | | 746,000 |
| Project Management (5%) | | | 373,000 |
| **Subtotal** | | | **8,580,000** |
| Contingency (30%) | | | 2,580,000 |
| **Total** | | | **11,200,000** |
| Yearly operations and maintenance | | | 259,000 |

**Table B.3c: Dynamic Shoulder Lanes Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 4,640,000 |
| Pavement Replacement | 20 | 16,800 | 336,000 |
| Pavement Removal | 150 | 16,800 | 2,520,000 |
| Barrier Wall, Concrete, Remove | 25 | 12,500 | 313,000 |
| Concrete Median Barrier, Modified | 100 | 12,500 | 1,250,000 |
| Lighting, Markings, ITS | 150,000 | 1 | 150,000 |
| Casting, Adjust to Grade | 65,000 | 1 | 65,000 |
| Pavement Improvements (Alternative 3) | | | 1,940,000 |
| Joint Repair (inside and outside shoulders) | 60 | 32,240 | 1,940,000 |
| Drainage Improvements (Alternative 5) | | | 1,900,000 |
| Pavement Removal | 50 | 3,400 | 170,000 |
| Pavement Patching | 350 | 3,400 | 1,190,000 |
| Casting, Adjust to Grade | 260,000 | 1 | 260,000 |
| Clean Inlet | 260,000 | 1 | 260,000 |
| Inlet, Patching | 125 | 110 | 13,800 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 15,500,000 | 1 | 15,500,000 |
| Noise Barrier Modifications (Provision) | 3,663,000 | 1 | 3,670,000 |
| Civil Infrastructure - Subtotal | | | 27,700,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 64 | 10,900,000 |
| Cantilever equipment/cabling | 16,000 | 64 | 1,030,000 |
| Lane control signs | 30,000 | 64 | 1,920,000 |
| CCTV cameras | 8,000 | 64 | 512,000 |
| Cabinets, handholes, power service, communications | 61,750 | 64 | 3,960,000 |
| Central ATM software | 350,000 | 1 | 350,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 396,160 | 1 | 397,000 |
| Systems Subtotal | | | 20,300,000 |
| Design (10%) | | | 4,790,000 |
| Project Management (5%) | | | 2,400,000 |
| **Subtotal** | | | **55,100,000** |
| Contingency (30%) | | | 16,600,000 |
| **Total** | | | **71,600,000** |
| Yearly operations and maintenance | | | 615,000 |

**Table B.4a: Variable Speed Limit Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 3,500,000 | 1 | 3,500,000 |
| Pavement Patching & Removal | 15,000 | 49 | 735,000 |
| Civil Infrastructure - Subtotal | | | 4,240,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Inside/outside shoulder VSL's | 78,000 | 49 | 3,830,000 |
| Cabinets, handholes, power service, communications | 61,750 | 49 | 3,030,000 |
| Microwave radar detector | 6,000 | 49 | 294,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Integration and testing (2% of construction cost) | 152,835 | 1 | 153,000 |
| Systems Subtotal | | | 7,800,000 |
| Design (10%) | | | 1,210,000 |
| Project Management (5%) | | | 602,000 |
| **Subtotal** | | | **13,900,000** |
| Contingency (30%) | | | 4,160,000 |
| **Total** | | | **18,000,000** |
| Yearly operations and maintenance | | | 156,000 |

**Table B.4b: Variable Speed Limit Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 750,000 | 1 | 750,000 |
| Pavement Patching & Removal | | | |
| Civil Infrastructure - Subtotal | | | 750,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Standalone VSL's | 40,000 | 8 | 320,000 |
| Cabinets, handholes, power service, communications | 61,750 | 8 | 494,000 |
| Microwave radar detector | 6,000 | 8 | 48,000 |
| Integration and testing (2% of construction cost) | 17,240 | 1 | 17,300 |
| Systems Subtotal | | | 880,000 |
| Design (10%) | | | 163,000 |
| Project Management (5%) | | | 81,500 |
| **Subtotal** | | | **1,880,000** |
| Contingency (30%) | | | 563,000 |
| **Total** | | | **2,440,000** |
| Yearly operations and maintenance | | | 17,600 |

**Table B.4c: Variable Speed Limit Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 4,250,000 | 1 | 4,250,000 |
| Pavement Patching & Removal | 15,000 | 49 | 735,000 |
| Civil Infrastructure - Subtotal | | | 4,990,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Inside/outside shoulder VSL's | 78,000 | 49 | 3,830,000 |
| Cabinets, handholes, power service, communications | 61,750 | 57 | 3,520,000 |
| Microwave radar detector | 6,000 | 57 | 342,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Standalone VSL's | 40,000 | 8 | 320,000 |
| Integration and testing (2% of construction cost) | 170,075 | 1 | 171,000 |
| Systems Subtotal | | | 8,680,000 |
| Design (10%) | | | 1,370,000 |
| Project Management (5%) | | | 683,000 |
| **Subtotal** | | | **15,800,000** |
| Contingency (30%) | | | 4,720,000 |
| **Total** | | | **20,500,000** |
| Yearly operations and maintenance | | | 174,000 |

**Table B.5a: Dynamic Shoulder Lanes and Ramp Metering Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 3,680,000 |
| Pavement Replacement | 20 | 13,400 | 268,000 |
| Pavement Removal | 150 | 13,400 | 2,010,000 |
| Barrier Wall, Concrete, Remove | 25 | 10,000 | 250,000 |
| Concrete Median Barrier, Modified | 100 | 10,000 | 1,000,000 |
| Lighting, Markings, ITS | 100,000 | 1 | 100,000 |
| Casting, Adjust to Grade | 50,000 | 1 | 50,000 |
| Pavement Improvements (Alternative 3) | | | 1,780,000 |
| Joint Repair (inside and outside shoulders) | 60 | 29,600 | 1,780,000 |
| Drainage Improvements (Alternative 5) | | | 1,800,000 |
| Pavement Removal | 50 | 3,200 | 160,000 |
| Pavement Patching | 350 | 3,200 | 1,120,000 |
| Casting, Adjust to Grade | 250,000 | 1 | 250,000 |
| Clean Inlet | 250,000 | 1 | 250,000 |
| Inlet, Patching | 125 | 100 | 12,500 |
| Miscellaneous (guardrail, pavement patching, etc) | 350,000 | 1 | 350,000 |
| Cantilevers | 125,000 | 5 | 625,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 13,500,000 | 1 | 13,500,000 |
| Noise Barrier Modifications (Provision) | 2,358,000 | 1 | 2,360,000 |
| Civil Infrastructure - Subtotal | | | 24,100,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 58 | 9,860,000 |
| Cantilever equipment/cabling | 16,000 | 58 | 928,000 |
| Lane control signs | 30,000 | 58 | 1,740,000 |
| CCTV cameras | 8,000 | 58 | 464,000 |
| Cabinets, handholes, power service, communications | 61,750 | 58 | 3,590,000 |
| Signal poles, heads, loops, cabling | 10,300 | 7 | 72,100 |
| Cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Ramp metering software | 150,000 | 7 | 1,050,000 |
| Central ATM software | 350,000 | 1 | 350,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Integration and testing (2% of construction cost) | 382,112 | 1 | 383,000 |
| Systems Subtotal | | | 19,500,000 |
| Design (10%) | | | 4,360,000 |
| Project Management (5%) | | | 2,180,000 |
| **Subtotal** | | | **50,200,000** |
| Contingency (30%) | | | 15,100,000 |
| **Total** | | | **65,200,000** |
| Yearly operations and maintenance | | | 670,000 |

**Table B.5b: Dynamic Shoulder Lanes and Ramp Metering Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 956,000 |
| Pavement Replacement | 20 | 3,400 | 68,000 |
| Pavement Removal | 150 | 3,400 | 510,000 |
| Barrier Wall, Concrete, Remove | 25 | 2,500 | 62,500 |
| Concrete Median Barrier, Modified | 100 | 2,500 | 250,000 |
| Lighting, Markings, ITS | 50,000 | 1 | 50,000 |
| Casting, Adjust to Grade | 15,000 | 1 | 15,000 |
| Pavement Improvements (Alternative 3) | | | 159,000 |
| Joint Repair (inside and outside shoulders) | 60 | 2,640 | 159,000 |
| Drainage Improvements (Alternative 5) | | | 102,000 |
| Pavement Removal | 50 | 200 | 10,000 |
| Pavement Patching | 350 | 200 | 70,000 |
| Casting, Adjust to Grade | 10,000 | 1 | 10,000 |
| Clean Inlet | 10,000 | 1 | 10,000 |
| Inlet, Patching | 125 | 10 | 1,250 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 2,500,000 | 1 | 2,500,000 |
| Noise Barrier Modifications (Provision) | 1,305,000 | 1 | 1,310,000 |
| **Civil Infrastructure - Subtotal** | | | **5,030,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 6 | 1,020,000 |
| Cantilever equipment/cabling | 16,000 | 6 | 96,000 |
| Lane control signs | 30,000 | 6 | 180,000 |
| CCTV cameras | 8,000 | 6 | 48,000 |
| Cabinets, handholes, power service, communications | 61,750 | 6 | 371,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 47,690 | 1 | 47,700 |
| **Systems Subtotal** | | | **2,440,000** |
| Design (10%) | | | 746,000 |
| Project Management (5%) | | | 373,000 |
| **Subtotal** | | | **8,580,000** |
| Contingency (30%) | | | 2,580,000 |
| **Total** | | | **11,200,000** |
| Yearly operations and maintenance | | | 259,000 |

**Table B.5c: Dynamic Shoulder Lanes and Ramp Metering Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 4,640,000 |
| Pavement Replacement | 20 | 16,800 | 336,000 |
| Pavement Removal | 150 | 16,800 | 2,520,000 |
| Barrier Wall, Concrete, Remove | 25 | 12,500 | 313,000 |
| Concrete Median Barrier, Modified | 100 | 12,500 | 1,250,000 |
| Lighting, Markings, ITS | 150,000 | 1 | 150,000 |
| Casting, Adjust to Grade | 65,000 | 1 | 65,000 |
| Pavement Improvements (Alternative 3) | | | 1,940,000 |
| Joint Repair (inside and outside shoulders) | 60 | 32,240 | 1,940,000 |
| Drainage Improvements (Alternative 5) | | | 1,900,000 |
| Pavent Removal | 50 | 3,400 | 170,000 |
| Pavment Patching | 350 | 3,400 | 1,190,000 |
| Casting, Adjust to Grade | 260,000 | 1 | 260,000 |
| Clean Inlet | 260,000 | 1 | 260,000 |
| Inlet, Patching | 125 | 110 | 13,800 |
| Miscellaneous (guardrail, pavement patching, etc) | 350,000 | 1 | 350,000 |
| Cantilevers | 125,000 | 5 | 625,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 16,000,000 | 1 | 16,000,000 |
| Noise Barrier Modifications (Provision) | 3,663,000 | 1 | 3,670,000 |
| **Civil Infrastructure - Subtotal** | | | **29,100,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 64 | 10,900,000 |
| Cantilever equipment/cabling | 16,000 | 64 | 1,030,000 |
| Lane control signs | 30,000 | 64 | 1,920,000 |
| CCTV cameras | 8,000 | 64 | 512,000 |
| Cabinets, handholes, power service, communications | 61,750 | 64 | 3,960,000 |
| Signal poles, heads, loops, cabling | 10,300 | 7 | 72,100 |
| Cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Ramp metering software | 150,000 | 7 | 1,050,000 |
| Central ATM software | 350,000 | 1 | 350,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 429,802 | 1 | 430,000 |
| **Systems Subtotal** | | | **22,000,000** |
| Design (10%) | | | 5,110,000 |
| Project Management (5%) | | | 2,560,000 |
| **Subtotal** | | | **58,700,000** |
| Contingency (30%) | | | 17,700,000 |
| **Total** | | | **76,300,000** |
| Yearly operations and maintenance | | | 719,000 |

**Table B.6a: Dynamic Shoulder Lanes and Variable Speed Limits Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 3,680,000 |
| Pavement Replacement | 20 | 13,400 | 268,000 |
| Pavement Removal | 150 | 13,400 | 2,010,000 |
| Barrier Wall, Concrete, Remove | 25 | 10,000 | 250,000 |
| Concrete Median Barrier, Modified | 100 | 10,000 | 1,000,000 |
| Lighting, Markings, ITS | 100,000 | 1 | 100,000 |
| Casting, Adjust to Grade | 50,000 | 1 | 50,000 |
| Pavement Improvements (Alternative 3) | | | 1,780,000 |
| Joint Repair (inside and outside shoulders) | 60 | 29,600 | 1,780,000 |
| Drainage Improvements (Alternative 5) | | | 1,800,000 |
| Pavement Removal | 50 | 3,200 | 160,000 |
| Pavement Patching | 350 | 3,200 | 1,120,000 |
| Casting, Adjust to Grade | 250,000 | 1 | 250,000 |
| Clean Inlet | 250,000 | 1 | 250,000 |
| Inlet, Patching | 125 | 100 | 12,500 |
| Miscellaneous (guardrail, pavement patching, etc) | 1,100,000 | 1 | 1,100,000 |
| Cantilevers | 125,000 | 5 | 625,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 13,000,000 | 1 | 13,000,000 |
| Noise Barrier Modifications (Provision) | 2,358,000 | 1 | 2,360,000 |
| Civil Infrastructure - Subtotal | | | 24,400,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 58 | 9,860,000 |
| Cantilever equipment/cabling | 16,000 | 58 | 928,000 |
| Lane control signs | 30,000 | 58 | 1,740,000 |
| CCTV cameras | 8,000 | 58 | 464,000 |
| Cabinets, handholes, power service, communications | 61,750 | 58 | 3,590,000 |
| Central ATM software | 350,000 | 1 | 350,000 |
| Inside/outside shoulder VSL's | 14,000 | 49 | 686,000 |
| Microwave radar detector | 6,000 | 49 | 294,000 |
| Integration and testing (2% of construction cost) | 358,070 | 1 | 359,000 |
| Systems Subtotal | | | 18,300,000 |
| Design (10%) | | | 4,260,000 |
| Project Management (5%) | | | 2,130,000 |
| **Subtotal** | | | **49,000,000** |
| Contingency (30%) | | | 14,700,000 |
| **Total** | | | **63,700,000** |
| Yearly operations and maintenance | | | 576,000 |

**Table B.6b: Dynamic Shoulder Lanes and Variable Speed Limits Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 956,000 |
| Pavement Replacement | 20 | 3,400 | 68,000 |
| Pavement Removal | 150 | 3,400 | 510,000 |
| Barrier Wall, Concrete, Remove | 25 | 2,500 | 62,500 |
| Concrete Median Barrier, Modified | 100 | 2,500 | 250,000 |
| Lighting, Markings, ITS | 50,000 | 1 | 50,000 |
| Casting, Adjust to Grade | 15,000 | 1 | 15,000 |
| Pavement Improvements (Alternative 3) | | | 159,000 |
| Joint Repair (inside and outside shoulders) | 60 | 2,640 | 159,000 |
| Drainage Improvements (Alternative 5) | | | 102,000 |
| Pavement Removal | 50 | 200 | 10,000 |
| Pavement Patching | 350 | 200 | 70,000 |
| Casting, Adjust to Grade | 10,000 | 1 | 10,000 |
| Clean Inlet | 10,000 | 1 | 10,000 |
| Inlet, Patching | 125 | 10 | 1,250 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 3,000,000 | 1 | 3,000,000 |
| Noise Barrier Modifications (Provision) | 1,305,000 | 1 | 1,310,000 |
| **Civil Infrastructure - Subtotal** | | | **5,530,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 6 | 1,020,000 |
| Cantilever equipment/cabling | 16,000 | 6 | 96,000 |
| Lane control signs | 30,000 | 6 | 180,000 |
| CCTV cameras | 8,000 | 6 | 48,000 |
| Cabinets, handholes, power service, communications | 61,750 | 14 | 865,000 |
| Standalone VSL's | 40,000 | 8 | 320,000 |
| Microwave radar detector | 6,000 | 8 | 48,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 64,930 | 1 | 65,000 |
| **Systems Subtotal** | | | **3,320,000** |
| Design (10%) | | | 884,000 |
| Project Management (5%) | | | 442,000 |
| **Subtotal** | | | **10,200,000** |
| Contingency (30%) | | | 3,050,000 |
| **Total** | | | **13,300,000** |
| Yearly operations and maintenance | | | 207,000 |

**Table B.6c: Dynamic Shoulder Lanes and Variable Speed Limits Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 4,640,000 |
| Pavement Replacement | 20 | 16,800 | 336,000 |
| Pavement Removal | 150 | 16,800 | 2,520,000 |
| Barrier Wall, Concrete, Remove | 25 | 12,500 | 313,000 |
| Concrete Median Barrier, Modified | 100 | 12,500 | 1,250,000 |
| Lighting, Markings, ITS | 150,000 | 1 | 150,000 |
| Casting, Adjust to Grade | 65,000 | 1 | 65,000 |
| Pavement Improvements (Alternative 3) | | | 1,940,000 |
| Joint Repair (inside and outside shoulders) | 60 | 32,240 | 1,940,000 |
| Drainage Improvements (Alternative 5) | | | 1,900,000 |
| Pavent Removal | 50 | 3,400 | 170,000 |
| Pavment Patching | 350 | 3,400 | 1,190,000 |
| Casting, Adjust to Grade | 260,000 | 1 | 260,000 |
| Clean Inlet | 260,000 | 1 | 260,000 |
| Inlet, Patching | 125 | 110 | 13,800 |
| Miscellaneous (guardrail, pavement patching, etc) | 1,100,000 | 1 | 1,100,000 |
| Cantilevers | 125,000 | 5 | 625,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 16,000,000 | 1 | 16,000,000 |
| Noise Barrier Modifications (Provision) | 3,663,000 | 1 | 3,670,000 |
| Civil Infrastructure - Subtotal | | | 29,900,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 64 | 10,900,000 |
| Cantilever equipment/cabling | 16,000 | 64 | 1,030,000 |
| Lane control signs | 30,000 | 64 | 1,920,000 |
| CCTV cameras | 8,000 | 64 | 512,000 |
| Cabinets, handholes, power service, communications | 61,750 | 72 | 4,450,000 |
| Central ATM software | 350,000 | 1 | 350,000 |
| Inside/outside shoulder VSL's | 14,000 | 49 | 686,000 |
| Microwave radar detector | 6,000 | 57 | 342,000 |
| Standalone VSL's | 40,000 | 8 | 320,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 423,000 | 1 | 423,000 |
| Systems Subtotal | | | 21,600,000 |
| Design (10%) | | | 5,150,000 |
| Project Management (5%) | | | 2,580,000 |
| **Subtotal** | | | **59,200,000** |
| Contingency (30%) | | | 17,800,000 |
| **Total** | | | **76,900,000** |
| Yearly operations and maintenance | | | 642,000 |

**Table B.7a: Ramp Metering and Variable Speed Limits Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 4,250,000 | 1 | 4,250,000 |
| Miscellaneous (guardrail, pavement patching, etc) | 1,085,000 | 1 | 1,090,000 |
| Cantilevers | 125,000 | 5 | 625,000 |
| **Civil Infrastructure - Subtotal** | | | **5,960,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Inside/outside shoulder VSL's | 78,000 | 49 | 3,830,000 |
| Cabinets, handholes, power service, communications | 61,750 | 49 | 3,030,000 |
| Microwave radar detector | 6,000 | 49 | 294,000 |
| Signal poles, heads, loops, cabling | 10,300 | 7 | 72,100 |
| Cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Ramp metering software | 150,000 | 1 | 150,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Integration and testing (2% of construction cost) | 168,477 | 1 | 169,000 |
| **Systems Subtotal** | | | **8,600,000** |
| Design (10%) | | | 1,460,000 |
| Project Management (5%) | | | 728,000 |
| **Subtotal** | | | **16,800,000** |
| Contingency (30%) | | | 5,030,000 |
| **Total** | | | **21,800,000** |
| Yearly operations and maintenance | | | 312,000 |

**Table B.7b: Ramp Metering and Variable Speed Limits Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 750,000 | 1 | 750,000 |
| Pavement Patching & Removal | | | |
| Civil Infrastructure - Subtotal | | | 750,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Standalone VSL's | 40,000 | 8 | 320,000 |
| Cabinets, handholes, power service, communications | 61,750 | 8 | 494,000 |
| Microwave radar detector | 6,000 | 8 | 48,000 |
| Integration and testing (2% of construction cost) | 17,240 | 1 | 17,300 |
| Systems Subtotal | | | 880,000 |
| Design (10%) | | | 163,000 |
| Project Management (5%) | | | 81,500 |
| **Subtotal** | | | **1,880,000** |
| Contingency (30%) | | | 563,000 |
| **Total** | | | **2,440,000** |
| Yearly operations and maintenance | | | 17,600 |

**Table B.7c: Ramp Metering and Variable Speed Limits Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 5,000,000 | 1 | 5,000,000 |
| Miscellaneous (guardrail, pavement patching, etc) | 1,085,000 | 1 | 1,090,000 |
| Cantilevers | 125,000 | 5 | 625,000 |
| Pavement Patching & Removal | | | |
| Civil Infrastructure - Subtotal | | | 6,710,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Inside/outside shoulder VSL's | 78,000 | 49 | 3,830,000 |
| Cabinets, handholes, power service, communications | 61,750 | 57 | 3,520,000 |
| Microwave radar detector | 6,000 | 57 | 342,000 |
| Signal poles, heads, loops, cabling | 10,300 | 7 | 72,100 |
| Cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Ramp metering software | 150,000 | 1 | 150,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Standalone VSL's | 40,000 | 8 | 320,000 |
| Integration and testing (2% of construction cost) | 185,717 | 1 | 186,000 |
| Systems Subtotal | | | 9,480,000 |
| Design (10%) | | | 1,620,000 |
| Project Management (5%) | | | 810,000 |
| **Subtotal** | | | **18,700,000** |
| Contingency (30%) | | | 5,590,000 |
| **Total** | | | **24,200,000** |
| Yearly operations and maintenance | | | 330,000 |

**Table B.8a: Dynamic Shoulder Lanes, Ramp Metering, and Variable Speed Limits Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 13,500,000 | 1 | 13,500,000 |
| Ramp Metering Miscellaneous (guardrail, pavement patching, etc) | 1,085,000 | 1 | 1,090,000 |
| Cantilevers | 125,000 | 5 | 625,000 |
| Superelevation Correction | | | 3,680,000 |
| Pavement Replacement | 20 | 13,400 | 268,000 |
| Pavement Removal | 150 | 13,400 | 2,010,000 |
| Barrier Wall, Concrete, Remove | 25 | 10,000 | 250,000 |
| Concrete Median Barrier, Modified | 100 | 10,000 | 1,000,000 |
| Lighting, Markings, ITS | 100,000 | 1 | 100,000 |
| Casting, Adjust to Grade | 50,000 | 1 | 50,000 |
| Pavement Improvements (Alternative 3) | | | 1,780,000 |
| Joint Repair (inside and outside shoulders) | 60 | 29,600 | 1,780,000 |
| Drainage Improvements (Alternative 5) | | | 1,800,000 |
| Pavement Removal | 50 | 3,200 | 160,000 |
| Pavement Patching | 350 | 3,200 | 1,120,000 |
| Casting, Adjust to Grade | 250,000 | 1 | 250,000 |
| Clean Inlet | 250,000 | 1 | 250,000 |
| Inlet, Patching | 125 | 100 | 12,500 |
| Noise Barrier Modifications (Provision) | 2,358,000 | 1 | 2,360,000 |
| **Civil Infrastructure - Subtotal** | | | **24,900,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Inside/outside shoulder VSL's | 14,000 | 49 | 686,000 |
| Cabinets, handholes, power service, communications | 61,750 | 49 | 3,030,000 |
| Microwave radar detector | 6,000 | 49 | 294,000 |
| Signal poles, heads, loops, cabling | 10,300 | 7 | 72,100 |
| Cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Ramp metering software | 150,000 | 1 | 150,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 100 | 1,000,000 |
| Cantilever Structures and Foundations | 170,000 | 58 | 9,860,000 |
| Cantilever equipment/cabling | 16,000 | 58 | 928,000 |
| Lane control signs | 30,000 | 58 | 1,740,000 |
| CCTV cameras | 8,000 | 58 | 464,000 |
| Central ATM software | 350,000 | 1 | 350,000 |
| Integration and testing (2% of construction cost) | 382,597 | 1 | 383,000 |
| **Systems Subtotal** | | | **19,600,000** |
| Design (10%) | | | 4,440,000 |
| Project Management (5%) | | | 2,220,000 |
| **Subtotal** | | | **51,000,000** |
| Contingency (30%) | | | 15,300,000 |
| **Total** | | | **66,300,000** |
| Yearly operations and maintenance | | | 671,000 |

**Table B.8b: Dynamic Shoulder Lanes, Ramp Metering, and Variable Speed Limits Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 956,000 |
| Pavement Replacement | 20 | 3,400 | 68,000 |
| Pavement Removal | 150 | 3,400 | 510,000 |
| Barrier Wall, Concrete, Remove | 25 | 2,500 | 62,500 |
| Concrete Median Barrier, Modified | 100 | 2,500 | 250,000 |
| Lighting, Markings, ITS | 50,000 | 1 | 50,000 |
| Casting, Adjust to Grade | 15,000 | 1 | 15,000 |
| Pavement Improvements (Alternative 3) | | | 159,000 |
| Joint Repair (inside and outside shoulders) | 60 | 2,640 | 159,000 |
| Drainage Improvements (Alternative 5) | | | 102,000 |
| Pavement Removal | 50 | 200 | 10,000 |
| Pavement Patching | 350 | 200 | 70,000 |
| Casting, Adjust to Grade | 10,000 | 1 | 10,000 |
| Clean Inlet | 10,000 | 1 | 10,000 |
| Inlet, Patching | 125 | 10 | 1,250 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 3,000,000 | 1 | 3,000,000 |
| Noise Barrier Modifications (Provision) | 1,305,000 | 1 | 1,310,000 |
| Civil Infrastructure - Subtotal | | | 5,530,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 6 | 1,020,000 |
| Cantilever equipment/cabling | 16,000 | 6 | 96,000 |
| Lane control signs | 30,000 | 6 | 180,000 |
| CCTV cameras | 8,000 | 6 | 48,000 |
| Cabinets, handholes, power service, communications | 61,750 | 14 | 865,000 |
| Standalone VSL's | 40,000 | 8 | 320,000 |
| Microwave radar detector | 6,000 | 8 | 48,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 64,930 | 1 | 65,000 |
| Systems Subtotal | | | 3,320,000 |
| Design (10%) | | | 884,000 |
| Project Management (5%) | | | 442,000 |
| **Subtotal** | | | **10,200,000** |
| Contingency (30%) | | | 3,050,000 |
| **Total** | | | **13,300,000** |
| Yearly operations and maintenance | | | 207,000 |

**Table B.8c: Dynamic Shoulder Lanes, Ramp Metering, and Variable Speed Limits Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 16,500,000 | 1 | 16,500,000 |
| Ramp Metering Miscellaneous (guardrail, pavement patching, etc) | 1,085,000 | 1 | 1,090,000 |
| Cantilevers | 125,000 | 5 | 625,000 |
| Superelevation Correction | | | 4,640,000 |
| Pavement Replacement | 20 | 16,800 | 336,000 |
| Pavement Removal | 150 | 16,800 | 2,520,000 |
| Barrier Wall, Concrete, Remove | 25 | 12,500 | 313,000 |
| Concrete Median Barrier, Modified | 100 | 12,500 | 1,250,000 |
| Lighting, Markings, ITS | 150,000 | 1 | 150,000 |
| Casting, Adjust to Grade | 65,000 | 1 | 65,000 |
| Pavement Improvements (Alternative 3) | | | 1,940,000 |
| Joint Repair (inside and outside shoulders) | 60 | 32,240 | 1,940,000 |
| Drainage Improvements (Alternative 5) | | | 1,900,000 |
| Pavement Removal | 50 | 3,400 | 170,000 |
| Pavement Patching | 350 | 3,400 | 1,190,000 |
| Casting, Adjust to Grade | 260,000 | 1 | 260,000 |
| Clean Inlet | 260,000 | 1 | 260,000 |
| Inlet, Patching | 125 | 110 | 13,800 |
| Noise Barrier Modifications (Provision) | 3,663,000 | 1 | 3,670,000 |
| **Civil Infrastructure - Subtotal** | | | **30,400,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Inside/outside shoulder VSL's | 14,000 | 49 | 686,000 |
| Cabinets, handholes, power service, communications | 61,750 | 63 | 3,900,000 |
| Microwave radar detector | 6,000 | 57 | 342,000 |
| Signal poles, heads, loops, cabling | 10,300 | 7 | 72,100 |
| Cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Ramp metering software | 150,000 | 1 | 150,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 100 | 1,000,000 |
| Cantilever Structures and Foundations | 170,000 | 64 | 10,900,000 |
| Cantilever equipment/cabling | 16,000 | 64 | 1,030,000 |
| Lane control signs | 30,000 | 64 | 1,920,000 |
| CCTV cameras | 8,000 | 64 | 512,000 |
| Central ATM software | 350,000 | 1 | 350,000 |
| Standalone VSL's | 40,000 | 8 | 320,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 447,527 | 1 | 448,000 |
| **Systems Subtotal** | | | **22,900,000** |
| Design (10%) | | | 5,320,000 |
| Project Management (5%) | | | 2,660,000 |
| **Subtotal** | | | **61,200,000** |
| Contingency (30%) | | | 18,400,000 |
| **Total** | | | **79,500,000** |
| Yearly operations and maintenance | | | 737,000 |

**Table B.9a: Queue Warning Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 3,000,000 | 1 | 3,000,000 |
| | | | |
| Civil Infrastructure - Subtotal | | | 3,000,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Butterfly Mounted DMS | 217,000 | 29 | 3,260,000 |
| Cabinets, Handholes, Power Service, Communications | 61,750 | 29 | 927,000 |
| Queue Warning Software | 250,000 | 1 | 250,000 |
| Center to Center Integration | 100,000 | 1 | 100,000 |
| Communications Redundancy and Protection of Existing Equipment | 10,000 | 50 | 500,000 |
| Integration and testing (2% of construction cost) | 100,625 | 1 | 101,000 |
| Systems Subtotal | | | 5,140,000 |
| Design (10%) | | | 814,000 |
| Project Management (5%) | | | 407,000 |
| **Subtotal** | | | **9,360,000** |
| Contingency (30%) | | | 2,810,000 |
| **Total** | | | **12,200,000** |
| Yearly operations and maintenance | | | 103,000 |

**Table B.9b: Queue Warning Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 300,000 | 1 | 300,000 |
| | | | |
| Civil Infrastructure - Subtotal | | | 300,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 13,400 | 1 | 13,400 |
| Systems Subtotal | | | 684,000 |
| Design (10%) | | | 98,400 |
| Project Management (5%) | | | 49,200 |
| **Subtotal** | | | **1,140,000** |
| Contingency (30%) | | | 340,000 |
| **Total** | | | **1,480,000** |
| Yearly operations and maintenance | | | 13,700 |

**Table B.9c: Queue Warning Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 3,300,000 | 1 | 3,300,000 |
| | | | |
| Civil Infrastructure - Subtotal | | | 3,300,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Butterfly Mounted DMS | 217,000 | 29 | 3,260,000 |
| Cabinets, Handholes, Power Service, Communications | 61,750 | 29 | 927,000 |
| Queue Warning Software | 250,000 | 1 | 250,000 |
| Center to Center Integration | 100,000 | 1 | 100,000 |
| Communications Redundancy and Protection of Existing Equipment | 10,000 | 50 | 500,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Integration and testing (2% of construction cost) | 114,025 | 1 | 115,000 |
| Systems Subtotal | | | 5,820,000 |
| Design (10%) | | | 912,000 |
| Project Management (5%) | | | 456,000 |
| **Subtotal** | | | **10,500,000** |
| Contingency (30%) | | | 3,150,000 |
| **Total** | | | **13,700,000** |
| Yearly operations and maintenance | | | 117,000 |

**Table B.10a: Broadway Interchange and I-65 Interchange Modifications Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 250,000 | 1 | 250,000 |
| Exit Ramp to SB I-65 | | | 1,110,000 |
| Pavement Removal | 20 | 2,800 | 56,000 |
| Pavement, Full Depth Widening | 150 | 2,800 | 420,000 |
| Barrier Wall Concrete, Remove | 25 | 1,000 | 25,000 |
| Retaining Wall & Moment Slab | 600,000 | 1 | 600,000 |
| EB I-80/94 Shoulder Work | | | 1,050,000 |
| Pavement Removal | 20 | 10,700 | 214,000 |
| Pavement, Full Depth Replacement | 150 | 4,700 | 705,000 |
| Barrier Wall Concrete, Remove | 25 | 1,000 | 25,000 |
| Concrete Median Barrier | 100 | 1,000 | 100,000 |
| Broadway Ave Interchange | | | 375,000 |
| Signal Modification | 125,000 | 1 | 125,000 |
| Pavement and Barrier Improvements | 250,000 | 1 | 250,000 |
| Civil Infrastructure - Subtotal | | | 2,770,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| | | | |
| | | | |
| Systems Subtotal | | | 0 |
| Design (10%) | | | 277,000 |
| Project Management (5%) | | | 139,000 |
| **Subtotal** | | | **3,190,000** |
| Contingency (30%) | | | 956,000 |
| **Total** | | | **4,150,000** |
| | | | |

**Table B.10b: Broadway Interchange and I-65 Interchange Modifications Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| | | | |
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| | | | |
| | | | |
| Civil Infrastructure - Subtotal | | | 0 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| | | | |
| | | | |
| Systems Subtotal | | | 0 |
| Design (10%) | | | 0 |
| Project Management (5%) | | | 0 |
| **Subtotal** | | | **0** |
| Contingency (30%) | | | 0 |
| **Total** | | | **0** |
| | | | |

**Table B.10c: Broadway Interchange and I-65 Interchange Modifications Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 250,000 | 1 | 250,000 |
| Exit Ramp to SB I-65 | | | 1,110,000 |
| Pavement Removal | 20 | 2,800 | 56,000 |
| Pavement, Full Depth Widening | 150 | 2,800 | 420,000 |
| Barrier Wall Concrete, Remove | 25 | 1,000 | 25,000 |
| Retaining Wall & Moment Slab | 600,000 | 1 | 600,000 |
| EB I-80/94 Shoulder Work | | | 1,050,000 |
| Pavement Removal | 20 | 10,700 | 214,000 |
| Pavement, Full Depth Replacement | 150 | 4,700 | 705,000 |
| Barrier Wall Concrete, Remove | 25 | 1,000 | 25,000 |
| Concrete Median Barrier | 100 | 1,000 | 100,000 |
| Broadway Ave Interchange | | | 375,000 |
| Signal Modification | 125,000 | 1 | 125,000 |
| Pavement and Barrier Improvements | 250,000 | 1 | 250,000 |
| Civil Infrastructure - Subtotal | | | 2,770,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| | | | |
| | | | |
| Systems Subtotal | | | 0 |
| Design (10%) | | | 277,000 |
| Project Management (5%) | | | 139,000 |
| **Subtotal** | | | **3,190,000** |
| Contingency (30%) | | | 956,000 |
| **Total** | | | **4,150,000** |
| | | | |

**Table B.11a: EB I-80/94 Advance Warning Signage (east of I-65 Interchange) Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 125,000 | 1 | 125,000 |
| Signage | | | 275,000 |
| Overhead Cantilevers | 90,000 | 3 | 270,000 |
| Barrier removal | 20 | 240 | 4,800 |
| | | | |
| Civil Infrastructure - Subtotal | | | 400,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| | | | |
| | | | |
| Systems Subtotal | | | 0 |
| Design (10%) | | | 40,000 |
| Project Management (5%) | | | 20,000 |
| **Subtotal** | | | **460,000** |
| Contingency (30%) | | | 138,000 |
| **Total** | | | **598,000** |
| | | | |

**Table B.11b: EB I-80/94 Advance Warning Signage (east of I-65 Interchange) Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| Civil Infrastructure - Subtotal | | | 0 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| | | | |
| | | | |
| Systems Subtotal | | | 0 |
| Design (10%) | | | 0 |
| Project Management (5%) | | | 0 |
| **Subtotal** | | | **0** |
| Contingency (30%) | | | 0 |
| **Total** | | | **0** |
| | | | |

**Table B.11c: EB I-80/94 Advance Warning Signage (east of I-65 Interchange) Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 125,000 | 1 | 125,000 |
| Signage | | | 275,000 |
| Overhead Cantilevers | 90,000 | 3 | 270,000 |
| Barrier removal | 20 | 240 | 4,800 |
| | | | |
| Civil Infrastructure - Subtotal | | | 400,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| | | | |
| | | | |
| Systems Subtotal | | | 0 |
| Design (10%) | | | 40,000 |
| Project Management (5%) | | | 20,000 |
| **Subtotal** | | | **460,000** |
| Contingency (30%) | | | 138,000 |
| **Total** | | | **598,000** |
| | | | |

**Table B.12a: Interchange Sequence Signs (Median Butterfly) Implementation Costs (Indiana)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 900,000 | 1 | 900,000 |
| Signage | | | 909,000 |
| Overhead Cantilevers | 85,000 | 9 | 765,000 |
| Barrier removal | 200 | 720 | 144,000 |
| Civil Infrastructure - Subtotal | | | 1,810,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| | | | |
| | | | |
| Systems Subtotal | | | 0 |
| Design (10%) | | | 181,000 |
| Project Management (5%) | | | 90,500 |
| **Subtotal** | | | **2,090,000** |
| Contingency (30%) | | | 625,000 |
| **Total** | | | **2,710,000** |
| | | | |

**Table B.12b: Interchange Sequence Signs (Median Butterfly) Implementation Costs (Illinois)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 400,000 | 1 | 400,000 |
| Signage | | | 202,000 |
| Overhead Cantilevers | 85,000 | 2 | 170,000 |
| Barrier removal | 200 | 160 | 32,000 |
| Civil Infrastructure - Subtotal | | | 602,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| | | | |
| | | | |
| Systems Subtotal | | | 0 |
| Design (10%) | | | 60,200 |
| Project Management (5%) | | | 30,100 |
| **Subtotal** | | | **693,000** |
| Contingency (30%) | | | 208,000 |
| **Total** | | | **900,000** |
| | | | |

**Table B.12c: Interchange Sequence Signs (Median Butterfly) Implementation Costs (Entire Corridor)**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 1,300,000 | 1 | 1,300,000 |
| Signage | | | 1,120,000 |
| Overhead Cantilevers | 85,000 | 11 | 935,000 |
| Barrier removal (Illinois) | 200 | 880 | 176,000 |
| Civil Infrastructure - Subtotal | | | 2,420,000 |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| | | | |
| | | | |
| Systems Subtotal | | | 0 |
| Design (10%) | | | 242,000 |
| Project Management (5%) | | | 121,000 |
| **Subtotal** | | | **2,780,000** |
| Contingency (30%) | | | 832,000 |
| **Total** | | | **3,610,000** |
| | | | |

# APPENDIX C

## Proposed Ramp Metering Locations

## CALUMET AVENUE INTERCHANGE

The following exhibits illustrate the proposed locations for the ramp meter signals and the resulting storage length on the ramps prior to potentially affecting the operation of the arterial roadway.

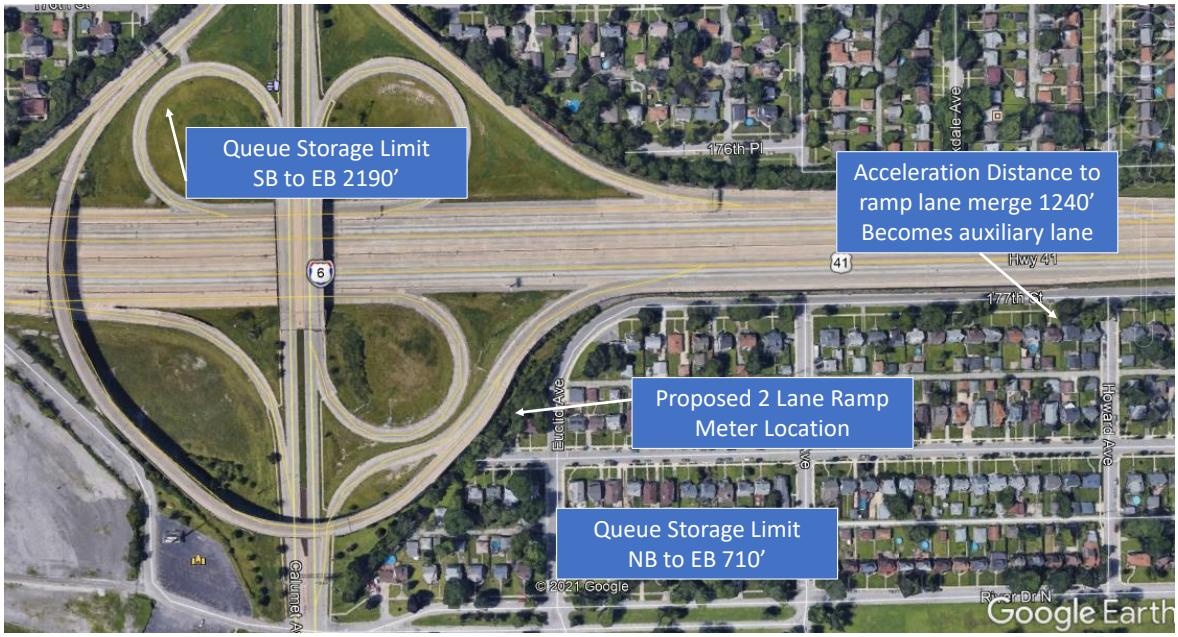



**Figure C.1: Calumet Avenue EB**


**Figure C.2: Calumet Avenue WB**

## INDIANAPOLIS BOULEVARD INTERCHANGE

The following exhibits illustrate the proposed locations for the ramp meter signals and the resulting storage length on the ramps prior to potentially affecting the operation of the arterial roadway.

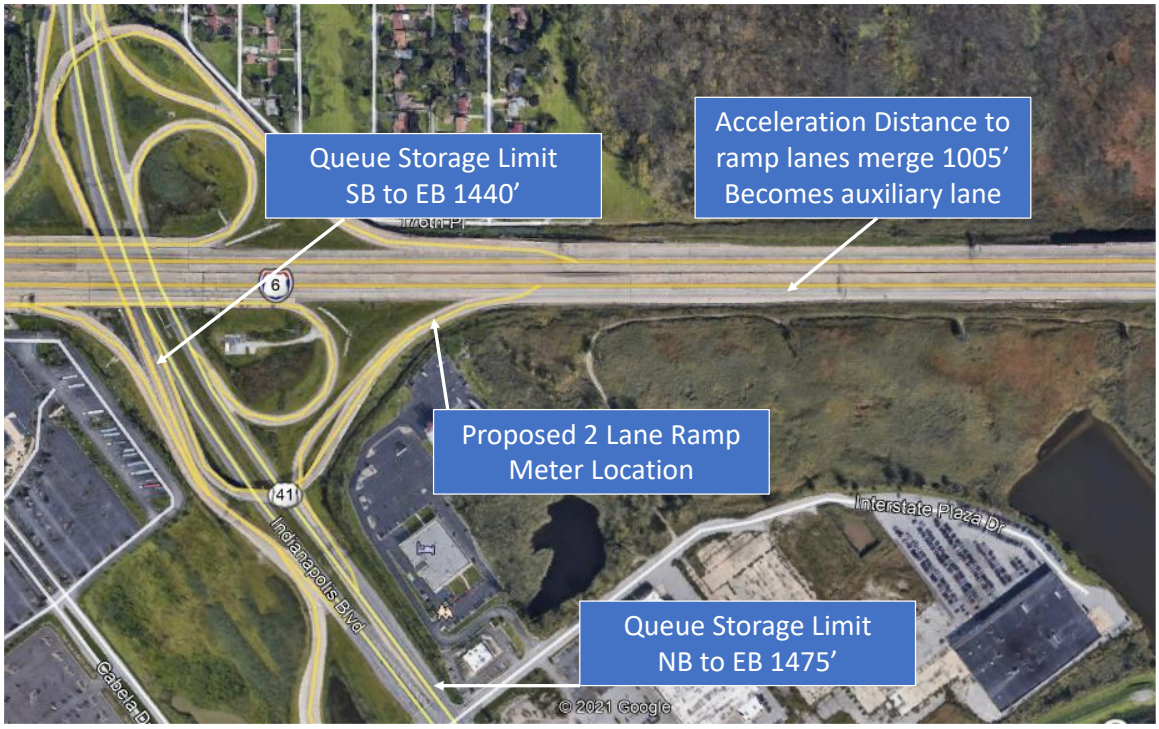



Figure C.3: Indianapolis Boulevard EB


Figure C.4: Indianapolis Boulevard WB

## KENNEDY AVENUE INTERCHANGE

The following exhibits illustrate the proposed locations for the ramp meter signals and the resulting storage length on the ramps prior to potentially affecting the operation of the arterial roadway.

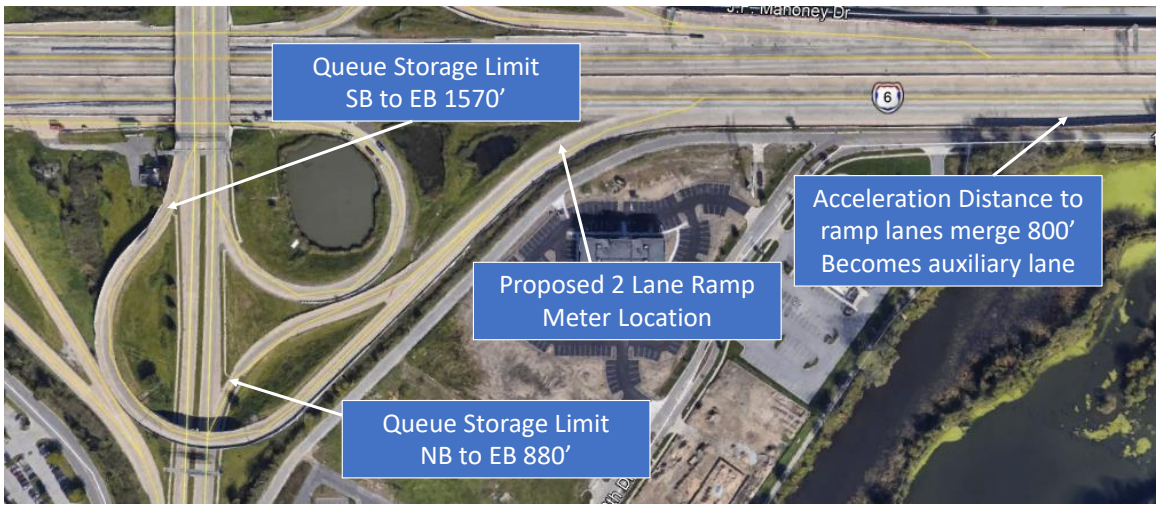



Figure C.5: Kennedy Avenue EB


Figure C.6: Kennedy Avenue WB

## CLINE AVENUE INTERCHANGE

The following exhibits illustrate the proposed locations for the ramp meter signals and the resulting storage length on the ramps prior to potentially affecting the operation of the arterial roadway.

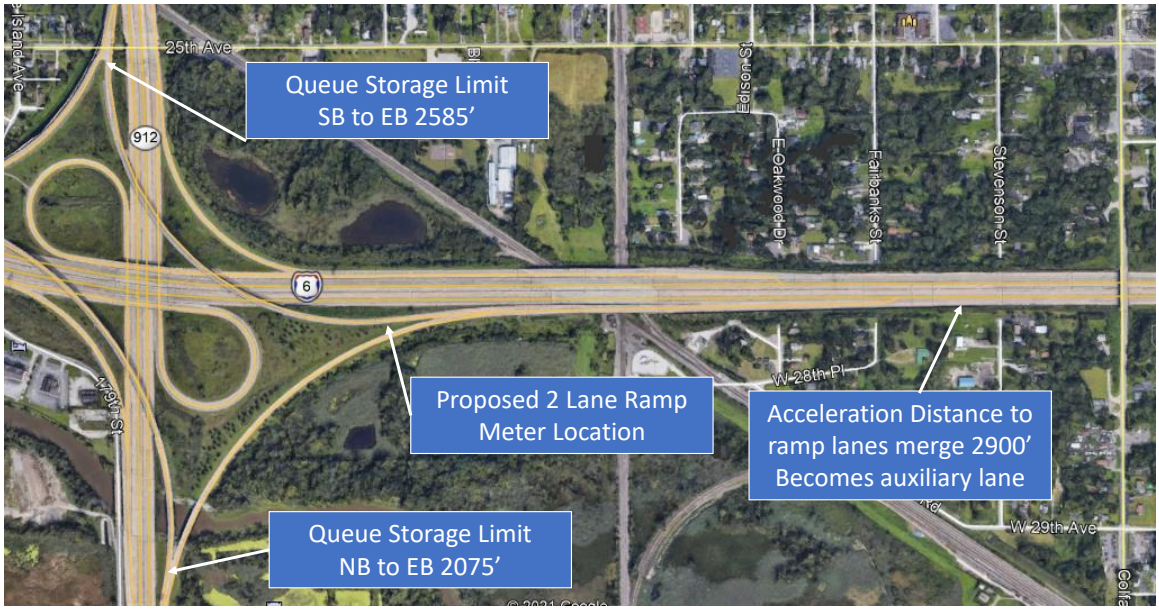



Figure C.7: Cline Avenue EB


Figure C.8: Cline Avenue WB

## BURR STREET INTERCHANGE

The following exhibit illustrates the proposed locations for the ramp meter signals and the resulting storage length on the ramps prior to potentially affecting the operation of the arterial roadway.

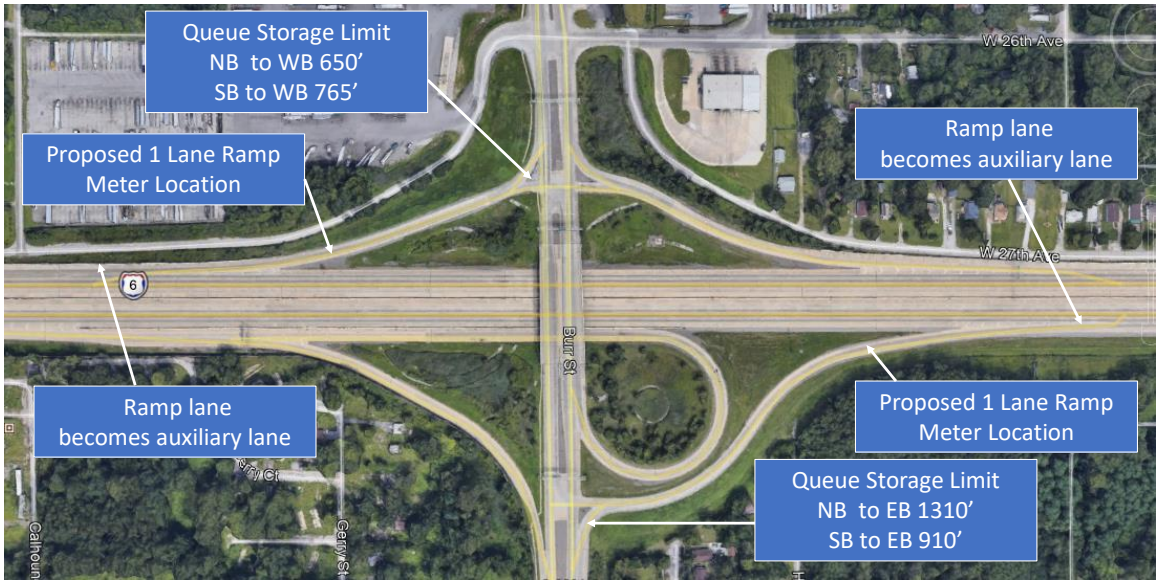



Figure C.9: Burr Street EB and WB

## GRANT STREET INTERCHANGE

The following exhibits illustrate the proposed locations for the ramp meter signals and the resulting storage length on the ramps prior to potentially affecting the operation of the arterial roadway.

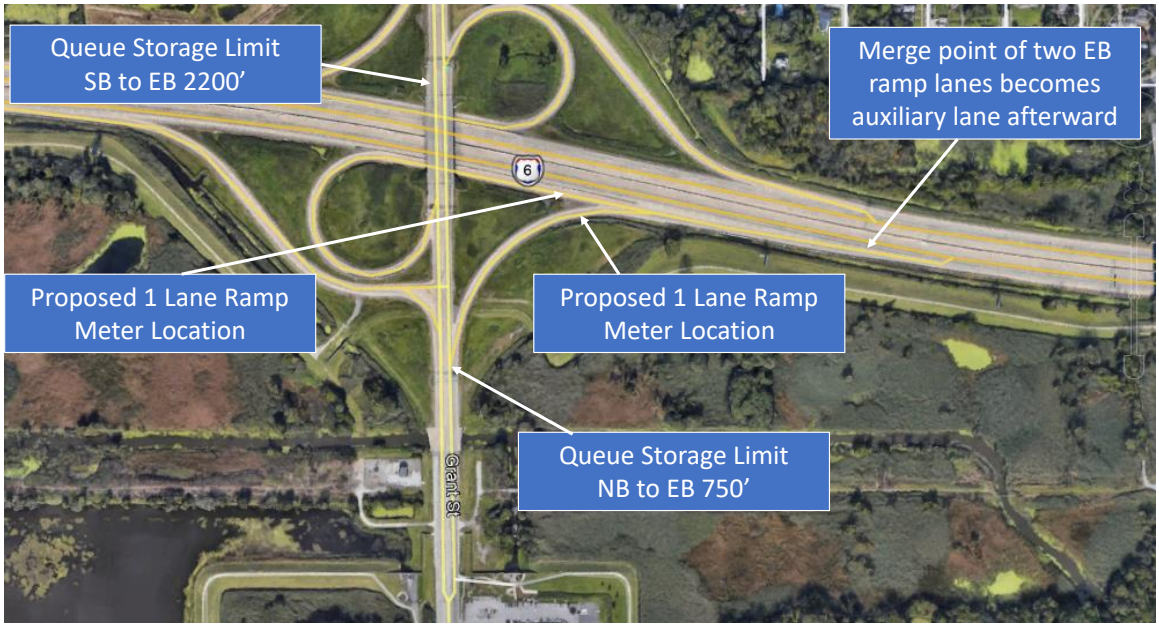



**Figure C.10: Grant Street EB**


**Figure C.11: Grant Street WB**

## BROADWAY INTERCHANGE

The following exhibits illustrate the proposed locations for the ramp meter signals and the resulting storage length on the ramps prior to potentially affecting the operation of the arterial roadway.

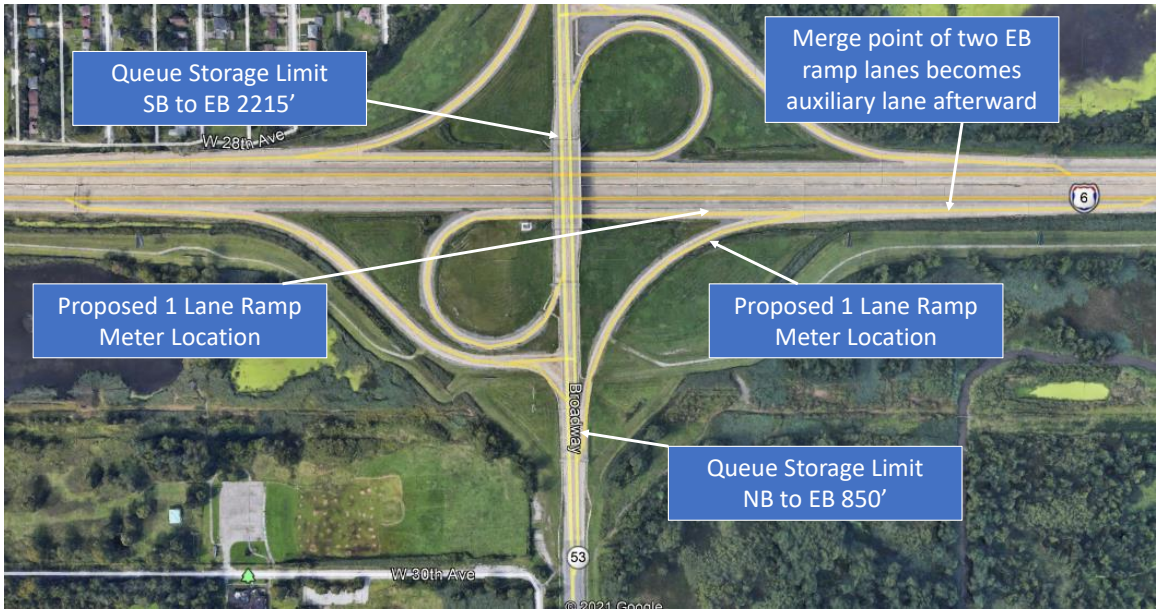



Figure C.12: Broadway EB

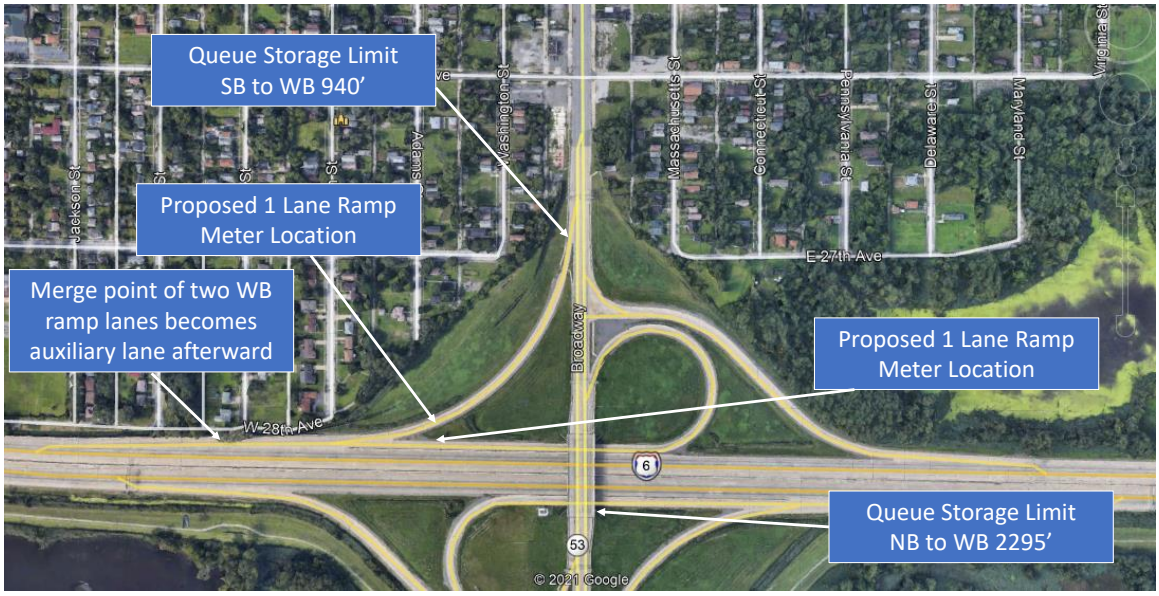



Figure C.13: Broadway WB

# APPENDIX D

## Traffic Operations Results and Detailed Benefits Analysis

The proposed TSMO traffic operations strategies and strategy combinations were testing using the micro-simulation model for the 2019 and 2040 AM and PM peak periods. This appendix provides the detailed traffic operations results including throughput, speed, density, and travel times amongst others. Comparison to the Existing and Future Base scenario traffic operations performance are provided for each measure of effectiveness (MOE). The evaluation is segmented into two discrete levels, namely:

- Network Level; and
- Corridor Level.

In addition, detailed results regarding the benefits analysis and project prioritization are provided in this appendix including year-over-year estimated monetary benefits and costs derived for each Traffic Operations TSMO strategy and strategy combination. The results for each TSMO individual traffic operations strategy and strategy combination are provided in this appendix are listed in **Table D.1**:

**Table D.1: Traffic Operations TSMO Strategy Combinations Description**

| ID | DESCRIPTION |
|---|---|
| | Ramp Metering |
| | Dynamic Shoulder Lanes |
| | Variable Speed Limits |
| SC1 | Dynamic Shoulder Lanes + Ramp Metering |
| SC2 | Dynamic Shoulder Lanes + Variable Speed Limits |
| SC3 | Ramp Metering + Variable Speed Limits |
| SC4 | Dynamic Shoulder Lanes + Ramp Metering + Variable Speed Limits |

## D.1 Network Level

Network statistics provide a simple apples-to-apples comparison of the overall traffic operations performance of each strategy and strategy combination relative to the Existing and Future Base scenarios for the entire study area network, inclusive of the Borman Expressway and all adjoining ramps and municipal roadways. Network-level metrics include vehicles hours traveled and vehicles miles traveled.

### Vehicle Hours Traveled (VHT in veh-hr)

The network travel time (VHT) as modeled, is separated into two categories, the Borman mainline and adjoining ramps, and the municipal network. This provides a better overview of each strategy and strategy combination's effectiveness with respect to the two broad road classes. VHT for the 2019 and 2040 AM and PM peak periods are reported in **Table D.2** to **Table D.5** below for all TSMO scenarios relative to the Existing and Future Base scenarios.

Note that the Variable Speed Limits strategy was not evaluated for the 2019 AM scenario (or any derivations of combinations involving Variable Speed Limits) due to the fact that the observed data did not show enough localized congestion during this time period to warrant application of Variable Speed Limits.

The legend below defines the symbols used in the following tables:

**Legend:** **Abs.** Absolute Value (units per table type)
**Δ** Difference between the Base and each scenario

**Table D.2: 2019 AM Vehicle Hours Traveled - VHT (Hours)**

| AREA | CLASS | - | SC1 | | |
|---|---|---|---|---|---|
| | | Base | RM | DSL | DSL RM |
| | | Abs. | Δ (%) | Δ (%) | Δ (%) |
| Borman | Truck | 1,880 | 0 (0%) | 40 (2%) | 40 (2%) |
| | Auto | 8,220 | 10 (0%) | 290 (3%) | 300 (4%) |
| | **Total** | 10,100 | 0 (0%) | 320 (3%) | 340 (3%) |
| Municipal | Truck | 50 | 10 (20%) | 0 (7%) | 0 (7%) |
| | Auto | 6,350 | 0 (0%) | 90 (1%) | 50 (1%) |
| | **Total** | 6,400 | -10 (0%) | 90 (1%) | 50 (1%) |
| **Total** | | 16510 | **16,510** | **410 (2%)** | **390 (2%)** |

***Note:*** *Scenarios with Dynamic Shoulder Lanes are compared to a normalized base (N.Base) to account for increased demand*

**Table D.3: 2019 PM Vehicle Hours Traveled - VHT (Hours)**

| AREA | CLASS | - | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|---|
| | | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | | Abs. | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) |
| Borman | Truck | 2,100 | 0 (0%) | -40 (-2%) | 10 (0%) | -40 (-2%) | -40 (-2%) | -20 (-1%) | -40 (-2%) |
| | Auto | 12,410 | 90 (1%) | -330 (-3%) | 80 (1%) | -280 (-2%) | -330 (-3%) | -30 (0%) | -290 (-2%) |
| | **Total** | 14,510 | 110 (1%) | -370 (-3%) | 110 (1%) | -310 (-2%) | -370 (-3%) | -40 (0%) | -330 (-2%) |
| Municipal | Truck | 110 | 0 (0%) | 0 (-3%) | 0 (0%) | 0 (-1%) | 0 (-1%) | 0 (0%) | 0 (-2%) |
| | Auto | 11,700 | -30 (0%) | -360 (-3%) | -240 (-2%) | -180 (-2%) | -310 (-3%) | 420 (4%) | -280 (-2%) |
| | **Total** | 11,810 | -30 (0%) | -360 (-3%) | -240 (-2%) | -180 (-2%) | -310 (-3%) | 420 (4%) | -280 (-2%) |
| **Total** | | 26320 | **26,320** | **80 (0%)** | **-730 (-3%)** | **-130 (0%)** | **-490 (-2%)** | **-680 (-3%)** | **380 (1%)** |

Table D.4: 2040 AM Vehicle Hours Traveled - VHT (Hours)

| AREA | CLASS | - | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|---|
| | | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | | Abs. | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) |
| Borman | Truck | 2,240 | 0 (0%) | 76 (3%) | 0 (0%) | 68 (3%) | 76 (3%) | 0 (0%) | 70 (3%) |
| | Auto | 9,450 | 40 (0%) | 487 (5%) | -20 (0%) | 464 (5%) | 496 (5%) | 20 (0%) | 473 (5%) |
| | **Total** | 11,690 | 40 (0%) | 563 (5%) | -20 (0%) | 533 (5%) | 572 (5%) | 20 (0%) | 543 (5%) |
| Municipal | Truck | 80 | 0 (0%) | -1 (-1%) | 0 (0%) | -2 (-3%) | -1 (-1%) | 0 (0%) | -2 (-3%) |
| | Auto | 7,110 | 30 (0%) | 212 (3%) | -20 (0%) | 204 (3%) | 194 (3%) | 0 (0%) | 202 (3%) |
| | **Total** | 7,190 | 30 (0%) | 211 (3%) | -20 (0%) | 201 (3%) | 193 (3%) | 0 (0%) | 200 (3%) |
| **Total** | | **18880** | **70 (0%)** | **770 (4%)** | **-40 (0%)** | **730 (4%)** | **760 (4%)** | **20 (0%)** | **740 (4%)** |

Table D.5: 2040 PM Vehicle Hours Traveled - VHT (Hours)

| AREA | CLASS | - | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|---|
| | | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | | Abs. | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) |
| Borman | Truck | 3,290 | -210 (-6%) | -373 (-11%) | -90 (-3%) | -415 (-13%) | -408 (-12%) | -110 (-3%) | -405 (-12%) |
| | Auto | 17,490 | -1100 (-6%) | -1650 (-9%) | -520 (-3%) | -1886 (-11%) | -1807 (-10%) | -580 (-3%) | -1814 (-10%) |
| | **Total** | 20,780 | -1310 (-6%) | -2023 (-10%) | -600 (-3%) | -2302 (-11%) | -2216 (-11%) | -690 (-3%) | -2219 (-11%) |
| Municipal | Truck | 190 | 0 (0%) | +11 (6%) | -20 (-11%) | 2 (1%) | 4 (2%) | -10 (-5%) | -4 (-2%) |
| | Auto | 18,330 | +840 (5%) | -1081 (-6%) | -1960 (-11%) | -1093 (-6%) | -1254 (-7%) | -1120 (-6%) | -1115 (-6%) |
| | **Total** | 18,520 | +840 (5%) | -1070 (-6%) | -1980 (-11%) | -1092 (-6%) | -1250 (-7%) | -1120 (-6%) | -1119 (-6%) |
| **Total** | | 39300 | **-470 (-1%)** | **-3090 (-8%)** | **-2580 (-7%)** | **-3390 (-9% )** | **-3470 (-9%)** | **-1810 (-5%)** | **-3340 (-8%)** |

***Note:*** *Scenarios with Dynamic Shoulder Lanes are compared to a normalized base (N.Base) to account for increased demand*

## Vehicle Miles Traveled (VMT in veh-thousand miles)

The network travel distance (VMT) as modeled, is also separated into two categories, the Borman mainline and adjoining ramps, and the municipal network. VMT for the 2019 and 2040 AM and PM peak periods are reported in **Table D.6** to **Table D.9** below for all TSMO scenarios relative to the Existing Base scenario.

**Table D.6: 2019 AM Vehicle Miles Traveled (Thousand Miles)**

| AREA | CLASS | - | SC1 | | |
|---|---|---|---|---|---|
| | | Base | RM | DSL | DSL RM |
| | | Abs. | Δ (%) | Δ (%) | Δ (%) |
| Borman | Truck | 179 | -1 (0%) | 2 (1%) | 2 (1%) |
| | Auto | 778 | -4 (-1%) | 20 (3%) | 18 (2%) |
| | **Total** | 957 | -5 (-1%) | 22 (2%) | 20 (2%) |
| Municipal | Truck | 2 | 0 (1%) | 0 (10%) | 0 (11%) |
| | Auto | 247 | 0 (0%) | 1 (0%) | 0 (0%) |
| | **Total** | 252 | 0 (0%) | 1 (0%) | 1 (0%) |
| **Total** | | 1,209 | **-5 (0%)** | **22 (2%)** | **20 (2%)** |

**Table D.7: 2019 PM Vehicle Miles Traveled (Thousand Miles)**

| AREA | CLASS | - | SC1 | | | | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|---|
| | | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | | Abs. | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) |
| Borman | Truck | 178 | -1 (0%) | 2 (1%) | -1 (0%) | 2 (1%) | 2 (1%) | -1 (0%) | 2 (1%) |
| | Auto | 1,017 | -6 (-1%) | -3 (0%) | -3 (0%) | -5 (0%) | -2 (0%) | -7 (-1%) | -4 (0%) |
| | **Total** | 1,195 | -6 (-1%) | -1 (0%) | -4 (0%) | -2 (0%) | 0 (0%) | -7 (-1%) | -2 (0%) |
| Municipal | Truck | 3 | 0 (-1%) | 0 (1%) | 0 (-2%) | 0 (2%) | 0 (3%) | 0 (-1%) | 0 (2%) |
| | Auto | 385 | 0 (0%) | -4 (-1%) | -2 (0%) | -2 (-1%) | -4 (-1%) | 3 (1%) | -3 (-1%) |
| | **Total** | 391 | 0 (0%) | -4 (-1%) | -2 (0%) | -3 (-1%) | -3 (-1%) | 3 (1%) | -3 (-1%) |
| **Total** | | 1,587 | **-7 (0%)** | **-5 (0%)** | **-5 (0%)** | **-5 (0%)** | **-3 (0%)** | **-4 (0%)** | **-5 (0%)** |

### Table D.8: 2040 AM Vehicle Miles Traveled (Thousand Miles)

| AREA | CLASS | - | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|---|
| | | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | | Abs. | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) |
| | Truck | 207 | -1 (0%) | 5 (2%) | -1 (0%) | 4 (2%) | 4 (2%) | -1 (0%) | 4 (2%) |
| Borman | Auto | 876 | -4 (0%) | 29 (3%) | -3 (0%) | 26 (3%) | 29 (3%) | -4 (0%) | 26 (3%) |
| | **Total** | 1,083 | -4 (0%) | 33 (3%) | -4 (0%) | 30 (3%) | 33 (3%) | -5 (0%) | 30 (3%) |
| | Truck | 3 | 0 (-1%) | 0 (-4%) | 0 (-1%) | 0 (-6%) | 0 (-5%) | 0 (-2%) | 0 (-7%) |
| Municipal | Auto | 275 | 0 (0%) | 5 (2%) | -1 (0%) | 5 (2%) | 5 (2%) | 0 (0%) | 5 (2%) |
| | **Total** | 281 | 0 (0%) | 5 (2%) | -1 (0%) | 5 (2%) | 5 (2%) | 0 (0%) | 5 (2%) |
| **Total** | | **1,364** | **-4 (0%)** | **38 (3%)** | **-4 (0%)** | **35 (3%)** | **38 (3%)** | **-5 (0%)** | **35 (3%)** |

### Table D.9: 2040 PM Vehicle Miles Traveled (Thousand Miles)

| AREA | CLASS | - | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|---|
| | | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | | Abs. | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) | Δ (%) |
| | Truck | 204 | 6 (3%) | 14 (7%) | 2 (1%) | 14 (7%) | 14 (7%) | 4 (2%) | 14 (7%) |
| Borman | Auto | 1,096 | 3 (0%) | 76 (7%) | 0 (0%) | 75 (7%) | 80 (7%) | -5 (0%) | 76 (7%) |
| | **Total** | 1,301 | 9 (1%) | 90 (7%) | 1 (0%) | 89 (7%) | 94 (7%) | -1 (0%) | 89 (7%) |
| | Truck | 5 | 0 (1%) | 0 (5%) | 0 (-2%) | 0 (2%) | 0 (5%) | 0 (1%) | 0 (0%) |
| Municipal | Auto | 442 | 2 (0%) | 2 (0%) | 0 (0%) | 6 (1%) | 2 (0%) | 2 (0%) | 4 (1%) |
| | **Total** | 449 | 2 (1%) | 2 (0%) | 0 (0%) | 6 (1%) | 2 (1%) | 2 (0%) | 4 (1%) |
| **Total** | | **1,750** | **11 (1%)** | **92 (5%)** | **1 (0%)** | **95 (5%)** | **96 (5%)** | **1 (0%)** | **94 (5%)** |

## Volume Difference and Diversion to Municipal Network

The diversion to the municipal network metric is based on volume difference plots between each TSMO strategy or strategy combination and the respective 2019 or 2040 Base scenario. By comparing traffic volumes from the TSMO scenarios and Existing and Future Base scenario, traffic pattern changes may be identified to support reasoning for changes in VHT and VMT.

The volume difference plots are presented in **Table D.10** and **Table D.11** for the 2019 and 2040 horizon years, respectively. The magnitude of change to peak hour volume is color-coded as per the legend provided in **Figure D.1** below.

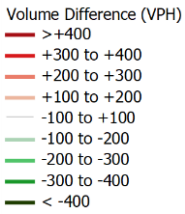



**Figure D.1: Volume Difference Legend**

**Table D.10: 2019 Volume Difference Plots**

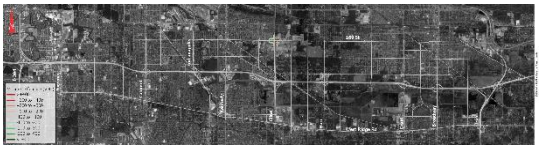
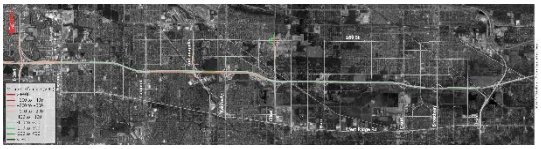
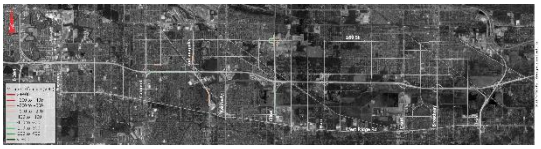
| Scenario | AM Peak Period | PM Peak Period |
|---|---|---|
| Ramp Metering |  |  |
| Dynamic Shoulder Lanes |  |  |
| Variable Speed Limits | N/A |  |
| SC1 Dynamic Shoulder Lanes + Ramp Metering |  |  |
| SC2 Dynamic Shoulder Lanes + Variable Speed Limits | N/A |  |
| SC3 Ramp Metering + Variable Speed Limits | N/A |  |
| SC4 Dynamic Shoulder Lanes + Ramp Metering + Variable Speed Limits | N/A |  |

**Table D.11: 2040 Volume Difference Plots**

| Scenario | AM Peak Period | PM Peak Period |
|---|---|---|
| Ramp Metering |  |  |
| Dynamic Shoulder Lanes |  |  |
| Variable Speed Limits |  |  |
| SC1 Dynamic Shoulder Lanes + Ramp Metering |  |  |
| SC2 Dynamic Shoulder Lanes + Variable Speed Limits |  |  |
| SC3 Ramp Metering + Variable Speed Limits |  |  |
| SC4 Dynamic Shoulder Lanes + Ramp Metering + Variable Speed Limits |  |  |

## D.2 Corridor-Level

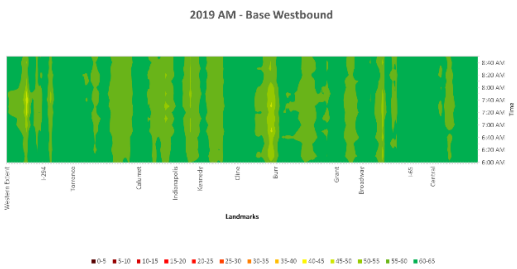
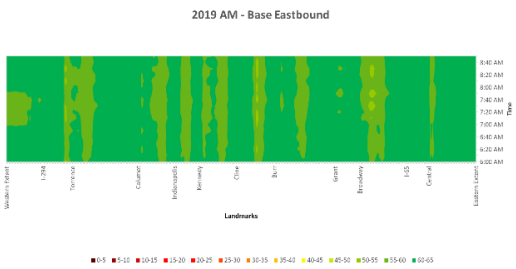
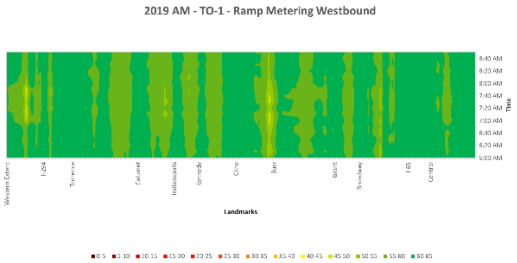
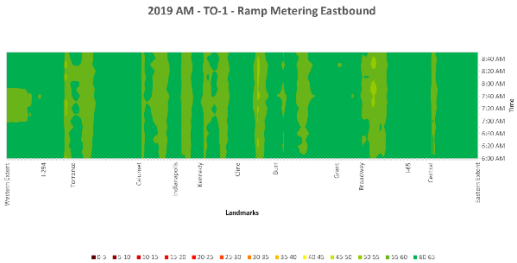
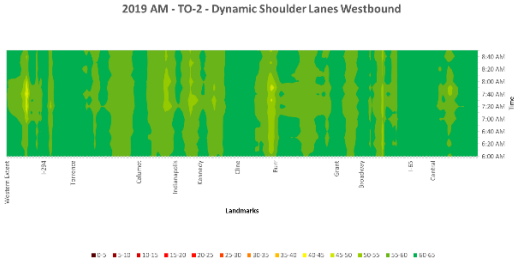
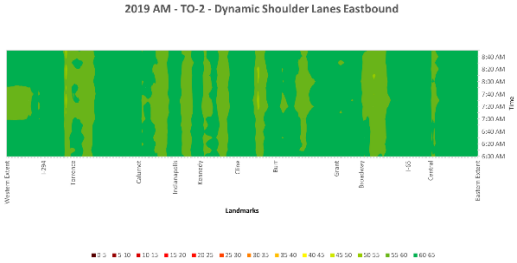
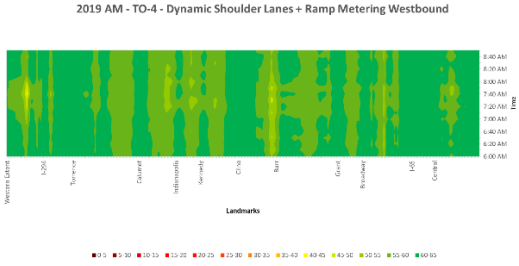
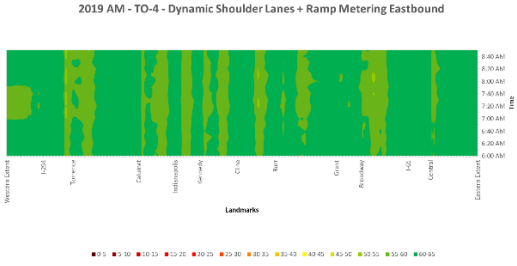
Corridor-level measures of effectiveness are aimed at understanding highway mainline traffic operations as well as the performance of the adjoining entrance and exit ramps. Corridor measures of effectiveness include the following:

- Highway Speed (Miles per hour)
- Highway Mainline Throughput (Vehicles per hour)
- Travel Times (Minutes)
- Reliability

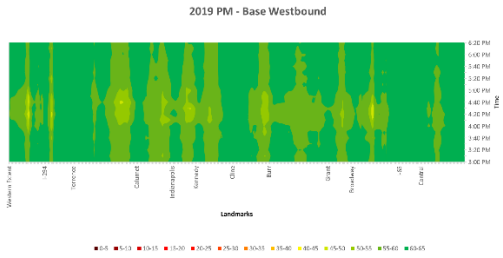
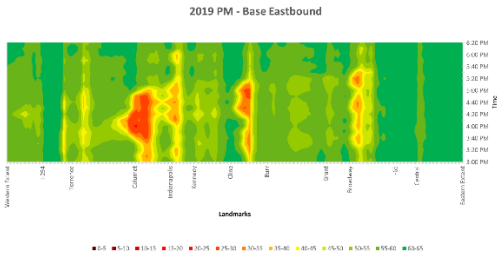
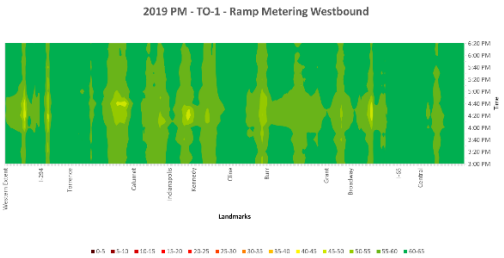
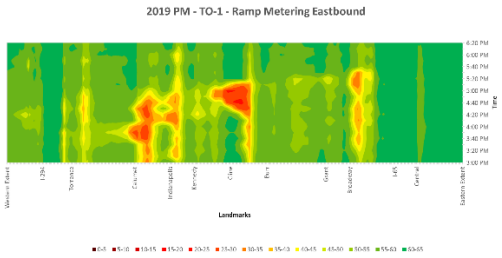
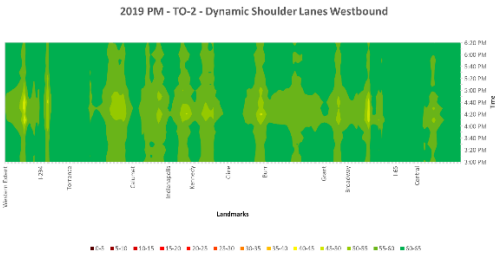
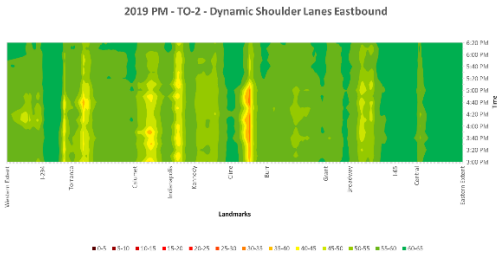
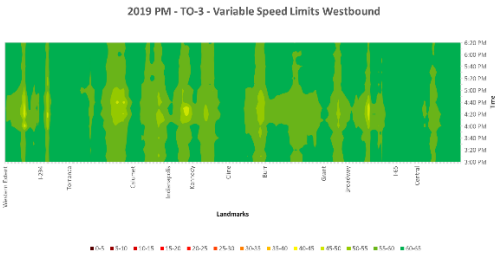
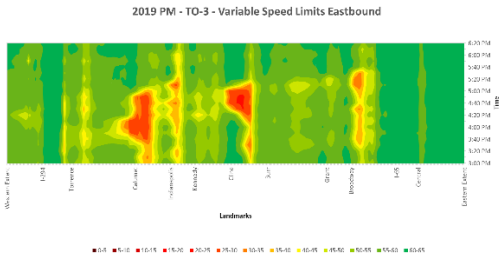
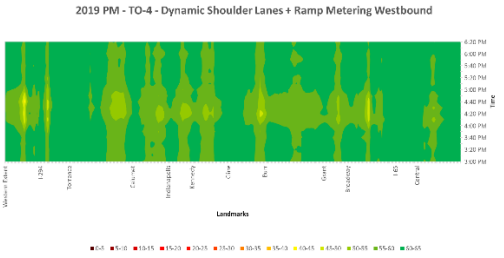
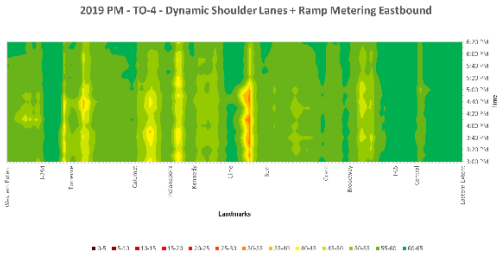
### Freeway Speed (Miles per Hour)

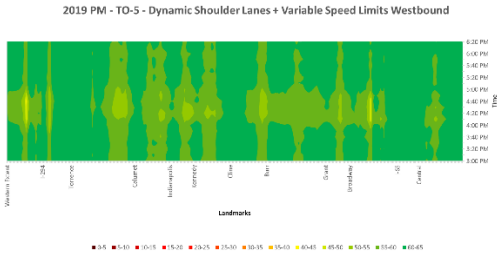
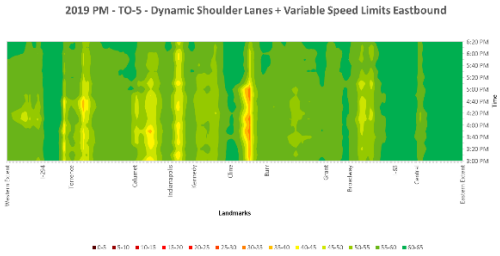
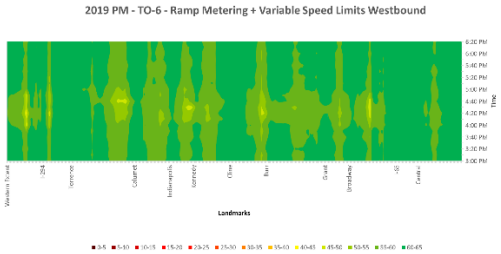
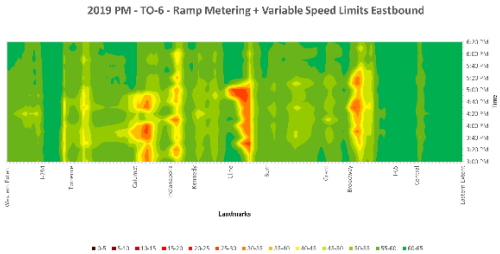
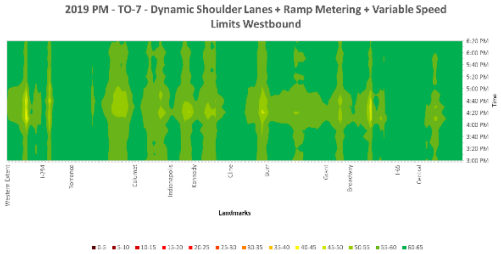
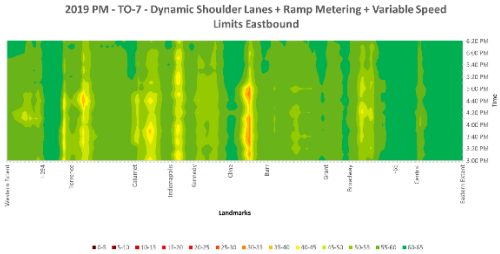
Freeway speeds were obtained from the traffic operations model outputs and processed into speed contour plots. The color gradient is set from red to green, with a red area signifying congestion and slower speeds whereas a green area indicates minimal congestion and faster speeds. By presenting corridor speeds in this manner, areas with improved traffic operations become apparent by the changes in color. Speed contour plots for the Existing and Future Base scenario and key TSMO scenarios are shown in **Table D.12** to **Table D.15** below with the speed plots segmented into westbound and eastbound directions, respectively.

## Table D.12: 2019 AM Speed Heat Maps

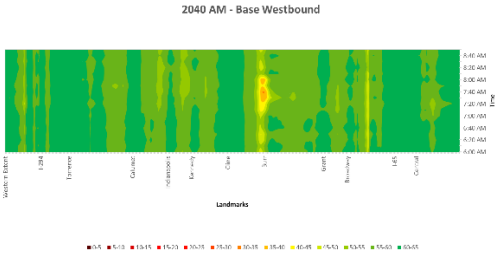
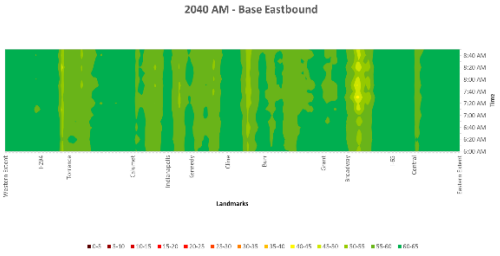
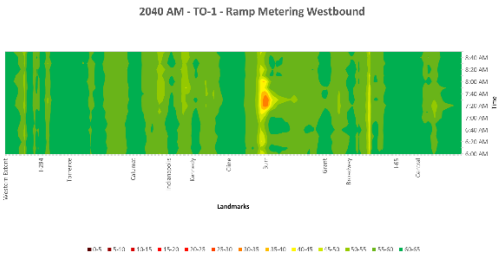
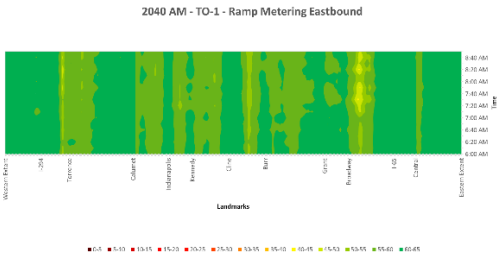
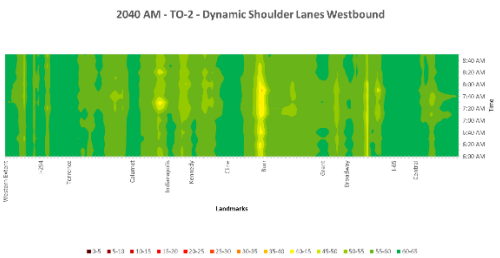
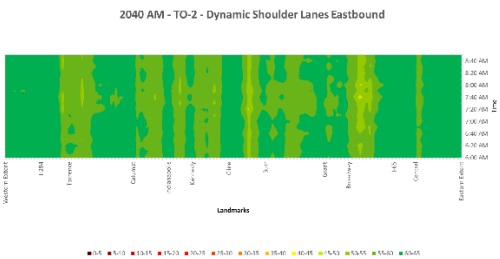
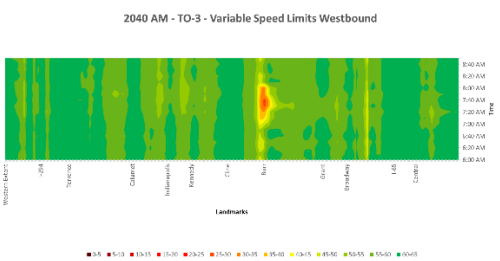
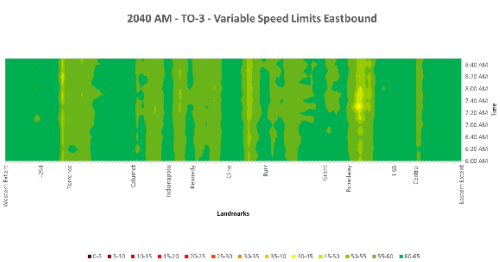
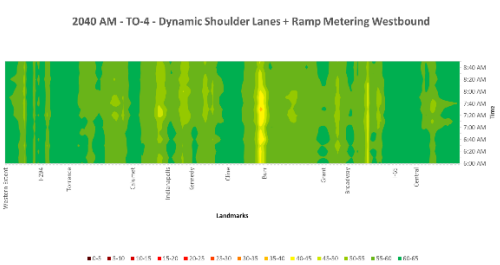
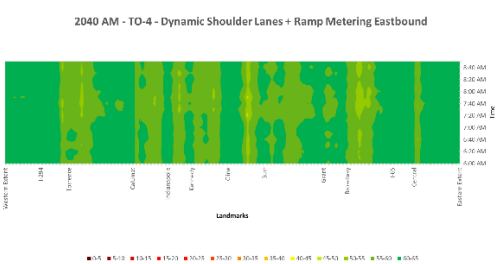
| Scenario | Westbound | Eastbound |
|---|---|---|
| 2019 AM - Base |  |  |
| 2019 AM - Ramp Metering |  |  |
| 2019 AM - Dynamic Shoulder Lanes |  |  |
| 2019 AM SC1 Dynamic Shoulder Lanes + Ramp Metering |  |  |

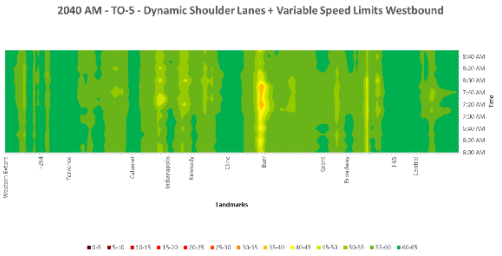
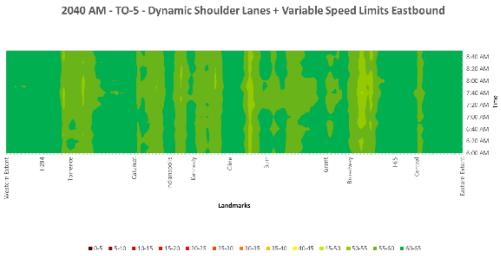
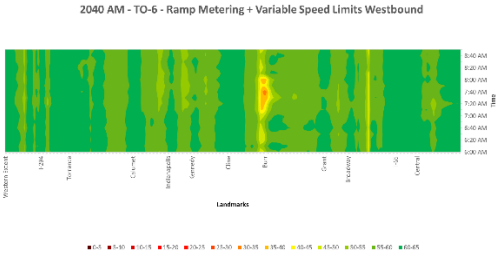
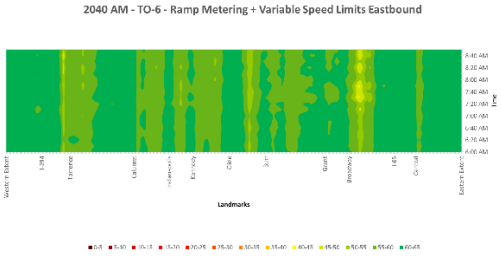
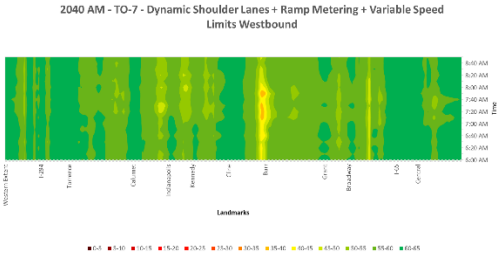
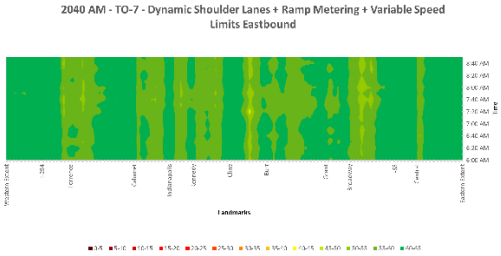
## Table D.13: 2019 PM Speed Heat Maps

| Scenario | Westbound | Eastbound |
|---|---|---|
| 2019 PM - Base |  |  |
| 2019 PM - Ramp Metering |  |  |
| 2019 PM - Dynamic Shoulder Lanes |  |  |
| 2019 PM - Variable Speed Limits |  |  |
| 2019 PM SC1 Dynamic Shoulder Lanes + Ramp Metering |  |  |

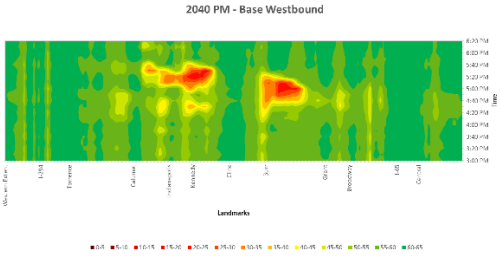
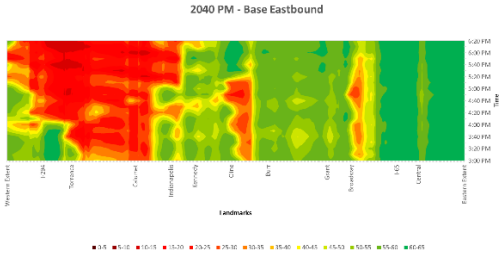
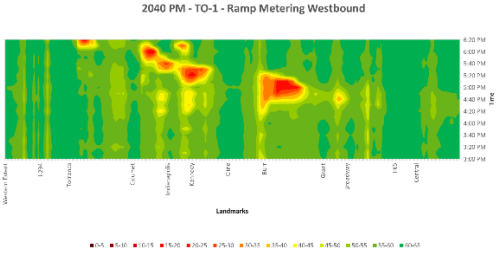
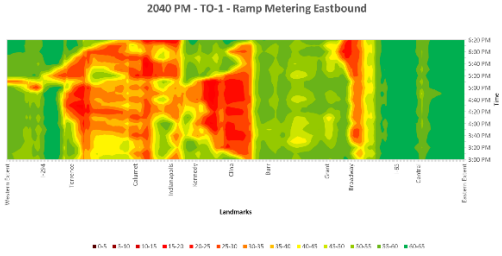
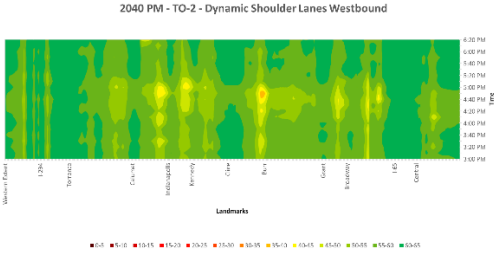
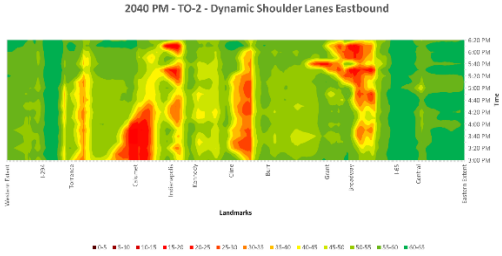
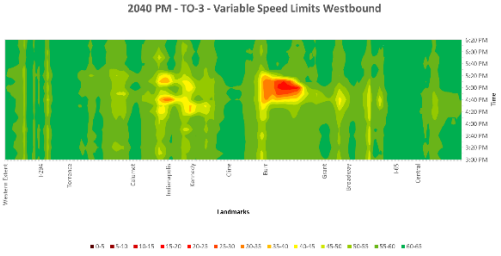
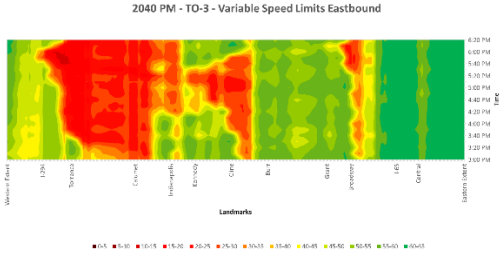
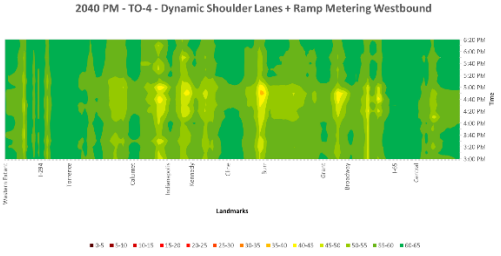
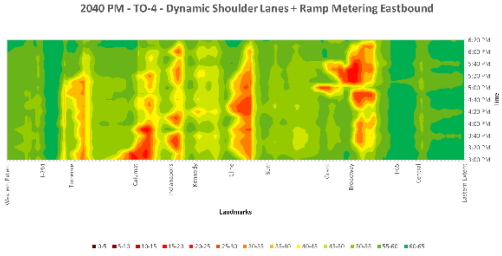
| Scenario | Westbound | Eastbound |
|---|---|---|
| 2019 PM SC2 Dynamic Shoulder Lanes + Variable Speed Limits |  |  |
| 2019 PM SC3 Ramp Metering + Variable Speed Limits |  |  |
| 2019 PM SC4 Dynamic Shoulder Lanes + Ramp Metering + Variable Speed Limits |  |  |

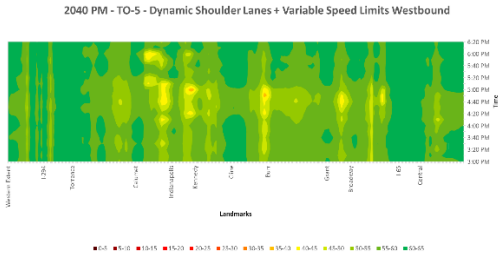
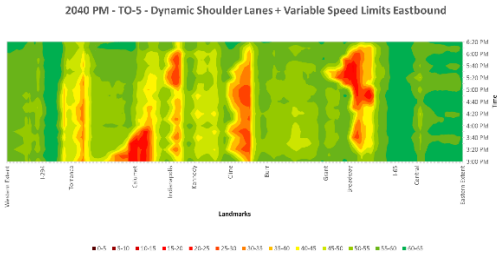
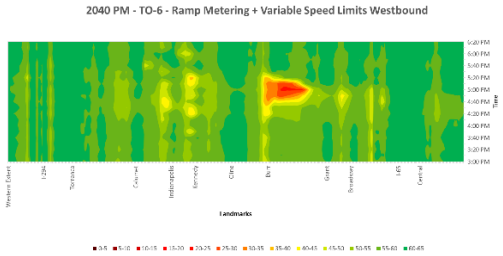
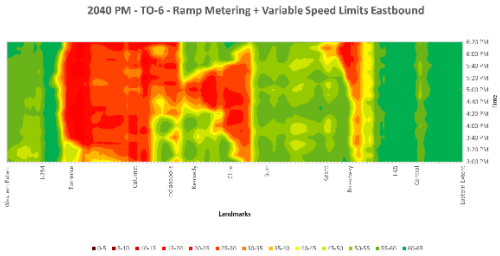
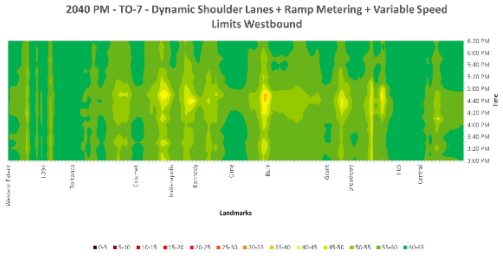
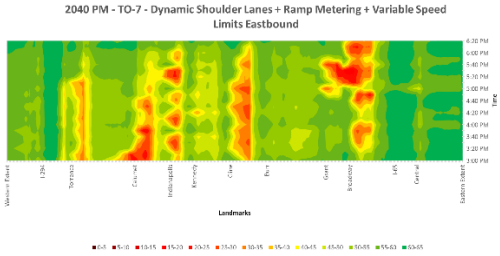
## Table D.14: 2040 AM Speed Heat Maps

| Scenario | Westbound | Eastbound |
|---|---|---|
| 2040 AM - Base |  |  |
| 2040 AM - Ramp Metering |  |  |
| 2040 AM - Dynamic Shoulder Lanes |  |  |
| 2040 AM - Variable Speed Limits |  |  |
| 2040 AM SC1 Dynamic Shoulder Lanes + Ramp Metering |  |  |

| Scenario | Westbound | Eastbound |
|---|---|---|
| 2040 AM SC2 Dynamic Shoulder Lanes + Variable Speed Limits |  |  |
| 2040 AM SC3 Ramp Metering + Variable Speed Limits |  |  |
| 2040 AM SC4 Dynamic Shoulder Lanes + Ramp Metering + Variable Speed Limits |  |  |

## Table D.15: 2040 PM Speed Heat Maps

| Scenario | Westbound | Eastbound |
|---|---|---|
| 2040 PM - Base |  |  |
| 2040 PM - Ramp Metering |  |  |
| 2040 PM - Dynamic Shoulder Lanes |  |  |
| 2040 PM - Variable Speed Limits |  |  |
| 2040 PM SC1 Dynamic Shoulder Lanes + Ramp Metering |  |  |

| Scenario | Westbound | Eastbound |
|---|---|---|
| 2040 PM SC2 Dynamic Shoulder Lanes + Variable Speed Limits |  |  |
| 2040 PM SC3 Ramp Metering + Variable Speed Limits |  |  |
| 2040 PM SC4 Dynamic Shoulder Lanes + Ramp Metering + Variable Speed Limits |  |  |

## Freeway Mainline Throughput (Vehicles per Hour)

Freeway throughput volumes were obtained from the traffic operations model outputs on various freeway segments at interchanges to provide context on the number of vehicles being processed. The change to throughputs for the AM and PM peak hours, are compared between the Existing and Future Base scenarios and the TSMO scenarios in the **Table D.16** to **Table D.19** below. Strategy combinations with the Dynamic Shoulder Lane include the absolute (Abs) volume (vehicles per hour) within the shoulder as well as the difference (Δ) to the Base scenario.

**Table D.16: 2019 AM Freeway Mainline Throughput (Vehicles per Hour)**

| | | | | | | SC1 |
|---|---|---|---|---|---|---|
| | | | Base | RM | DSL | DSL RM |
| TYPE | INTERCHANGE | DIRECTION | Abs. (vph) | Δ Total | Δ Total \| Abs. DSL | Δ Total \| Abs. DSL |
| Mainline | Eastbound | I-94 | 3,600 | +0 | +30 \| -- | +30 \| -- |
| | | Torrence | 4,250 | +10 | +90 \| 10 | +110 \| 10 |
| | | Calumet | 4,050 | -10 | +40 \| 10 | +40 \| 10 |
| | | Indianapolis | 4,350 | +0 | +190 \| 20 | +130 \| 30 |
| | | Kennedy | 4,500 | +10 | +150 \| 50 | +110 \| 30 |
| | | Cline | 4,050 | 0 | +50 \| 20 | +60 \| 10 |
| | | Burr | 4,650 | 0 | +20 \| 20 | +30 \| 20 |
| | | Grant | 4,600 | -10 | +40 \| 60 | +30 \| 60 |
| | | Broadway | 4,450 | -20 | +80 \| 80 | +90 \| 90 |
| | | I-65 | 2,350 | +10 | +120 \| -- | +130 \| -- |
| Mainline | Westbound | I-94 | 4,350 | -20 | +290 \| -- | +310 \| -- |
| | | Torrence | 3,800 | -10 | +280 \| -- | +290 \| -- |
| | | Calumet | 4,550 | -10 | +350 \| 80 | +340 \| 60 |
| | | Indianapolis | 4,850 | -30 | +390 \| 150 | +340 \| 160 |
| | | Kennedy | 4,950 | -20 | +330 \| 140 | +300 \| 130 |
| | | Cline | 4,250 | -10 | +190 \| 40 | +190 \| 30 |
| | | Burr | 5,100 | -20 | +180 \| 250 | +180 \| 250 |
| | | Grant | 4,900 | -10 | +210 \| 50 | +210 \| 40 |
| | | Broadway | 4,700 | +0 | +240 \| 40 | +250 \| 40 |
| | | I-65 | 2,600 | +0 | +80 \| -- | +80 \| -- |

## Table D.17: 2019 PM Freeway Mainline Throughput (Vehicles per Hour)

| | | | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|---|---|
| TYPE | INTERCHANGE | DIRECTION | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | | | Abs. (vph) | Δ Total | Δ Total \| Abs. DSL | Δ Total | Δ Total \| Abs. DSL | Δ Total \| Abs. DSL | Δ Total | Δ Total \| Abs. DSL |
| Mainline | Eastbound | I-94 | 4,700 | -10 | +140 \| -- | 0 | +150 \| -- | +150 \| -- | 0 | +150 \| -- |
| | | Torrence | 5,900 | -80 | +60 \| 100 | -70 | +70 \| 80 | +60 \| 120 | -50 | +70 \| 100 |
| | | Calumet | 6,050 | +30 | +50 \| 370 | -10 | +70 \| 360 | +70 \| 470 | +0 | +60 \| 450 |
| | | Indianapolis | 6,450 | -40 | +100 \| 810 | +0 | +100 \| 780 | +100 \| 830 | -170 | +80 \| 790 |
| | | Kennedy | 6,450 | +20 | +130 \| 690 | +30 | +120 \| 710 | +200 \| 760 | -100 | +110 \| 730 |
| | | Cline | 5,700 | +10 | +50 \| 570 | +20 | +50 \| 620 | +130 \| 600 | +140 | +70 \| 570 |
| | | Burr | 6,350 | +40 | +80 \| 460 | +30 | +60 \| 450 | +150 \| 500 | +70 | +70 \| 440 |
| | | Grant | 6,350 | -20 | +70 \| 650 | -40 | +50 \| 660 | +130 \| 680 | +70 | +70 \| 670 |
| | | Broadway | 6,100 | +30 | +200 \| 710 | -10 | +190 \| 700 | +220 \| 730 | +140 | +210 \| 710 |
| | | I-65 | 3,000 | -20 | +50 \| -- | -40 | +30 \| -- | +70 \| -- | +20 | +30 \| -- |
| Mainline | Westbound | I-94 | 4,500 | +10 | +230 \| -- | -10 | +230 \| -- | +220 \| -- | -20 | +220 \| -- |
| | | Torrence | 3,600 | +30 | +240 \| -- | +20 | +240 \| -- | +230 \| -- | +10 | +240 \| -- |
| | | Calumet | 5,000 | +30 | +50 \| 150 | +40 | +60 \| 180 | +50 \| 160 | +40 | +60 \| 180 |
| | | Indianapolis | 5,300 | +60 | +100 \| 180 | +60 | +80 \| 190 | +110 \| 200 | -20 | +70 \| 160 |
| | | Kennedy | 5,550 | -10 | +110 \| 230 | +20 | +90 \| 210 | +100 \| 270 | +20 | +100 \| 220 |
| | | Cline | 4,800 | -20 | +80 \| 70 | -10 | +60 \| 70 | +40 \| 50 | +10 | +90 \| 70 |
| | | Burr | 5,450 | +10 | +120 \| 310 | -10 | +160 \| 320 | +160 \| 310 | +10 | +170 \| 320 |
| | | Grant | 5,450 | +10 | +140 \| 120 | 0 | +190 \| 140 | +190 \| 120 | -10 | +200 \| 130 |
| | | Broadway | 5,250 | +0 | +140 \| 110 | -10 | +140 \| 140 | +130 \| 140 | 0 | +130 \| 100 |
| | | I-65 | 2,900 | 0 | +40 \| -- | 0 | +40 \| -- | +40 \| -- | 0 | +40 \| -- |

## Table D.18: 2040 AM Freeway Mainline Throughput (Vehicles per Hour)

| TYPE | INTERCHANGE | DIRECTION | Base | RM | DSL | VSL | SC1 DSL RM | SC2 DSL VSL | SC3 RM VSL | SC4 DSL RM VSL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Abs. (vph) | Δ Total | Δ Total \| Abs. DSL | Δ Total | Δ Total \| Abs. DSL | Δ Total \| Abs. DSL | Δ Total | Δ Total \| Abs. DSL |
| Mainline | Eastbound | I-94 | 4,800 | +0 | -70 \| – | +0 | -70 \| – | -70 \| – | +0 | -70 \| – |
| | | Torrence | 5,000 | +10 | -150 \| 20 | +10 | -150 \| 10 | -160 \| 20 | +10 | -140 \| 10 |
| | | Calumet | 4,650 | +0 | +20 \| 20 | -10 | +20 \| 30 | +30 \| 30 | -10 | +30 \| 10 |
| | | Indianapolis | 5,000 | 0 | +20 \| 80 | +0 | 0 \| 60 | +20 \| 60 | -10 | +10 \| 40 |
| | | Kennedy | 5,250 | -10 | +40 \| 90 | 0 | +30 \| 110 | +20 \| 80 | -20 | +0 \| 100 |
| | | Cline | 4,650 | 0 | +60 \| 70 | +0 | +70 \| 50 | +60 \| 60 | +0 | +60 \| 60 |
| | | Burr | 5,300 | +0 | +80 \| 90 | +10 | +70 \| 70 | +80 \| 70 | +0 | +70 \| 60 |
| | | Grant | 5,300 | -20 | -40 \| 170 | -20 | -30 \| 180 | -30 \| 150 | -30 | -30 \| 150 |
| | | Broadway | 5,200 | +10 | -90 \| 220 | 0 | -100 \| 200 | -80 \| 200 | +20 | -90 \| 180 |
| | | I-65 | 2,800 | 0 | +140 \| -- | +0 | -20 \| – | +150 \| -- | 0 | -20 \| – |
| Mainline | Westbound | I-94 | 4,450 | +0 | +230 \| -- | -30 | +210 \| -- | +220 \| -- | -10 | +210 \| -- |
| | | Torrence | 3,950 | +0 | +240 \| -- | -20 | +230 \| -- | +240 \| -- | -10 | +220 \| -- |
| | | Calumet | 4,700 | +0 | +450 \| 110 | -10 | +440 \| 150 | +430 \| 110 | -20 | +420 \| 130 |
| | | Indianapolis | 5,200 | +10 | +490 \| 350 | -40 | +450 \| 340 | +490 \| 300 | -30 | +440 \| 280 |
| | | Kennedy | 5,400 | -10 | +460 \| 290 | -40 | +420 \| 310 | +470 \| 330 | -20 | +400 \| 300 |
| | | Cline | 4,750 | +10 | +410 \| 100 | -10 | +400 \| 90 | +410 \| 110 | -10 | +390 \| 90 |
| | | Burr | 5,800 | +10 | +400 \| 790 | -20 | +390 \| 770 | +410 \| 880 | -20 | +360 \| 840 |
| | | Grant | 5,650 | +20 | +320 \| 190 | +10 | +310 \| 150 | +330 \| 190 | -10 | +300 \| 170 |
| | | Broadway | 5,300 | +10 | +320 \| 160 | +10 | +300 \| 130 | +320 \| 160 | +20 | +310 \| 150 |
| | | I-65 | 2,900 | 0 | +190 \| -- | 0 | +190 \| -- | +190 \| -- | +0 | +190 \| -- |

**Table D.19: 2040 PM Freeway Mainline Throughput (Vehicles per Hour)**

| TYPE | INTERCHANGE | DIRECTION | Base | RM | DSL | VSL | SC1 DSL RM | SC2 DSL VSL | SC3 RM VSL | SC4 DSL RM VSL |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Abs. (vph) | Δ Total | Δ Total \| Abs. DSL | Δ Total | Δ Total \| Abs. DSL | Δ Total \| Abs. DSL | Δ Total | Δ Total \| Abs. DSL |
| Mainline | Eastbound | I-94 | 5,300 | -50 | +220 \| -- | +10 | +220 \| -- | +220 \| -- | +20 | +200 \| -- |
| | | Torrence | 5,950 | +20 | +680 \| 360 | -300 | +630 \| 320 | +610 \| 350 | -300 | +660 \| 360 |
| | | Calumet | 5,650 | +320 | +1280 \| 1250 | +90 | +1130 \| 910 | +1160 \| 930 | +200 | +1160 \| 1000 |
| | | Indianapolis | 6,050 | +170 | +1560 \| 1530 | +70 | +1390 \| 1480 | +1380 \| 1460 | +100 | +1430 \| 1550 |
| | | Kennedy | 6,300 | +0 | +1350 \| 1470 | +110 | +1260 \| 1420 | +1210 \| 1390 | -70 | +1250 \| 1400 |
| | | Cline | 5,800 | -30 | +1050 \| 1470 | +40 | +970 \| 1460 | +980 \| 1510 | -50 | +910 \| 1410 |
| | | Burr | 6,400 | +80 | +910 \| 1100 | +20 | +850 \| 1060 | +940 \| 1110 | -40 | +780 \| 1010 |
| | | Grant | 6,350 | +120 | +790 \| 1210 | +20 | +600 \| 1130 | +830 \| 1170 | -10 | +550 \| 1080 |
| | | Broadway | 6,200 | +420 | +750 \| 1280 | +90 | +610 \| 1280 | +820 \| 1310 | +30 | +520 \| 1170 |
| | | I-65 | 3,000 | +150 | +490 \| -- | +30 | +390 \| -- | +470 \| -- | +40 | +490 \| -- |
| Mainline | Westbound | I-94 | 4,800 | -60 | +180 \| -- | +20 | +200 \| -- | +220 \| -- | +30 | +200 \| -- |
| | | Torrence | 4,100 | -90 | +220 \| -- | +20 | +240 \| -- | +270 \| -- | +20 | +240 \| -- |
| | | Calumet | 5,550 | -60 | +150 \| 300 | -10 | +190 \| 350 | +260 \| 350 | -30 | +160 \| 340 |
| | | Indianapolis | 5,900 | +80 | +430 \| 680 | +140 | +400 \| 670 | +490 \| 720 | +70 | +390 \| 650 |
| | | Kennedy | 6,100 | +40 | +360 \| 670 | +0 | +450 \| 730 | +480 \| 740 | -20 | +420 \| 710 |
| | | Cline | 5,400 | +0 | +490 \| 320 | +0 | +480 \| 300 | +500 \| 310 | -20 | +520 \| 310 |
| | | Burr | 6,150 | -20 | +560 \| 1010 | +20 | +520 \| 950 | +510 \| 950 | -30 | +560 \| 1000 |
| | | Grant | 6,300 | +30 | +220 \| 450 | -20 | +230 \| 470 | +290 \| 480 | -50 | +230 \| 490 |
| | | Broadway | 5,900 | -10 | +250 \| 430 | +10 | +180 \| 480 | +200 \| 450 | +20 | +270 \| 480 |
| | | I-65 | 3,400 | 0 | +190 \| -- | 0 | +190 \| -- | +190 \| -- | 0 | +190 \| -- |

## Travel Times (Minutes)

Travel times were obtained from the traffic operations model for three key sub-routes as discussed in Section 5.1.2, namely for the corridor, for arterials, and for entrance ramps. Travel times for the 2019 and 2040 AM and PM peak hours were compared between the Existing and Future Base scenarios and the TSMO scenarios for each direction of travel. Results for each sub-route are provided as tables in the subsequent sections.

### Corridor Travel Times

Corridor travel times represent the end-to-end east-west route from approximately I-394 to I-65. The time differences on this route between each TSMO scenario and the Existing and Future Base scenarios are presented in Table D.20 to Table D.23.

### Table D.20: 2019 AM Corridor Travel Times (Minutes)

| ROUTE | | | | SC1 |
|---|---|---|---|---|
| | Base | RM | DSL | DSL RM |
| | Abs. (Mins) | Δ | Δ | Δ |
| Westbound | 16.5 | 0.0 (0%) | 0.1 (1%) | 0.1 (1%) |
| Eastbound | 16.6 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |

### Table D.21: 2019 PM Corridor Travel Times (Minutes)

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| Westbound | 16.7 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| Eastbound | 20.9 | -0.3 (-1%) | -2.3 (-11%) | 0.0 (0%) | -2.3 (-11%) | -2.3 (-11%) | -1.1 (-5%) | -2.3 (-11%) |

### Table D.22: 2040 AM Corridor Travel Times (Minutes)

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| Westbound | 16.9 | 0.0 (0%) | 0.2 (1%) | 0.1 (1%) | 0.1 (1%) | 0.2 (1%) | 0.0 (0%) | 0.2 (1%) |
| Eastbound | 17.0 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |

### Table D.23: 2040 PM Corridor Travel Times (Minutes)

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| Westbound | 17.6 | 0.0 (0%) | -0.2 (-1%) | 0.1 (0%) | -0.1 (-1%) | -0.1 (-1%) | 0.0 (0%) | -0.2 (-1%) |
| Eastbound | 27.8 | -1.9 (-7%) | -6.1 (-22%) | 0.0 (0%) | -6.6 (-24%) | -6.4 (-23%) | 0.1 (0%) | -6.7 (-24%) |

### Arterial Travel Times

Arterial travel times represent the north-south routes along key arterials crossing the freeway and consists of segments approximately two intersections upstream and downstream of the freeway facility. This metric aims to compare the impacts to local traffic crossing the freeway during the AM and PM peak hour. The travel time differences on these routes between each TSMO scenario and the Existing and Future Base scenarios are presented in Table D24 to Table D27.

**Table D.24: 2019 AM Arterial Travel Times (Minutes)**

| ROUTE | | | | SC1 |
|---|---|---|---|---|
| | Base | RM | DSL | DSL RM |
| | Abs. (Mins) | Δ | Δ | Δ |
| NB - I394 | 2.3 | 0.0 (-1%) | 0.2 (10%) | 0.2 (10%) |
| SB - I394 | 2.0 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB - Torrence | 1.4 | 0.0 (-2%) | 0.0 (1%) | 0.0 (0%) |
| SB - Torrence | 1.7 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB - Calumet | 0.0 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB - Calumet | 1.6 | 0.0 (0%) | 0.1 (7%) | 0.1 (5%) |
| NB - Indianapolis | 2.4 | 0.1 (6%) | 0.1 (5%) | 0.1 (2%) |
| SB - Indianapolis | 2.0 | 0.0 (-1%) | 0.0 (0%) | 0.0 (-1%) |
| NB - Kennedy | 2.1 | 0.0 (0%) | 0.0 (-2%) | 0.0 (0%) |
| SB - Kennedy | 2.0 | 0.0 (0%) | 0.0 (-1%) | 0.0 (-1%) |
| NB - Cline | 1.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (-1%) |
| SB - Cline | 1.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB - Burr | 2.1 | 0.0 (0%) | 0.0 (-1%) | 0.0 (-1%) |
| SB - Burr | 1.9 | 0.0 (1%) | 0.0 (0%) | 0.0 (0%) |
| NB - Grant | 1.8 | 0.0 (-1%) | 0.0 (0%) | 0.0 (-1%) |
| SB - Grant | 1.4 | 0.0 (1%) | 0.0 (3%) | 0.0 (1%) |
| NB - Broadway | 1.6 | 0.0 (0%) | 0.0 (0%) | 0.0 (-1%) |
| SB - Broadway | 1.7 | 0.0 (1%) | 0.0 (-1%) | 0.0 (-1%) |
| NB - I65 | 3.4 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB - I65 | 3.3 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |

Table D.25: 2019 PM Arterial Travel Times (Minutes)

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| NB - I394 | 2.0 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB - I394 | 5.2 | -0.1 (-2%) | -0.3 (-5%) | -0.1 (-2%) | -0.4 (-8%) | -0.3 (-6%) | -0.2 (-3%) | -0.3 (-6%) |
| NB - Torrence | 1.2 | 0.0 (-2%) | 0.0 (0%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (0%) | 0.0 (-1%) | 0.0 (1%) |
| SB - Torrence | 1.8 | 0.1 (5%) | -0.1 (-4%) | 0.1 (5%) | 0.0 (1%) | -0.1 (-3%) | -0.1 (-8%) | -0.1 (-6%) |
| NB - Calumet | 0.0 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB - Calumet | 2.6 | -0.2 (-7%) | 0.2 (6%) | -0.1 (-4%) | 0.1 (3%) | 0.1 (5%) | -0.2 (-8%) | 0.1 (4%) |
| NB - Indianapolis | 3.0 | 0.2 (6%) | 0.0 (-1%) | 0.1 (4%) | 0.0 (1%) | 0.1 (3%) | 0.0 (1%) | 0.1 (3%) |
| SB - Indianapolis | 2.9 | 0.1 (3%) | -0.1 (-4%) | 0.0 (1%) | -0.1 (-2%) | -0.2 (-6%) | -0.1 (-3%) | -0.1 (-3%) |
| NB - Kennedy | 2.3 | 0.1 (4%) | 0.0 (-1%) | 0.0 (2%) | 0.0 (1%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (-1%) |
| SB - Kennedy | 2.2 | 0.0 (2%) | 0.0 (2%) | 0.1 (2%) | 0.1 (4%) | 0.1 (3%) | 0.0 (-1%) | 0.1 (3%) |
| NB - Cline | 1.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB - Cline | 1.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB - Burr | 3.1 | -0.3 (-10%) | 0.2 (7%) | -0.1 (-4%) | 0.1 (4%) | 0.1 (2%) | -0.1 (-5%) | 0.1 (3%) |
| SB - Burr | 2.0 | 0.0 (-1%) | 0.0 (0%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) |
| NB - Grant | 2.0 | 0.0 (-2%) | 0.0 (-2%) | 0.0 (-1%) | 0.0 (1%) | -0.1 (-4%) | 0.0 (0%) | 0.0 (-2%) |
| SB - Grant | 1.7 | 0.0 (0%) | 0.0 (3%) | 0.0 (1%) | 0.0 (-2%) | 0.0 (1%) | 0.0 (3%) | 0.0 (0%) |
| NB - Broadway | 1.7 | 0.0 (0%) | 0.0 (-1%) | 0.0 (1%) | 0.0 (0%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (-1%) |
| SB - Broadway | 1.9 | 0.0 (0%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (-2%) | 0.0 (1%) |
| NB - I65 | 3.4 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB - I65 | 3.4 | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) | 0.0 (1%) | 0.0 (1%) |

Table D.26: 2040 AM Arterial Travel Times (Minutes)

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| NB - I394 | 2.0 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB - I394 | 2.0 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB - Torrence | 1.4 | 0.0 (0%) | 0.0 (-3%) | 0.0 (0%) | -0.1 (-4%) | 0.0 (-3%) | 0.0 (0%) | 0.0 (-3%) |
| SB - Torrence | 1.6 | 0.0 (0%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (-1%) | 0.0 (-1%) | 0.0 (-1%) | 0.0 (-1%) |
| NB - Calumet | 1.6 | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) | 0.0 (1%) | 0.0 (1%) | 0.0 (-1%) | 0.0 (2%) |
| SB - Calumet | 1.8 | 0.0 (-1%) | 0.0 (-2%) | 0.0 (0%) | 0.0 (0%) | 0.0 (-2%) | 0.0 (-3%) | 0.0 (1%) |
| NB - Indianapolis | 2.7 | -0.1 (-5%) | -0.3 (-10%) | -0.2 (-7%) | -0.3 (-11%) | -0.2 (-6%) | -0.2 (-8%) | -0.1 (-4%) |
| SB - Indianapolis | 2.1 | 0.0 (1%) | 0.0 (-2%) | 0.0 (-1%) | 0.0 (-1%) | 0.0 (-1%) | 0.0 (-2%) | 0.0 (-2%) |
| NB - Kennedy | 2.2 | 0.0 (-1%) | -0.1 (-2%) | 0.0 (-1%) | 0.0 (-2%) | 0.0 (0%) | 0.0 (-1%) | -0.1 (-3%) |
| SB - Kennedy | 2.0 | 0.0 (1%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (-1%) | 0.0 (0%) |
| NB - Cline | 1.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB - Cline | 1.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB - Burr | 2.1 | 0.0 (1%) | 0.0 (1%) | 0.0 (1%) | 0.1 (3%) | 0.0 (2%) | 0.0 (2%) | 0.0 (1%) |
| SB - Burr | 1.9 | 0.0 (0%) | 0.0 (1%) | 0.0 (-1%) | 0.0 (1%) | 0.0 (1%) | 0.0 (2%) | 0.0 (1%) |
| NB - Grant | 1.8 | 0.0 (2%) | 0.1 (3%) | 0.0 (0%) | 0.0 (1%) | 0.1 (4%) | 0.0 (-2%) | 0.0 (1%) |
| SB - Grant | 1.4 | 0.0 (2%) | 0.1 (4%) | 0.0 (2%) | 0.1 (5%) | 0.1 (4%) | 0.0 (0%) | 0.1 (5%) |
| NB - Broadway | 1.7 | 0.0 (0%) | 0.1 (4%) | 0.0 (0%) | 0.0 (2%) | 0.0 (3%) | 0.0 (-1%) | 0.0 (3%) |
| SB - Broadway | 1.7 | 0.0 (-1%) | 0.1 (3%) | 0.0 (-1%) | 0.0 (3%) | 0.0 (3%) | 0.0 (-2%) | 0.0 (3%) |
| NB - I65 | 3.4 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB - I65 | 3.3 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |

## Table D.27: 2040 PM Arterial Travel Times (Minutes)

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| NB - I394 | 2.0 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB - I394 | 6.6 | -0.1 (-1%) | -1.1 (-16%) | -0.1 (-2%) | -1.1 (-16%) | -1.5 (-23%) | 0.1 (2%) | -1.1 (-17%) |
| NB - Torrence | 1.3 | 0.0 (0%) | 0.0 (-2%) | 0.0 (-1%) | 0.0 (-2%) | 0.0 (-3%) | 0.0 (-2%) | 0.0 (-1%) |
| SB - Torrence | 4.0 | -1.9 (-46%) | -2.1 (-52%) | -1.9 (-46%) | -2.3 (-57%) | -2.3 (-56%) | -2.2 (-56%) | -2.2 (-56%) |
| NB - Calumet | 1.8 | 1.2 (71%) | -0.1 (-6%) | -0.1 (-5%) | -0.1 (-5%) | -0.1 (-5%) | 0.4 (26%) | -0.1 (-7%) |
| SB - Calumet | 3.2 | -0.2 (-5%) | -0.3 (-10%) | -0.1 (-4%) | -0.2 (-7%) | -0.5 (-14%) | -0.3 (-9%) | -0.4 (-12%) |
| NB - Indianapolis | 3.7 | 0.1 (3%) | -0.2 (-5%) | 0.0 (0%) | -0.1 (-2%) | 0.0 (-1%) | 0.3 (8%) | 0.1 (2%) |
| SB - Indianapolis | 3.4 | 0.6 (17%) | -0.1 (-3%) | -0.1 (-4%) | 0.2 (7%) | -0.2 (-6%) | -0.1 (-3%) | 0.4 (11%) |
| NB - Kennedy | 3.0 | -0.1 (-5%) | -0.2 (-8%) | -0.3 (-9%) | -0.3 (-10%) | -0.4 (-14%) | 0.2 (5%) | -0.2 (-8%) |
| SB - Kennedy | 2.4 | 0.0 (-1%) | 0.0 (2%) | 0.0 (0%) | 0.1 (3%) | 0.0 (2%) | 0.0 (0%) | 0.1 (5%) |
| NB - Cline | 1.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) | 0.0 (0%) |
| SB - Cline | 2.0 | -0.2 (-8%) | -0.1 (-7%) | 0.0 (-2%) | -0.1 (-4%) | -0.2 (-8%) | -0.1 (-3%) | -0.1 (-3%) |
| NB - Burr | 3.5 | -0.3 (-9%) | 0.0 (-1%) | -0.1 (-3%) | 0.2 (5%) | 0.5 (14%) | 0.0 (0%) | 0.3 (9%) |
| SB - Burr | 2.0 | 0.0 (1%) | 0.0 (1%) | 0.0 (1%) | 0.0 (1%) | 0.1 (3%) | 0.0 (1%) | 0.0 (0%) |
| NB - Grant | 2.1 | 0.0 (2%) | 0.1 (5%) | 0.0 (-2%) | 0.0 (2%) | 0.2 (7%) | 0.0 (-2%) | 0.2 (7%) |
| SB - Grant | 1.7 | 0.0 (0%) | 0.0 (2%) | 0.0 (0%) | 0.0 (1%) | 0.1 (3%) | 0.0 (1%) | 0.1 (5%) |
| NB - Broadway | 1.8 | 0.0 (-2%) | 0.0 (0%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (-1%) | 0.0 (-1%) | 0.0 (0%) |
| SB - Broadway | 2.0 | 0.0 (1%) | 0.0 (2%) | 0.0 (-1%) | 0.2 (12%) | 0.0 (0%) | 0.0 (-1%) | 0.5 (27%) |
| NB - I65 | 3.5 | 0.0 (0%) | 0.2 (5%) | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) | 0.0 (1%) |
| SB - I65 | 3.6 | 0.0 (0%) | 0.1 (2%) | 0.0 (0%) | 0.0 (1%) | 0.0 (1%) | 0.0 (-1%) | 0.1 (2%) |

### Entrance Ramp Travel Times

Entrance ramp travel times are measured from the entrance ramp terminal traffic signal to approximately 2 to 3 miles downstream on the freeway. This metric aims to estimate potential delay or travel time savings for entrance ramp movements between each TSMO scenario and the Existing and Future Base scenarios. The results of the comparison are shown as differences to the Existing Baseline scenario in Table D.28 to Table D.31.

**Table D.28: 2019 AM Entrance Ramp Travel Times (Minutes)**

| ROUTE | | | | SC1 |
|---|---|---|---|---|
| | Base | RM | DSL | DSL RM |
| | Abs. (Mins) | Δ | Δ | Δ |
| NB to EB - I394 | 3.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB to WB - I394 | 2.3 | 0.0 (1%) | 0.0 (1%) | 0.0 (1%) |
| SB to EB - I94 (Route 1) | 4.2 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB to EB - I94 (Route 2) | 4.3 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB to EB - I94 (Route 3) | 4.4 | 0.0 (0%) | 0.0 (1%) | 0.0 (1%) |
| SB to WB - I94 | 1.9 | 0.0 (1%) | 0.0 (1%) | 0.0 (1%) |
| NB to EB - Torrence | 4.2 | 0.0 (0%) | 0.0 (1%) | 0.0 (1%) |
| NB to EB - Torrence - Short | 2.7 | 0.0 (-1%) | 0.0 (0%) | 0.0 (0%) |
| NB to WB - Torrence | 3.4 | 0.0 (1%) | 0.0 (1%) | 0.0 (1%) |
| SB to EB - Torrence | 4.1 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB to EB - Torrence - Short | 2.5 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB to WB - Torrence | 6.1 | 0.1 (2%) | 0.2 (4%) | 0.3 (5%) |
| NB to EB - Calumet | 3.9 | 0.1 (4%) | 0.0 (0%) | 0.1 (4%) |
| NB to WB - Calumet | 3.8 | 0.1 (3%) | 0.0 (0%) | 0.1 (3%) |
| SB to EB - Calumet | 4.1 | 0.2 (4%) | 0.0 (0%) | 0.2 (4%) |
| SB to WB - Calumet | 4.1 | 0.1 (2%) | 0.0 (1%) | 0.1 (2%) |
| NB to EB - Indianapolis | 3.9 | 0.1 (4%) | 0.0 (0%) | 0.1 (4%) |
| NB to WB - Indianapolis | 3.6 | 0.1 (4%) | 0.0 (1%) | 0.2 (4%) |
| SB to EB - Indianapolis | 3.9 | 0.1 (3%) | 0.0 (0%) | 0.1 (4%) |

| ROUTE | | | | SC1 |
|---|---|---|---|---|
| | Base | RM | DSL | DSL RM |
| | Abs. (Mins) | Δ | Δ | Δ |
| SB to WB - Indianapolis | 3.5 | 0.1 (3%) | 0.0 (1%) | 0.1 (3%) |
| NB to EB Kennedy | 3.5 | 0.1 (4%) | 0.0 (1%) | 0.1 (4%) |
| NB to WB - Kennedy | 3.1 | 0.1 (5%) | 0.0 (1%) | 0.2 (6%) |
| SB to EB - Kennedy | 3.6 | 0.1 (4%) | 0.0 (0%) | 0.1 (4%) |
| SB to WB - Kennedy | 3.0 | 0.1 (4%) | 0.1 (2%) | 0.2 (6%) |
| NB to EB - Cline | 3.9 | 0.2 (4%) | 0.0 (0%) | 0.1 (3%) |
| NB to WB - Cline | 4.3 | 0.2 (4%) | 0.1 (2%) | 0.2 (6%) |
| SB to EB - Cline | 4.0 | 0.2 (4%) | 0.0 (0%) | 0.2 (4%) |
| SB to WB - Cline | 4.0 | 0.1 (3%) | 0.1 (2%) | 0.2 (6%) |
| NB to EB - Burr | 4.0 | 0.1 (3%) | 0.0 (0%) | 0.1 (3%) |
| NB to WB - Burr | 4.0 | 0.1 (3%) | 0.0 (1%) | 0.2 (4%) |
| SB to EB - Burr | 4.0 | 0.1 (4%) | 0.0 (0%) | 0.1 (3%) |
| SB to WB - Burr | 4.0 | 0.1 (3%) | 0.1 (1%) | 0.2 (4%) |
| NB to EB - Grant | 3.9 | 0.1 (3%) | 0.0 (0%) | 0.1 (3%) |
| NB to WB - Grant | 3.8 | 0.1 (4%) | 0.0 (1%) | 0.2 (5%) |
| SB to EB - Grant | 4.2 | 0.1 (3%) | 0.0 (0%) | 0.2 (4%) |
| SB to WB - Grant | 3.6 | 0.1 (4%) | 0.0 (0%) | 0.1 (4%) |
| NB to EB - Broadway | 3.1 | 0.1 (3%) | 0.0 (-1%) | 0.1 (3%) |
| NB to WB - Broadway | 3.7 | 0.1 (4%) | 0.0 (1%) | 0.2 (5%) |
| SB to EB - Broadway | 3.3 | 0.1 (4%) | 0.0 (0%) | 0.1 (3%) |
| SB to WB - Broadway | 3.4 | 0.1 (4%) | 0.0 (1%) | 0.2 (4%) |
| NB to EB - I65 | 3.2 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB to WB - I65 | 3.4 | 0.0 (0%) | 0.1 (2%) | 0.0 (1%) |
| SB to EB - I65 | 3.6 | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) |
| SB to WB - I65 | 3.5 | 0.0 (0%) | 0.0 (1%) | 0.0 (1%) |

## Table D.29: 2019 PM Entrance Ramp Travel Times (Minutes)

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| NB to EB - I394 | 6.6 | -0.3 (-4%) | -0.7 (-11%) | 0.1 (2%) | -0.4 (-6%) | -0.5 (-8%) | -0.9 (-14%) | -0.6 (-9%) |
| NB to WB - I394 | 2.3 | 0.0 (0%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) |
| SB to EB - I94 (Route 1) | 5.7 | -0.2 (-4%) | -0.5 (-8%) | -0.1 (-1%) | -0.5 (-9%) | -0.5 (-9%) | -0.4 (-7%) | -0.4 (-8%) |
| SB to EB - I94 (Route 2) | 8.6 | -0.3 (-4%) | -1.3 (-15%) | -0.2 (-3%) | -1.3 (-15%) | -1.4 (-16%) | -1.5 (-17%) | -1.1 (-13%) |
| SB to EB - I94 (Route 3) | 6.4 | -0.3 (-4%) | -0.5 (-8%) | -0.2 (-3%) | -0.6 (-10%) | -0.7 (-11%) | -0.5 (-8%) | -0.5 (-8%) |
| SB to WB - I94 | 1.9 | 0.0 (0%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) |
| NB to EB - Torrence | 7.0 | -0.6 (-9%) | -1.5 (-22%) | 0.1 (2%) | -1.4 (-20%) | -1.4 (-20%) | -1.1 (-16%) | -1.4 (-20%) |
| NB to EB - Torrence - Short | 4.0 | -0.2 (-5%) | -0.3 (-9%) | 0.1 (2%) | -0.2 (-5%) | -0.3 (-7%) | -0.4 (-9%) | -0.3 (-7%) |
| NB to WB - Torrence | 3.3 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (1%) | 0.0 (0%) |
| SB to EB - Torrence | 6.7 | -0.7 (-10%) | -1.6 (-24%) | 0.1 (1%) | -1.5 (-22%) | -1.5 (-22%) | -1.2 (-18%) | -1.5 (-22%) |
| SB to EB - Torrence - Short | 3.7 | -0.2 (-6%) | -0.3 (-9%) | 0.0 (1%) | -0.2 (-6%) | -0.3 (-7%) | -0.4 (-11%) | -0.3 (-7%) |
| SB to WB - Torrence | 4.0 | 0.0 (1%) | 0.0 (0%) | 0.0 (0%) | 0.1 (1%) | 0.1 (2%) | 0.0 (1%) | 0.0 (1%) |
| NB to EB - Calumet | 5.3 | 0.8 (15%) | -0.8 (-16%) | 0.0 (0%) | -0.7 (-14%) | -0.8 (-16%) | 0.8 (15%) | -0.7 (-14%) |
| NB to WB - Calumet | 3.9 | 0.1 (3%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (2%) | 0.0 (0%) | 0.1 (3%) | 0.1 (2%) |
| SB to EB - Calumet | 5.6 | 0.6 (11%) | -0.9 (-16%) | 0.0 (0%) | -0.7 (-13%) | -0.9 (-16%) | 0.6 (11%) | -0.7 (-13%) |
| SB to WB - Calumet | 4.2 | 0.1 (1%) | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) | 0.1 (1%) | 0.0 (1%) |
| NB to EB - Indianapolis | 4.9 | 0.4 (8%) | -0.4 (-8%) | 0.2 (3%) | -0.2 (-4%) | -0.3 (-7%) | 0.1 (2%) | -0.3 (-6%) |
| NB to WB - Indianapolis | 3.8 | 0.1 (4%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (2%) | 0.0 (-1%) | 0.1 (4%) | 0.1 (3%) |
| SB to EB - Indianapolis | 5.0 | 0.5 (9%) | -0.4 (-7%) | 0.2 (4%) | -0.1 (-3%) | -0.3 (-6%) | 0.2 (3%) | -0.2 (-4%) |
| SB to WB - Indianapolis | 3.6 | 0.1 (2%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (1%) | 0.0 (-1%) | 0.1 (3%) | 0.0 (1%) |
| NB to EB Kennedy | 4.4 | 0.5 (10%) | -0.3 (-7%) | 0.2 (5%) | -0.1 (-3%) | -0.3 (-6%) | 0.1 (2%) | -0.2 (-4%) |
| NB to WB - Kennedy | 3.2 | 0.1 (4%) | 0.0 (0%) | 0.0 (0%) | 0.1 (3%) | 0.0 (0%) | 0.1 (4%) | 0.1 (4%) |
| SB to EB - Kennedy | 4.6 | 0.5 (10%) | -0.3 (-7%) | 0.3 (6%) | -0.1 (-2%) | -0.3 (-6%) | 0.1 (1%) | -0.2 (-4%) |

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| SB to WB - Kennedy | 3.1 | 0.1 (4%) | 0.0 (0%) | 0.0 (0%) | 0.1 (4%) | 0.0 (-1%) | 0.1 (4%) | 0.1 (4%) |
| NB to EB - Cline | 5.7 | 0.2 (4%) | -0.2 (-3%) | 0.0 (1%) | 0.0 (1%) | -0.1 (-1%) | 0.1 (1%) | -0.1 (-3%) |
| NB to WB - Cline | 4.4 | 0.2 (4%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (2%) | 0.0 (0%) | 0.2 (3%) | 0.1 (3%) |
| SB to EB - Cline | 6.6 | 0.4 (6%) | -0.3 (-4%) | -0.2 (-4%) | 0.3 (4%) | 0.0 (0%) | 0.5 (7%) | 0.0 (1%) |
| SB to WB - Cline | 4.1 | 0.1 (3%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (2%) | 0.0 (0%) | 0.1 (3%) | 0.1 (2%) |
| NB to EB - Burr | 4.6 | 0.1 (3%) | -0.3 (-6%) | -0.1 (-2%) | -0.1 (-3%) | -0.3 (-6%) | 0.1 (2%) | -0.1 (-3%) |
| NB to WB - Burr | 4.1 | 0.1 (3%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (2%) | 0.0 (-1%) | 0.1 (3%) | 0.1 (2%) |
| SB to EB - Burr | 4.5 | 0.2 (4%) | -0.2 (-5%) | 0.0 (-1%) | -0.1 (-1%) | -0.2 (-5%) | 0.1 (2%) | -0.1 (-1%) |
| SB to WB - Burr | 4.1 | 0.1 (3%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (2%) | 0.0 (-1%) | 0.1 (3%) | 0.1 (3%) |
| NB to EB - Grant | 4.5 | 0.2 (4%) | -0.3 (-6%) | -0.1 (-1%) | -0.1 (-2%) | -0.3 (-6%) | 0.1 (3%) | -0.1 (-2%) |
| NB to WB - Grant | 3.8 | 0.2 (4%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (4%) | 0.0 (0%) | 0.2 (4%) | 0.1 (4%) |
| SB to EB - Grant | 4.7 | 0.2 (4%) | -0.3 (-6%) | 0.0 (-1%) | -0.1 (-2%) | -0.3 (-6%) | 0.2 (4%) | -0.1 (-3%) |
| SB to WB - Grant | 3.6 | 0.1 (4%) | 0.0 (0%) | 0.0 (0%) | 0.1 (3%) | 0.0 (0%) | 0.1 (4%) | 0.1 (3%) |
| NB to EB - Broadway | 3.4 | 0.2 (6%) | -0.1 (-2%) | 0.0 (0%) | 0.0 (1%) | -0.1 (-3%) | 0.1 (3%) | 0.0 (1%) |
| NB to WB - Broadway | 3.7 | 0.1 (4%) | 0.0 (0%) | 0.0 (0%) | 0.1 (4%) | 0.0 (0%) | 0.1 (4%) | 0.1 (4%) |
| SB to EB - Broadway | 3.6 | 0.1 (3%) | -0.1 (-3%) | 0.0 (0%) | 0.0 (1%) | -0.1 (-3%) | 0.1 (3%) | 0.0 (1%) |
| SB to WB - Broadway | 3.5 | 0.1 (4%) | 0.0 (0%) | 0.0 (0%) | 0.1 (4%) | 0.0 (0%) | 0.1 (4%) | 0.1 (4%) |
| NB to EB - I65 | 3.3 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB to WB - I65 | 4.0 | 0.0 (0%) | 0.2 (4%) | 0.0 (0%) | 0.2 (6%) | 0.3 (8%) | 0.2 (5%) | 0.2 (5%) |
| SB to EB - I65 | 3.6 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) | 0.0 (1%) |
| SB to WB - I65 | 3.6 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |

## Table D.30: 2040 AM Entrance Ramp Travel Times (Minutes)

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| NB to EB - I394 | 3.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) |
| NB to WB - I394 | 2.2 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB to EB - I94 (Route 1) | 4.3 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB to EB - I94 (Route 2) | 4.4 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB to EB - I94 (Route 3) | 4.5 | 0.0 (0%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (-1%) | 0.0 (-1%) | 0.0 (0%) | 0.0 (-1%) |
| SB to WB - I94 | 1.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB to EB - Torrence | 4.3 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (-1%) | 0.0 (1%) |
| NB to EB - Torrence - Short | 2.8 | 0.0 (-1%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| NB to WB - Torrence | 3.3 | 0.0 (1%) | 0.1 (2%) | 0.0 (0%) | 0.1 (2%) | 0.1 (2%) | 0.0 (0%) | 0.0 (1%) |
| SB to EB - Torrence | 4.2 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB to EB - Torrence - Short | 2.6 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB to WB - Torrence | 3.7 | 0.0 (1%) | 0.1 (2%) | 0.0 (0%) | 0.1 (2%) | 0.1 (3%) | -0.1 (-1%) | 0.1 (2%) |
| NB to EB - Calumet | 4.0 | 0.1 (3%) | 0.0 (0%) | 0.0 (0%) | 0.1 (3%) | 0.0 (0%) | 0.1 (3%) | 0.1 (3%) |
| NB to WB - Calumet | 3.8 | 0.1 (3%) | 0.1 (2%) | 0.0 (0%) | 0.2 (4%) | 0.1 (2%) | 0.1 (3%) | 0.2 (4%) |
| SB to EB - Calumet | 4.2 | 0.1 (3%) | 0.0 (0%) | 0.0 (0%) | 0.1 (3%) | 0.0 (0%) | 0.1 (3%) | 0.1 (3%) |
| SB to WB - Calumet | 4.1 | 0.1 (1%) | 0.1 (1%) | 0.0 (0%) | 0.1 (2%) | 0.1 (1%) | 0.0 (1%) | 0.1 (2%) |
| NB to EB - Indianapolis | 3.9 | 0.1 (4%) | 0.0 (0%) | 0.0 (0%) | 0.2 (4%) | 0.0 (0%) | 0.2 (4%) | 0.1 (4%) |
| NB to WB - Indianapolis | 3.7 | 0.1 (3%) | 0.0 (1%) | 0.0 (0%) | 0.2 (4%) | 0.0 (1%) | 0.1 (3%) | 0.2 (5%) |
| SB to EB - Indianapolis | 4.0 | 0.1 (3%) | 0.0 (0%) | 0.0 (0%) | 0.1 (3%) | 0.0 (0%) | 0.1 (3%) | 0.1 (3%) |
| SB to WB - Indianapolis | 3.5 | 0.1 (3%) | 0.1 (1%) | 0.0 (0%) | 0.2 (4%) | 0.1 (2%) | 0.1 (2%) | 0.2 (5%) |
| NB to EB Kennedy | 3.6 | 0.2 (4%) | 0.0 (1%) | 0.0 (0%) | 0.2 (4%) | 0.0 (1%) | 0.1 (4%) | 0.2 (4%) |
| NB to WB - Kennedy | 3.2 | 0.1 (4%) | 0.0 (2%) | 0.0 (0%) | 0.2 (6%) | 0.1 (2%) | 0.1 (4%) | 0.2 (6%) |
| SB to EB - Kennedy | 3.7 | 0.1 (3%) | 0.0 (0%) | 0.0 (0%) | 0.1 (3%) | 0.0 (0%) | 0.1 (4%) | 0.1 (3%) |
| SB to WB - Kennedy | 3.0 | 0.1 (5%) | 0.1 (2%) | 0.0 (0%) | 0.2 (6%) | 0.1 (2%) | 0.1 (4%) | 0.2 (6%) |

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| NB to EB - Cline | 4.0 | 0.1 (4%) | 0.0 (0%) | 0.0 (0%) | 0.2 (4%) | 0.0 (0%) | 0.1 (3%) | 0.2 (4%) |
| NB to WB - Cline | 4.4 | 0.2 (3%) | 0.1 (2%) | 0.0 (0%) | 0.3 (6%) | 0.1 (3%) | 0.1 (3%) | 0.3 (6%) |
| SB to EB - Cline | 4.1 | 0.2 (4%) | 0.0 (0%) | 0.0 (0%) | 0.2 (5%) | 0.0 (0%) | 0.2 (4%) | 0.2 (5%) |
| SB to WB - Cline | 4.1 | 0.2 (4%) | 0.1 (3%) | 0.0 (0%) | 0.3 (6%) | 0.1 (3%) | 0.1 (4%) | 0.3 (6%) |
| NB to EB - Burr | 4.2 | 0.1 (3%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (2%) | 0.0 (-1%) | 0.1 (3%) | 0.1 (2%) |
| NB to WB - Burr | 4.1 | 0.1 (3%) | 0.1 (2%) | 0.0 (0%) | 0.2 (5%) | 0.1 (2%) | 0.1 (3%) | 0.2 (5%) |
| SB to EB - Burr | 4.1 | 0.1 (3%) | 0.0 (0%) | 0.0 (0%) | 0.1 (4%) | 0.0 (1%) | 0.2 (4%) | 0.1 (4%) |
| SB to WB - Burr | 4.1 | 0.1 (3%) | 0.1 (1%) | 0.0 (0%) | 0.2 (4%) | 0.0 (1%) | 0.1 (2%) | 0.2 (4%) |
| NB to EB - Grant | 4.1 | 0.1 (3%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (3%) | 0.0 (-1%) | 0.1 (3%) | 0.1 (2%) |
| NB to WB - Grant | 4.2 | 0.1 (3%) | -0.1 (-3%) | 0.1 (3%) | 0.0 (0%) | -0.1 (-2%) | 0.1 (3%) | 0.0 (1%) |
| SB to EB - Grant | 4.4 | 0.1 (3%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (3%) | 0.0 (-1%) | 0.1 (3%) | 0.1 (2%) |
| SB to WB - Grant | 4.0 | 0.1 (3%) | -0.2 (-4%) | 0.1 (3%) | 0.0 (-1%) | -0.1 (-3%) | 0.1 (3%) | 0.0 (0%) |
| NB to EB - Broadway | 3.2 | 0.1 (4%) | 0.0 (-1%) | 0.0 (0%) | 0.1 (3%) | 0.0 (-1%) | 0.1 (3%) | 0.1 (2%) |
| NB to WB - Broadway | 3.8 | 0.1 (4%) | 0.0 (0%) | 0.0 (1%) | 0.2 (4%) | 0.0 (1%) | 0.1 (3%) | 0.2 (4%) |
| SB to EB - Broadway | 3.4 | 0.2 (5%) | 0.0 (1%) | 0.0 (0%) | 0.2 (5%) | 0.0 (1%) | 0.1 (3%) | 0.2 (5%) |
| SB to WB - Broadway | 3.6 | 0.1 (4%) | 0.0 (0%) | 0.0 (1%) | 0.1 (4%) | 0.0 (0%) | 0.1 (3%) | 0.1 (4%) |
| NB to EB - I65 | 3.3 | 0.0 (0%) | 0.1 (4%) | 0.0 (0%) | 0.0 (0%) | 0.1 (4%) | 0.0 (0%) | 0.0 (0%) |
| NB to WB - I65 | 5.0 | -0.1 (-3%) | -0.7 (-14%) | 0.0 (1%) | -0.6 (-12%) | -0.7 (-15%) | -0.2 (-4%) | -0.6 (-13%) |
| SB to EB - I65 | 3.7 | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) |
| SB to WB - I65 | 3.6 | 0.0 (0%) | 0.1 (3%) | 0.0 (0%) | 0.1 (3%) | 0.1 (3%) | 0.0 (0%) | 0.1 (3%) |

## Table D.31: 2040 PM Entrance Ramp Travel Times (Minutes)

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| NB to EB - I394 | 19.4 | -6.9 (-35%) | -11.1 (-57%) | -3.0 (-16%) | -10.7 (-55%) | -11.5 (-59%) | -3.9 (-20%) | -10.9 (-56%) |
| NB to WB - I394 | 2.2 | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) | 0.0 (1%) | 0.0 (1%) | 0.0 (0%) | 0.0 (1%) |
| SB to EB - I94 (Route 1) | 14.6 | -5.1 (-35%) | -8.7 (-59%) | 0.2 (1%) | -8.4 (-57%) | -8.9 (-61%) | -0.2 (-2%) | -8.7 (-59%) |
| SB to EB - I94 (Route 2) | 21.0 | -7.6 (-36%) | -12.1 (-58%) | 1.6 (8%) | -11.7 (-56%) | -12.6 (-60%) | -2.1 (-10%) | -12.1 (-57%) |
| SB to EB - I94 (Route 3) | 21.3 | -8.5 (-40%) | -14.1 (-66%) | -0.3 (-1%) | -13.4 (-63%) | -14.3 (-67%) | -1.0 (-5%) | -13.7 (-64%) |
| SB to WB - I94 | 1.8 | 0.0 (0%) | 0.0 (1%) | 0.0 (1%) | 0.0 (1%) | 0.0 (0%) | 0.0 (1%) | 0.0 (0%) |
| NB to EB - Torrence | 12.6 | -2.1 (-17%) | -5.5 (-44%) | -1.1 (-9%) | -5.8 (-46%) | -6.0 (-48%) | -2.1 (-16%) | -5.8 (-46%) |
| NB to EB - Torrence - Short | 9.1 | -1.4 (-16%) | -4.4 (-48%) | -1.1 (-12%) | -4.4 (-48%) | -4.5 (-49%) | -2.0 (-22%) | -4.4 (-48%) |
| NB to WB - Torrence | 3.2 | 0.0 (1%) | 0.0 (1%) | 0.0 (2%) | 0.1 (2%) | 0.0 (1%) | 0.0 (0%) | 0.0 (1%) |
| SB to EB - Torrence | 11.7 | -2.6 (-22%) | -5.2 (-44%) | -0.9 (-8%) | -5.5 (-47%) | -5.7 (-48%) | -1.6 (-14%) | -5.5 (-47%) |
| SB to EB - Torrence - Short | 8.4 | -2.1 (-25%) | -4.2 (-50%) | -1.0 (-12%) | -4.2 (-51%) | -4.3 (-51%) | -1.7 (-20%) | -4.2 (-51%) |
| SB to WB - Torrence | 3.4 | 0.0 (0%) | 0.0 (0%) | 0.0 (1%) | 0.0 (1%) | 0.0 (1%) | 0.0 (0%) | 0.0 (0%) |
| NB to EB - Calumet | 6.4 | 2.6 (41%) | -1.1 (-18%) | -0.4 (-6%) | -1.1 (-18%) | -1.4 (-22%) | 0.6 (10%) | -1.0 (-16%) |
| NB to WB - Calumet | 4.2 | 0.1 (1%) | -0.2 (-5%) | -0.1 (-3%) | -0.1 (-3%) | -0.2 (-5%) | -0.1 (-3%) | -0.1 (-3%) |
| SB to EB - Calumet | 6.6 | 4.4 (67%) | -1.1 (-17%) | -0.4 (-6%) | -1.1 (-16%) | -1.4 (-22%) | 0.6 (9%) | -1.0 (-15%) |
| SB to WB - Calumet | 4.4 | 0.0 (-1%) | -0.2 (-5%) | -0.1 (-3%) | -0.1 (-3%) | -0.2 (-4%) | -0.1 (-3%) | -0.1 (-3%) |
| NB to EB - Indianapolis | 7.1 | 1.1 (16%) | -1.3 (-18%) | -0.4 (-6%) | -1.3 (-19%) | -1.3 (-19%) | 0.1 (1%) | -1.3 (-19%) |
| NB to WB - Indianapolis | 3.9 | 0.1 (3%) | 0.0 (0%) | 0.1 (2%) | 0.2 (4%) | 0.0 (1%) | 0.1 (3%) | 0.1 (3%) |
| SB to EB - Indianapolis | 7.2 | 1.6 (23%) | -1.3 (-17%) | -0.4 (-6%) | -1.3 (-18%) | -1.4 (-19%) | 0.0 (1%) | -1.3 (-19%) |
| SB to WB - Indianapolis | 3.8 | 0.0 (1%) | 0.0 (0%) | 0.0 (0%) | 0.1 (2%) | 0.0 (1%) | 0.0 (1%) | 0.1 (2%) |
| NB to EB Kennedy | 6.6 | 1.1 (16%) | -1.0 (-15%) | -0.3 (-4%) | -1.0 (-16%) | -1.0 (-15%) | 0.1 (2%) | -1.1 (-16%) |
| NB to WB - Kennedy | 3.4 | 0.1 (3%) | 0.0 (0%) | 0.1 (2%) | 0.2 (5%) | 0.0 (1%) | 0.2 (5%) | 0.1 (4%) |
| SB to EB - Kennedy | 6.8 | 2.1 (31%) | -1.0 (-15%) | -0.3 (-4%) | -1.0 (-15%) | -1.1 (-17%) | 0.0 (0%) | -1.0 (-15%) |

| ROUTE | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| | Abs. (Mins) | Δ | Δ | Δ | Δ | Δ | Δ | Δ |
| SB to WB - Kennedy | 3.3 | 0.1 (3%) | 0.0 (1%) | 0.0 (1%) | 0.2 (6%) | 0.1 (2%) | 0.2 (5%) | 0.1 (4%) |
| NB to EB - Cline | 6.1 | 0.2 (3%) | -0.2 (-3%) | -0.1 (-1%) | -0.1 (-1%) | 0.0 (1%) | 0.0 (0%) | -0.2 (-4%) |
| NB to WB - Cline | 4.8 | 0.0 (1%) | -0.1 (-2%) | 0.1 (1%) | 0.1 (2%) | -0.1 (-1%) | 0.2 (5%) | 0.1 (1%) |
| SB to EB - Cline | 6.9 | 0.9 (13%) | -0.5 (-7%) | -0.3 (-4%) | -0.2 (-2%) | -0.3 (-5%) | 0.0 (0%) | -0.7 (-9%) |
| SB to WB - Cline | 4.6 | 0.0 (1%) | -0.1 (-2%) | 0.1 (2%) | 0.1 (3%) | -0.1 (-1%) | 0.2 (5%) | 0.1 (1%) |
| NB to EB - Burr | 5.0 | 0.4 (9%) | 0.0 (-1%) | 0.1 (2%) | 0.2 (4%) | 0.4 (7%) | 0.4 (7%) | 0.0 (0%) |
| NB to WB - Burr | 4.4 | 0.1 (2%) | -0.1 (-2%) | 0.0 (1%) | 0.1 (2%) | -0.1 (-2%) | 0.2 (4%) | 0.0 (1%) |
| SB to EB - Burr | 4.9 | 0.5 (9%) | -0.1 (-1%) | 0.1 (2%) | 0.2 (4%) | 0.3 (6%) | 0.5 (10%) | 0.0 (0%) |
| SB to WB - Burr | 4.4 | 0.1 (2%) | -0.1 (-2%) | 0.0 (1%) | 0.1 (1%) | -0.1 (-3%) | 0.2 (4%) | 0.0 (1%) |
| NB to EB - Grant | 4.9 | 0.4 (8%) | 0.4 (8%) | 0.0 (0%) | 0.6 (11%) | 0.6 (13%) | 0.3 (7%) | 0.4 (9%) |
| NB to WB - Grant | 4.5 | 0.2 (5%) | -0.4 (-9%) | 0.0 (0%) | -0.2 (-5%) | -0.4 (-9%) | 0.1 (3%) | -0.2 (-5%) |
| SB to EB - Grant | 5.0 | 0.4 (8%) | 0.3 (5%) | 0.0 (1%) | 0.6 (12%) | 0.6 (13%) | 0.4 (8%) | 0.4 (9%) |
| SB to WB - Grant | 4.3 | 0.2 (6%) | -0.4 (-10%) | 0.0 (0%) | -0.3 (-6%) | -0.4 (-10%) | 0.2 (4%) | -0.3 (-6%) |
| NB to EB - Broadway | 3.6 | 2.1 (59%) | 0.3 (8%) | 0.0 (0%) | 0.8 (22%) | 0.4 (11%) | 0.1 (3%) | 0.4 (10%) |
| NB to WB - Broadway | 4.3 | 0.2 (5%) | -0.3 (-8%) | 0.0 (-1%) | -0.1 (-3%) | -0.3 (-7%) | 0.1 (3%) | -0.2 (-4%) |
| SB to EB - Broadway | 3.8 | 2.2 (59%) | 0.3 (8%) | 0.0 (0%) | 0.8 (21%) | 0.4 (10%) | 0.2 (4%) | 0.5 (13%) |
| SB to WB - Broadway | 4.0 | 0.2 (5%) | -0.3 (-7%) | 0.0 (0%) | -0.1 (-3%) | -0.3 (-7%) | 0.1 (2%) | -0.2 (-4%) |
| NB to EB - I65 | 3.5 | 0.0 (0%) | 0.5 (13%) | -0.1 (-3%) | 1.0 (28%) | 0.8 (24%) | 0.1 (3%) | 1.4 (40%) |
| NB to WB - I65 | 5.7 | 0.2 (3%) | -0.1 (-1%) | 0.0 (0%) | 0.1 (1%) | 0.5 (9%) | 0.0 (1%) | 0.0 (0%) |
| SB to EB - I65 | 3.9 | 0.0 (1%) | 0.7 (19%) | -0.1 (-4%) | 1.4 (35%) | 1.2 (30%) | 0.0 (0%) | 1.8 (45%) |
| SB to WB - I65 | 3.8 | 0.0 (0%) | 0.0 (0%) | 0.0 (0%) | 0.1 (2%) | 0.1 (2%) | 0.0 (-1%) | 0.0 (1%) |

## Travel Time Reliability

Travel time reliability of each TSMO scenario is determined based on the 95th percentile travel time, average travel time, and the planning time index. While there is no individual reliability index, the three metrics can be compared across each scenario to quantify reliability. The results of each TSMO scenario by direction are compared to the Existing and Future Base scenarios, as presented in **Table D.32** to **Table D.39**.

### Table D.32: 2019 AM Westbound Travel Time Reliability

| WESTBOUND METRIC | | | | SC1 |
|---|---|---|---|---|
| | Base | RM | DSL | DSL RM |
| Average Speed (MPH) | 60 | 60 | 59 | 59 |
| 95% Travel Time (mins) | 17 | 17 | 17 | 17 |
| Planning Time Index | 1.0 | 1.0 | 1.0 | 1.0 |

### Table D.33: 2019 AM Eastbound Travel Time Reliability

| EASTBOUND METRIC | | | | SC1 |
|---|---|---|---|---|
| | Base | RM | DSL | DSL RM |
| Average Speed (MPH) | 60.0 | 60.0 | 60.0 | 60.0 |
| 95% Travel Time (mins) | 17.0 | 17.0 | 17.0 | 17.0 |
| Planning Time Index | 1.0 | 1.0 | 1.0 | 1.0 |

### Table D.34: 2019 PM Westbound Travel Time Reliability

| WESTBOUND METRIC | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| Average Speed (MPH) | 60.0 | 60.0 | 60.0 | 60.0 | 60.1 | 60.1 | 60.1 | 60.1 |
| 95% Travel Time (mins) | 17.0 | 17.0 | 17.0 | 17.0 | 16.6 | 16.5 | 16.6 | 16.5 |
| Planning Time Index | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

### Table D.35: 2019 PM Eastbound Travel Time Reliability

| EASTBOUND METRIC | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| Average Speed (MPH) | 51.0 | 51.0 | 55.0 | 50.0 | 55.1 | 55.1 | 53.1 | 55.1 |
| 95% Travel Time (mins) | 22.0 | 21.0 | 19.0 | 21.0 | 18.6 | 18.5 | 19.4 | 18.6 |
| Planning Time Index | 1.2 | 1.2 | 1.1 | 1.2 | 1.07 | 1.06 | 1.11 | 1.06 |

Table D.36: 2040 AM Westbound Travel Time Reliability

| WESTBOUND METRIC | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| Average Speed (MPH) | 59.0 | 59.0 | 58.0 | 58.0 | 58.0 | 57.9 | 58.7 | 58.0 |
| 95% Travel Time (mins) | 17.0 | 17.0 | 17.0 | 17.0 | 17.3 | 17.3 | 17.0 | 17.3 |
| Planning Time Index | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

Table D.37: 2040 AM Eastbound Travel Time Reliability

| EASTBOUND METRIC | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| Average Speed (MPH) | 59.0 | 59.0 | 59.0 | 59.0 | 59.4 | 59.4 | 59.3 | 59.4 |
| 95% Travel Time (mins) | 17.0 | 17.0 | 17.0 | 17.0 | 17.1 | 17.1 | 17.0 | 17.1 |
| Planning Time Index | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 | 1.0 |

Table D.38: 2040 PM Westbound Travel Time Reliability

| WESTBOUND METRIC | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| Average Speed (MPH) | 55 | 55 | 57 | 55 | 57.4 | 57.3 | 55.5 | 57.4 |
| 95% Travel Time (mins) | 19 | 19 | 17 | 19 | 17.4 | 17.4 | 18.4 | 17.4 |
| Planning Time Index | 1.1 | 1.10 | 1.00 | 1.10 | 1.00 | 1.00 | 1.05 | 1.00 |

Table D.39: 2040 PM Eastbound Travel Time Reliability

| EASTBOUND METRIC | | | | | SC1 | SC2 | SC3 | SC4 |
|---|---|---|---|---|---|---|---|---|
| | Base | RM | DSL | VSL | DSL RM | DSL VSL | RM VSL | DSL RM VSL |
| Average Speed (MPH) | 35.0 | 38.0 | 45.0 | 35.0 | 46.4 | 45.9 | 34.8 | 46.4 |
| 95% Travel Time (mins) | 31.0 | 28.0 | 24.0 | 30.0 | 23.1 | 23.4 | 31.0 | 22.8 |
| Planning Time Index | 1.8 | 1.60 | 1.40 | 1.70 | 1.32 | 1.33 | 1.77 | 1.30 |

## D.3 Detailed Benefit-Cost Analysis Results

This section provides the detailed data used to generate traffic operations Present Value (PV) benefits and costs for each individual TSMO strategy and strategy combination. The strategies and strategy combinations in the Traffic Operations TSMO group were analyzed using this approach and are reiterated below for reference in Table D.40.

**Table D.40: Traffic Operations TSMO Strategy and Strategy Combination Description**

| STRATEGY COMBINATION | DESCRIPTION |
|---|---|
| | Ramp Metering |
| | Dynamic Shoulder Lanes |
| | Variable Speed Limit |
| SC1 | Dynamic Shoulder Lanes + Ramp Metering |
| SC2 | Dynamic Shoulder Lanes + Variable Speed Limits |
| SC3 | Ramp Metering + Variable Speed Limits |
| SC4 | Dynamic Shoulder Lanes + Ramp Metering + Variable Speed Limits |

### Present Value Costs

The costs estimation methodology for each individual TSMO traffic operations strategy and strategy combination is described in detail in Section 5.1.4. The resulting Present Value (PV) costs are presented in Table D.41 overleaf. It was assumed that design and construction would commence in 2023 and last for approximately two years, with 50% of the cost incurred in the first year (2023) and the remaining 50% in the second year (2024). All values are presented in 2021 dollars.

### Present Value Benefits

The benefits estimation methodology for each individual TSMO traffic operations strategy and strategy combination is described in detail in Section 5.1.4. Two sets of Present Value traffic operations benefits are provided below, one for benefits stemming only from the I-80/94 corridor in Table D.42 overleaf, and a second for benefits from the entire study network (including changes to the municipal network) in Table D.43 overleaf. It was assumed that each project would be completed by 2025 and would start accruing benefits immediately in 2025 for the next 16 years. All values are presented in 2021 dollars.

**Table D.41: TSMO Traffic Operations Strategies and Strategy Combinations – Implementation Costs ($ Thousands)**

| PROJECT | TOTAL PRESENT VALUE COSTS (2021 $) | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **$6,400** | $- | $- | $2,549 | $2,644 | $171 | $171 | $171 | $171 | $171 | $171 | $171 | $171 | $171 | $171 | $171 | $171 | $171 | $171 | $171 | $171 |
| | **$66,100** | $ | $- | $38,447 | $39,869 | $614 | $614 | $614 | $614 | $614 | $614 | $614 | $614 | $614 | $614 | $614 | $614 | $614 | $614 | $614 | $614 |
| | **$19,200** | $- | $- | $10,979 | $11,386 | $173 | $173 | $173 | $173 | $173 | $173 | $173 | $173 | $173 | $173 | $173 | $173 | $173 | $173 | $173 | $173 |
| SC1 | **$72,300** | $- | $- | $41,011 | $42,529 | $718 | $718 | $718 | $718 | $718 | $718 | $718 | $718 | $718 | $718 | $718 | $718 | $718 | $718 | $718 | $718 |
| SC2 | **$69,500** | $- | $- | $41,335 | $42,865 | $641 | $641 | $641 | $641 | $641 | $641 | $641 | $641 | $641 | $641 | $641 | $641 | $641 | $641 | $641 | $641 |
| SC3 | **$25,200** | $- | $- | $13,007 | $13,489 | $329 | $329 | $329 | $329 | $329 | $329 | $329 | $329 | $329 | $329 | $329 | $329 | $329 | $329 | $329 | $329 |
| SC4 | **$73,000** | $- | $- | $42,731 | $44,312 | $736 | $736 | $736 | $736 | $736 | $736 | $736 | $736 | $736 | $736 | $736 | $736 | $736 | $736 | $736 | $736 |

**Table D.42: TSMO Traffic Operations Strategies and Strategy Combinations – Benefits to Borman Only ($ Thousands)**

| PROJECT | TOTAL PRESENT VALUE BENEFITS (2021 $) | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **$93,600** | $- | $- | $- | $- | $2,841 | $3,769 | $4,697 | $5,625 | $6,553 | $7,480 | $8,408 | $9,336 | $10,264 | $11,192 | $12,120 | $13,048 | $13,975 | $14,903 | $15,831 | $16,759 |
| | **$286,900** | $- | $- | $- | $- | $15,013 | $16,913 | $18,814 | $20,715 | $22,615 | $24,516 | $26,417 | $28,318 | $30,218 | $32,119 | $34,020 | $35,921 | $37,821 | $39,722 | $41,623 | $43,523 |
| | **$85,300** | $- | $- | $- | $- | $2,591 | $3,437 | $4,283 | $5,129 | $5,976 | $6,822 | $7,668 | $8,514 | $9,360 | $10,206 | $11,052 | $11,898 | $12,744 | $13,591 | $14,437 | $15,283 |
| SC1 | **$334,600** | $- | $- | $- | $- | $16,188 | $18,603 | $21,017 | $23,432 | $25,846 | $28,261 | $30,676 | $33,090 | $35,505 | $37,920 | $40,334 | $42,749 | $45,164 | $47,578 | $49,993 | $52,408 |
| SC2 | **$354,600** | $- | $- | $- | $- | $22,323 | $24,108 | $25,894 | $27,679 | $29,465 | $31,250 | $33,035 | $34,821 | $36,606 | $38,392 | $40,177 | $41,963 | $43,748 | $45,533 | $47,319 | $49,104 |
| SC3 | **$95,000** | $- | $- | $- | $- | $5,093 | $5,704 | $6,315 | $6,926 | $7,537 | $8,147 | $8,758 | $9,369 | $9,980 | $10,591 | $11,202 | $11,813 | $12,424 | $13,035 | $13,646 | $14,257 |
| SC4 | **$355,300** | $- | $- | $- | $- | $21,778 | $23,654 | $25,530 | $27,407 | $29,283 | $31,159 | $33,035 | $34,912 | $36,788 | $38,664 | $40,541 | $42,417 | $44,293 | $46,169 | $48,046 | $49,922 |

**Table D.43: TSMO Traffic Operations Strategies and Strategy Combinations – Benefits to Study Network ($ Thousands)**

| PROJECT | TOTAL PRESENT VALUE BENEFITS (2021 $) | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | 2037 | 2038 | 2039 | 2040 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | **$20,400** | $- | $- | $- | $- | $1,829 | $1,850 | $1,871 | $1,893 | $1,914 | $1,936 | $1,957 | $1,979 | $2,000 | $2,021 | $2,043 | $2,064 | $2,086 | $2,107 | $2,129 | $2,150 |
| | **$540,700** | $- | $- | $- | $- | $28,674 | $32,200 | $35,726 | $39,251 | $42,777 | $46,303 | $49,829 | $53,354 | $56,880 | $60,406 | $63,932 | $67,457 | $70,983 | $74,509 | $78,034 | $81,560 |
| | **$261,800** | $- | $- | $- | $- | $14,212 | $15,870 | $17,528 | $19,186 | $20,844 | $22,501 | $24,159 | $25,817 | $27,475 | $29,133 | $30,790 | $32,448 | $34,106 | $35,764 | $37,422 | $39,080 |
| SC1 | **$475,700** | $- | $- | $- | $- | $23,846 | $27,155 | $30,463 | $33,772 | $37,081 | $40,390 | $43,699 | $47,008 | $50,316 | $53,625 | $56,934 | $60,243 | $63,552 | $66,861 | $70,169 | $73,478 |
| SC2 | **$621,400** | $- | $- | $- | $- | $39,394 | $42,480 | $45,566 | $48,651 | $51,737 | $54,823 | $57,909 | $60,995 | $64,081 | $67,166 | $70,252 | $73,338 | $76,424 | $79,510 | $82,596 | $85,681 |
| SC3 | **$215,200** | $- | $- | $- | $- | $11,913 | $13,241 | $14,569 | $15,897 | $17,225 | $18,553 | $19,881 | $21,209 | $22,537 | $23,864 | $25,192 | $26,520 | $27,848 | $29,176 | $30,504 | $31,832 |
| SC4 | **$522,600** | $- | $- | $- | $- | $34,434 | $36,835 | $39,236 | $41,637 | $44,038 | $46,439 | $48,840 | $51,240 | $53,641 | $56,042 | $58,443 | $60,844 | $63,245 | $65,646 | $68,047 | $70,447 |

## TSMO Traffic Operations Strategy and Strategy Combination Assessment and Prioritization

This section focuses on establishing a prioritization of all individual TSMO traffic operations strategy and strategy combinations examined. The Present Value costs and benefits derived in the above section were used to generate a benefit-cost ratio (BCR). If a strategy or strategy combination has a BCR greater than 1.0, the strategy or strategy combination is expected to deliver a positive Net Present Value (NPV). Each strategy or strategy combination with a positive NPV is assigned a rank relative to all other strategies and strategy combinations. A lower rank indicates a higher BCR. The resultant BCR and NPV for the I-80/94 mainline (Borman) only are presented in Table D.44 and for the entire study network in Table D.45.

**Table D.44: Traffic Operations TSMO Strategy and Strategy Combination Prioritization – Borman Only**

| PROJECT | DESCRIPTION | BCR | RANK | NPV ($ MILLION) |
|---|---|---|---|---|
| | Ramp Metering | 14.4 | 1 | $87.1 |
| | Dynamic Shoulder Lanes | 3.7 | 6 | $209.5 |
| | Variable Speed Limit | 3.9 | 5 | $63.2 |
| SC1 | Dynamic Shoulder Lanes + Ramp Metering | 4.0 | 4 | $251.4 |
| SC2 | Dynamic Shoulder Lanes + Variable Speed Limits | 4.3 | 2 | $271.6 |
| SC3 | Ramp Metering + Variable Speed Limits | 3.5 | 7 | $67.6 |
| SC4 | Dynamic Shoulder Lanes + Ramp Metering + Variable Speed Limits | 4.1 | 3 | $268.8 |

**Table D.45: Traffic Operations TSMO Strategy and Strategy Combination Prioritization –Study Network**

| PROJECT | DESCRIPTION | BCR | RANK | NPV ($ MILLION) |
|---|---|---|---|---|
| | Ramp Metering | 3.1 | 7 | $13.9 |
| | Dynamic Shoulder Lanes | 7.0 | 4 | $463.3 |
| | Variable Speed Limit | 11.9 | 1 | $239.7 |
| SC1 | Dynamic Shoulder Lanes + Ramp Metering | 5.7 | 6 | $392.5 |
| SC2 | Dynamic Shoulder Lanes + Variable Speed Limits | 7.5 | 3 | $538.4 |
| SC3 | Ramp Metering + Variable Speed Limits | 7.9 | 2 | $187.8 |
| SC4 | Dynamic Shoulder Lanes + Ramp Metering + Variable Speed Limits | 6.0 | 5 | $436.1 |

## D.4 Safety Benefit Evaluation Results

### Variable Speed Limits

Table D.46: Estimated Safety Benefits for Variable Speed Limits – Eastbound Direction

| EASTBOUND SEGMENT | LENGTH | OBSERVED CRASHES (2017-2019) | | | | CRASHES SAVED | | | | PRESENT WORTH BENEFIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | (mi) | Fatal + Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | Fatal + Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | ($) |
| Torrence Ave off-ramp | 0.27 | 0 | 0 | 8 | 8 | 0.05 | 0.02 | 0.25 | 0.32 | **$2,658,029** |
| Between Torrence Ave off-ramp and I-94 SB on-ramp | 0.91 | 0 | 0 | 10 | 10 | 0.05 | 0.03 | 0.31 | 0.39 | **$3,311,744** |
| I-94 SB on-ramp | 0.28 | 0 | 6 | 51 | 57 | 0.05 | 0.12 | 1.39 | 1.56 | **$4,882,692** |
| Between I-94 SB on-ramp and SR-394 NB/Torrence Ave on-ramp | 0.45 | 0 | 0 | 15 | 15 | 0.07 | 0.04 | 0.46 | 0.56 | **$4,414,889** |
| SR-394 NB/Torrence Ave on-ramp | 0.50 | 0 | 0 | 5 | 5 | 0.06 | 0.03 | 0.18 | 0.27 | **$3,325,987** |
| Between SR-394 NB/Torrence Ave on-ramp and state line | 0.74 | 1 | 5 | 57 | 63 | 0.10 | 0.15 | 1.61 | 1.86 | **$8,402,885** |
| Between state line and Calumet I/C | 0.40 | 1 | 0 | 20 | 21 | 0.18 | 0.04 | 0.60 | 0.72 | **$5,383,889** |
| Calumet I/C | 0.87 | 5 | 2 | 53 | 60 | 0.17 | 0.08 | 1.47 | 1.72 | **$10,310,225** |
| Between Calumet I/C and Indianapolis I/C | 0.63 | 0 | 2 | 35 | 37 | 0.07 | 0.07 | 1.00 | 1.14 | **$5,243,633** |
| Indianapolis I/C | 0.90 | 4 | 1 | 46 | 51 | 0.14 | 0.06 | 1.28 | 1.48 | **$8,555,182** |
| Between Indianapolis I/C and Kennedy I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | | | | - | |
| Kennedy I/C | 1.00 | 2 | 5 | 67 | 74 | 0.11 | 0.15 | 1.85 | 2.10 | **$7,995,052** |
| Between Kennedy I/C and Cline I/C | 0.55 | 2 | 2 | 39 | 43 | 0.10 | 0.07 | 1.11 | 1.28 | **$7,090,971** |
| Cline I/C | 1.58 | 3 | 9 | 77 | 89 | 0.13 | 0.25 | 2.13 | 2.50 | **$10,600,269** |
| Between Cline I/C and Burr I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | | | | | |
| Burr I/C | 0.97 | 4 | 5 | 48 | 57 | 0.15 | 0.15 | 1.34 | 1.63 | **$9,749,694** |
| Between Burr I/C and Grant I/C | 1.42 | 7 | 2 | 41 | 50 | 0.23 | 0.09 | 1.17 | 1.50 | **$15,142,839** |
| Grant I/C | 1.10 | 2 | 7 | 40 | 49 | 0.11 | 0.19 | 1.12 | 1.42 | **$8,008,892** |

| EASTBOUND SEGMENT | LENGTH | OBSERVED CRASHES (2017-2019) | | | | CRASHES SAVED | | | | PRESENT WORTH BENEFIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | (mi) | Fatal + Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | Fatal + Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | ($) |
| Between Grant I/C and Broadway I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | | | | | |
| Broadway I/C | 1.06 | 6 | 3 | 45 | 54 | 0.19 | 0.10 | 1.26 | 1.55 | **$11,592,554** |
| Between Broadway I/C and I-65 I/C | 0.11 | 1 | 0 | 4 | 5 | 0.04 | 0.02 | 0.16 | 0.21 | **$2,437,198** |
| I-65 I/C | 2.28 | 0 | 4 | 41 | 45 | 0.06 | 0.13 | 1.15 | 1.35 | **$5,225,476** |
| Central Ave* | 0.23 | 0 | 1 | 1 | 2 | 0.03 | 0.02 | 0.08 | 0.14 | **$2,134,052** |
| **Total** | | **38** | **53** | **702** | **793** | **1.95** | **1.78** | **19.83** | **23.56** | $134,332,100 |

*The Variable Speed Limit strategy is not anticipated to be implemented on the Central Avenue segment, thus the segment is not included in the total benefit calculations.

**Table D.47: Estimated Safety Benefits for Variable Speed Limits – Westbound Direction**

| WESTBOUND SEGMENT | LENGTH | OBSERVED CRASHES (2017-2019) | | | | CRASHES SAVED | | | | PRESENT WORTH BENEFIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | (ml) | Fatal + Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | Fatal + Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | ($) |
| Central Ave* | 0.27 | 1 | 0 | 7 | 8 | 0.04 | 0.02 | 0.24 | 0.30 | **$2,709,687** |
| I-65 I/C | 2.38 | 5 | 6 | 97 | 108 | 0.17 | 0.18 | 2.67 | 3.02 | **$12,509,551** |
| Between I-65 I/C and Broadway I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | | | | - | |
| Broadway I/C | 1.12 | 6 | 3 | 81 | 90 | 0.19 | 0.10 | 2.23 | 2.52 | **$12,536,964** |
| Between Broadway I/C and Grant St I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | | | | - | |
| Grant St I/C | 1.05 | 3 | 2 | 46 | 51 | 0.13 | 0.08 | 1.28 | 1.49 | **$8,180,279** |
| Between Grant St I/C and Burr St I/C | 1.39 | 3 | 5 | 68 | 76 | 0.15 | 0.16 | 1.91 | 2.22 | **$12,002,771** |
| Burr St I/C | 0.94 | 4 | 0 | 46 | 50 | 0.15 | 0.04 | 1.28 | 1.47 | **$8,710,922** |
| Between Burr St I/C and Cline Ave I/C | 0.12 | 0 | 1 | 3 | 4 | 0.04 | 0.03 | 0.14 | 0.20 | **$2,549,191** |
| Cline Ave I/C | 1.78 | 5 | 6 | 85 | 96 | 0.18 | 0.18 | 2.35 | 2.71 | **$12,640,664** |
| Between Cline Ave I/C and Kennedy Ave I/C | 0.16 | 0 | 2 | 5 | 7 | 0.04 | 0.04 | 0.19 | 0.27 | **$2,676,594** |
| Kennedy Ave I/C | 1.07 | 3 | 2 | 45 | 50 | 0.13 | 0.08 | 1.26 | 1.47 | **$7,928,550** |

| WESTBOUND SEGMENT | LENGTH | OBSERVED CRASHES (2017-2019) | | | | CRASHES SAVED | | | | PRESENT WORTH BENEFIT |
|---|---|---|---|---|---|---|---|---|---|---|
| | (mi) | Fatal + Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | Fatal + Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | ($) |
| Between Kennedy Ave I/C and Indianapolis Blvd I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | | | | - | |
| Indianapolis Blvd I/C | 1.10 | 4 | 1 | 30 | 35 | 0.15 | 0.06 | 0.85 | 1.06 | **$8,376,323** |
| Between Indianapolis Blvd I/C and Calumet Ave I/C | 0.24 | 1 | 0 | 7 | 8 | 0.06 | 0.03 | 0.24 | 0.33 | **$3,726,785** |
| Calumet Ave I/C | 1.20 | 4 | 4 | 31 | 39 | 0.15 | 0.13 | 0.88 | 1.16 | **$9,018,228** |
| Between Calumet Ave I/C and state line | 0.28 | 0 | 0 | 9 | 9 | 0.06 | 0.03 | 0.30 | 0.39 | **$3,637,791** |
| Between state line and I-94 NB/IL 394 SB off-ramp | 0.62 | 0 | 2 | 16 | 18 | 0.08 | 0.08 | 0.49 | 0.65 | **$5,336,425** |
| I-94 NB/IL 394 SB off-ramp | 0.28 | 0 | 3 | 10 | 13 | 0.05 | 0.08 | 0.31 | 0.44 | **$3,473,887** |
| Between I-94 NB/IL 394 SB off-ramp and Torrence Ave off-ramp | 0.25 | 0 | 0 | 2 | 2 | 0.04 | 0.02 | 0.11 | 0.17 | **$2,520,327** |
| Torrence Ave off-ramp | 0.28 | 0 | 1 | 0 | 1 | 0.05 | 0.04 | 0.04 | 0.13 | **$2,621,227** |
| Between Torrence Ave off-ramp and Torrence Ave on-ramp | 1.08 | 2 | 7 | 37 | 46 | 0.10 | 0.15 | 1.04 | 1.28 | **$7,775,013** |
| Torrence Ave on-ramp | 0.28 | 0 | 1 | 6 | 7 | 0.05 | 0.04 | 0.20 | 0.29 | **$2,871,895** |
| Between Torrence Ave on-ramp and IL 394 NB on-ramp | 0.09 | 0 | 0 | 2 | 2 | 0.03 | 0.01 | 0.11 | 0.15 | **$1,628,661** |
| IL 394 NB on-ramp | 0.18 | 0 | 0 | 5 | 5 | 0.05 | 0.02 | 0.17 | 0.24 | **$2,559,038** |
| **Total** | | **40** | **46** | **631** | **717** | **2.03** | **1.58** | **18.04** | **21.65** | **$133,281,086** |

*The Variable Speed Limit strategy is not anticipated to be implemented on the Central Avenue segment, thus the segment is not included in the total benefit calculations.

## Queue Warning System

Table D.48: Estimated Safety Benefits for Queue Warning System – Eastbound Direction

| EASTBOUND SEGMENT | LENGTH | OBSERVED REAR END CRASHES | | | | | REAR END CRASHES SAVED | | | | PRESENT WORTH BENEFIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (mi) | Fatal | Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | Fatal | (Incap.) + Non-Incap. + Possible Injury * | Property Damage Only | Total | ($) |
| Torrence Ave off-ramp | 0.27 | 0 | 0 | 0 | 7 | 7 | - | 0.05 | (0.45) | (0.40) | **($42,072)** |
| Between Torrence Ave off-ramp and I-94 SB on-ramp | 0.91 | 0 | 1 | 1 | 14 | 16 | - | 0.10 | (0.83) | (0.73) | **$105,354** |
| I-94 SB on-ramp | 0.28 | 0 | 1 | 7 | 57 | 65 | - | 0.30 | (3.09) | (2.79) | **($485,415)** |
| Between I-94 SB on-ramp and SR-394 NB/Torrence Ave on-ramp | 0.45 | 0 | 0 | 0 | 22 | 22 | - | 0.07 | (1.30) | (1.23) | **$($607,865)** |
| SR-394 NB/Torrence Ave on-ramp | 0.50 | 0 | 0 | 0 | 8 | 8 | - | 0.07 | (0.51) | (0.45) | **$63,803** |
| Between SR-394 NB/Torrence Ave on-ramp and state line | 0.74 | 0 | 0 | 6 | 81 | 87 | - | 0.33 | (4.54) | (4.21) | **($1,412,310)** |
| Between state line and Calumet I/C | 0.40 | 0 | 1 | 1 | 25 | 27 | - | 0.14 | (1.47) | (1.33) | **($173,132)** |
| Calumet I/C | 0.87 | 0 | 3 | 3 | 55 | 61 | - | 0.33 | (3.05) | (2.72) | **($221,678)** |
| Between Calumet I/C and Indianapolis I/C | 0.63 | 0 | 0 | 3 | 26 | 29 | - | 0.18 | (1.52) | (1.34) | **$111,570** |
| Indianapolis I/C | 0.90 | 0 | 5 | 1 | 43 | 49 | - | 0.32 | (2.40) | (2.07) | **$344,667** |
| Between Indianapolis I/C and Kennedy I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | 0 | | | | - | |
| Kennedy I/C | 1.00 | 0 | 1 | 5 | 57 | 63 | - | 0.33 | (3.16) | (2.82) | **($297,486)** |
| Between Kennedy I/C and Cline I/C | 0.55 | 0 | 1 | 2 | 30 | 33 | - | 0.17 | (1.73) | (1.56) | **($141,920)** |
| Cline I/C | 1.58 | 0 | 4 | 6 | 51 | 61 | - | 0.54 | (2.84) | (2.31) | **$1,745,504** |
| Between Cline I/C and Burr I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | 0 | | | | - | |
| Burr I/C | 0.97 | 0 | 3 | 1 | 30 | 34 | - | 0.25 | (1.70) | (1.45) | **$439,666** |
| Between Burr I/C and Grant I/C | 1.42 | 0 | 4 | 7 | 44 | 55 | - | 0.57 | (2.51) | (1.95) | **$2,835,425** |
| Grant I/C | 1.10 | 0 | 1 | 2 | 31 | 34 | - | 0.21 | (1.76) | (1.55) | **$37,479** |

| EASTBOUND SEGMENT | LENGTH | OBSERVED REAR END CRASHES | | | | | REAR END CRASHES SAVED | | | | PRESENT WORTH BENEFIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (mi) | Fatal | Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | Fatal | (Incap.) + Non-Incap. + Possible Injury * | Property Damage Only | Total | ($) |
| Between Grant I/C and Broadway I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | 0 | | | | - | |
| Broadway I/C | 1.06 | 0 | 6 | 3 | 37 | 46 | - | 0.47 | (2.08) | (1.61) | **$1,900,386** |
| Between Broadway I/C and I-65 I/C | 0.11 | 0 | 1 | 0 | 0 | 1 | - | 0.05 | (0.11) | (0.06) | **$320,382** |
| I-65 I/C | 2.28 | 0 | 0 | 3 | 32 | 35 | - | 0.22 | (1.82) | (1.60) | **$48,380** |
| Central | 0.23 | 0 | 0 | 0 | 2 | 2 | - | 0.03 | (0.21) | (0.18) | **$109,803** |
| **Total** | | **-** | **32** | **51** | **652** | **735** | **-** | **5** | **(37)** | **(32)** | **$4,680,541** |

* Incapacitating injury crashes were considered in the total number of non-incapacitating and possible injury crashes in the safety benefit estimation, as the crash reduction factor of 16% applies to all three levels of injury. The actual benefits may be higher as incapacitating injuries are associated with a higher average crash cost than non-incapacitating and possible injuries, however the average crash costs in the RoadHAT software are grouped by 1) Fatal + Incap. Injury, 2) Non-Incap. + Possible Injury, and 3) PDO. In other words, the benefits of reducing incapacitating injury crashes may be under-estimated.

### Table D.49: Estimated Safety Benefits for Queue Warning System – Westbound Direction

| WESTBOUND SEGMENT | LENGTH | OBSERVED REAR END CRASHES | | | | | REAR END CRASHES SAVED | | | | PRESENT WORTH BENEFIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (mi) | Fatal | Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | Fatal | (Incap.) + Non-Incap. + Possible Injury * | Property Damage Only | Total | ($) |
| Central Ave | 0.27 | 0 | 2 | 1 | 6 | 9 | - | 0.08 | (0.42) | (0.34) | **$335,890** |
| I-65 I/C | 2.38 | 0 | 4 | 6 | 88 | 98 | - | 0.55 | (4.85) | (4.30) | **($187,912)** |
| Between I-65 I/C and Broadway I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | 0 | | | | - | |
| Broadway I/C | 1.12 | 0 | 10 | 4 | 98 | 112 | - | 0.69 | (5.37) | (4.68) | **$517,130** |
| Between Broadway I/C and Grant St I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | 0 | | | | - | |
| Grant St I/C | 1.05 | 0 | 3 | 3 | 38 | 44 | - | 0.34 | (2.13) | (1.80) | **$732,434** |
| Between Grant St I/C and Burr St I/C | 1.39 | 0 | 1 | 5 | 73 | 79 | - | 0.36 | (4.10) | (3.74) | **($736,648)** |
| Burr St I/C | 0.94 | 0 | 3 | 4 | 51 | 58 | - | 0.38 | (2.84) | (2.46) | **$405,358** |
| Between Burr St I/C and Cline Ave I/C | 0.12 | 0 | 0 | 0 | 1 | 1 | - | 0.04 | (0.16) | (0.12) | **$219,079** |
| Cline Ave I/C | 1.78 | 0 | 3 | 9 | 94 | 106 | - | 0.65 | (5.18) | (4.53) | **$343,445** |
| Between Cline Ave I/C and Kennedy Ave I/C | 0.16 | 0 | 0 | 1 | 3 | 4 | - | 0.06 | (0.27) | (0.21) | **$285,686** |
| Kennedy Ave I/C | 1.07 | 0 | 2 | 1 | 36 | 39 | - | 0.21 | (2.03) | (1.82) | **($249,908)** |

| WESTBOUND SEGMENT | LENGTH | OBSERVED REAR END CRASHES | | | | | REAR END CRASHES SAVED | | | | PRESENT WORTH BENEFIT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | (mi) | Fatal | Incap. Injury | Non-Incap. + Possible Injury | Property Damage Only | Total | Fatal | (Incap.) + Non-Incap. + Possible Injury * | Property Damage Only | Total | ($) |
| Between Kennedy Ave I/C and Indianapolis Blvd I/C | 0.00 | (less than 500 feet in length) | 0 | 0 | 0 | 0 | | | | - | |
| Indianapolis Blvd I/C | 1.10 | 0 | 2 | 2 | 20 | 24 | - | 0.25 | (1.17) | (0.91) | **$943,029** |
| Between Indianapolis Blvd I/C and Calumet Ave I/C | 0.24 | 0 | 0 | 0 | 1 | 1 | - | 0.06 | (0.16) | (0.11) | **$329,397** |
| Calumet Ave I/C | 1.20 | 0 | 2 | 0 | 18 | 20 | - | 0.17 | (1.06) | (0.89) | **$346,281** |
| Between Calumet Ave I/C and state line | 0.28 | 0 | 0 | 0 | 4 | 4 | - | 0.06 | (0.33) | (0.26) | **$257,771** |
| Between state line and I-94 NB/IL 394 SB off-ramp | 0.62 | 0 | 0 | 1 | 11 | 12 | - | 0.13 | (0.71) | (0.59) | **$435,205** |
| I-94 NB/IL 394 SB off-ramp | 0.28 | 0 | 0 | 3 | 9 | 12 | - | 0.15 | (0.56) | (0.41) | **$719,199** |
| Between I-94 NB/IL 394 SB off-ramp and Torrence Ave off-ramp | 0.25 | 0 | 0 | 0 | 0 | 0 | - | 0.05 | (0.11) | (0.06) | **$296,071** |
| Torrence Ave off-ramp | 0.28 | 0 | 0 | 1 | 1 | 2 | - | 0.08 | (0.14) | (0.06) | **$512,346** |
| Between Torrence Ave off-ramp and Torrence Ave on-ramp | 1.08 | 0 | 1 | 3 | 20 | 24 | - | 0.20 | (1.17) | (0.97) | **$694,214** |
| Torrence Ave on-ramp | 0.28 | 0 | 0 | 0 | 2 | 2 | - | 0.05 | (0.19) | (0.14) | **$238,962** |
| Between Torrence Ave on-ramp and IL 394 NB on-ramp | 0.09 | 0 | 0 | 0 | 0 | 0 | - | 0.03 | (0.11) | (0.08) | **$136,621** |
| IL 394 NB on-ramp | 0.18 | 0 | 0 | 0 | 2 | 2 | - | 0.04 | (0.19) | (0.14) | **$180,535** |
| **Total** | | **-** | **33** | **44** | **576** | **653** | **-** | **4.61** | **(33.22)** | **(28.62)** | **$6,754,185** |

* Incapacitating injury crashes were considered in the total number of non-incapacitating and possible injury crashes in the safety benefit estimation, as the crash reduction factor of 16% applies to all three levels of injury. The actual benefits may be higher as incapacitating injuries are associated with a higher average crash cost than non-incapacitating and possible injuries, however the average crash costs in the RoadHAT software are grouped by 1) Fatal + Incap. Injury, 2) Non-Incap. + Possible Injury, and 3) PDO. In other words, the benefits of reducing incapacitating injury crashes may be under-estimated.

# APPENDIX E

## TSMO Alternative Cost Estimates

## Table E.1a: Alternative 1 – Base Package Implementation Costs (TSMO Only) – Indiana

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 3,680,000 |
| Pavement Replacement | 20 | 13,400 | 268,000 |
| Pavement Removal | 150 | 13,400 | 2,010,000 |
| Barrier Wall, Concrete, Remove | 25 | 10,000 | 250,000 |
| Concrete Median Barrier, Modified | 100 | 10,000 | 1,000,000 |
| Lighting, Markings, ITS | 100,000 | 1 | 100,000 |
| Casting, Adjust to Grade | 50,000 | 1 | 50,000 |
| Pavement Improvements (Alternative 3) | | | 1,780,000 |
| Joint Repair (inside and outside shoulders) | 60 | 29,600 | 1,780,000 |
| Drainage Improvements (Alternative 5) | | | 1,800,000 |
| Pavement Removal | 50 | 3,200 | 160,000 |
| Pavement Patching | 350 | 3,200 | 1,120,000 |
| Casting, Adjust to Grade | 250,000 | 1 | 250,000 |
| Clean Inlet | 250,000 | 1 | 250,000 |
| Inlet, Patching | 125 | 100 | 12,500 |
| Cantilevers (for EB 65 Lane merge) | 125,000 | 5 | 625,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 13,000,000 | 1 | 13,000,000 |
| Noise Barrier Modifications (Provision) | 2,358,000 | 1 | 2,360,000 |
| **Civil Infrastructure - Subtotal** | | | **23,300,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 58 | 9,860,000 |
| Cantilever equipment/cabling | 16,000 | 58 | 928,000 |
| Lane control signs | 30,000 | 58 | 1,740,000 |
| CCTV cameras | 8,000 | 58 | 464,000 |
| Cabinets, handholes, power service, communications | 61,750 | 58 | 3,590,000 |
| Central ATM software | 400,000 | 1 | 400,000 |
| CAD Integration | 150,000 | 1 | 150,000 |
| Center to Center Integration | 150,000 | 1 | 150,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Integration and testing (2% of construction cost) | 355,470 | 1 | 356,000 |
| **Systems Subtotal** | | | **18,200,000** |
| TRIP Program Deployment | | | 150,000 |
| Startup Support | | | 350,000 |
| Design (10%) | | | 4,140,000 |
| Project Management (5%) | | | 2,070,000 |
| **Subtotal** | | | **48,100,000** |
| Contingency (30%) | | | 14,500,000 |
| **Total** | | | **62,500,000** |
| Yearly software, maintenance, TRIP, and enhanced clearance program | | | 1,490,000 |

General Assumptions:

Cantilever structure over inside shoulder lane only

Package Includes Event Management (full) comprised of the following complimentary strategies:

- Provide Optimal ITS Device Deployment
- Leverage Data from New Field Equipment
- Maintenance and Emergency Response Agency Access to CCTV

Annual Cost Assumptions:

Annual cost for Big Rig Towing and Recovery Incentive Program (TRIP) is $365,000

Annual cost for enhanced incident clearance is $365,000

Hire one new operator and two new maintenance technicians at $70k/yr

Annual system support including software, equipment parts, and maintenance materials are average of 3% of the total systems cost per year

### Table E.1b: Alternative 1 – Base Package Implementation Costs (TSMO Only) – Illinois

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 956,000 |
| Pavement Replacement | 20 | 3,400 | 68,000 |
| Pavement Removal | 150 | 3,400 | 510,000 |
| Barrier Wall, Concrete, Remove | 25 | 2,500 | 62,500 |
| Concrete Median Barrier, Modified | 100 | 2,500 | 250,000 |
| Lighting, Markings, ITS | 50,000 | 1 | 50,000 |
| Casting, Adjust to Grade | 15,000 | 1 | 15,000 |
| Pavement Improvements (Alternative 3) | | | 159,000 |
| Joint Repair (inside and outside shoulders) | 60 | 2,640 | 159,000 |
| Drainage Improvements (Alternative 5) | | | 102,000 |
| Pavement Removal | 50 | 200 | 10,000 |
| Pavement Patching | 350 | 200 | 70,000 |
| Casting, Adjust to Grade | 10,000 | 1 | 10,000 |
| Clean Inlet | 10,000 | 1 | 10,000 |
| Inlet, Patching | 125 | 10 | 1,250 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 3,000,000 | 1 | 3,000,000 |
| Noise Barrier Modifications (Provision) | 1,305,000 | 1 | 1,310,000 |
| **Civil Infrastructure - Subtotal** | | | **5,530,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 6 | 1,020,000 |
| Cantilever equipment/cabling | 16,000 | 6 | 96,000 |
| Lane control signs (inside shoulder) | 30,000 | 6 | 180,000 |
| CCTV cameras | 8,000 | 6 | 48,000 |
| Cabinets, handholes, power service, communications | 61,750 | 6 | 371,000 |
| Interagency Fiber Connections and Networking | 200,000 | 1 | 200,000 |
| Center to Center Software | 250,000 | 1 | 250,000 |
| Integration and testing (2% of construction cost) | 43,290 | 1 | 43,300 |
| **Systems Subtotal** | | | **2,210,000** |
| TRIP Program Deployment | | | 0 |
| Startup Support | | | 0 |
| Design (10%) | | | 773,000 |
| Project Management (5%) | | | 387,000 |
| **Subtotal** | | | **8,890,000** |
| Contingency (30%) | | | 2,670,000 |
| **Total** | | | **11,600,000** |
| Yearly operations and maintenance | | | 66,300 |

Cantilever structure over inside shoulder lane only

Hire two new maintenance technicians

Maintenance parts and materials cost an average of 2% of the total systems cost per year

O and M assumed to be 3% of the total systems cost per year

## Table E.1c: Alternative 1 – Base Package Implementation Costs (TSMO Only) – Entire Corridor

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 4,640,000 |
| Pavement Replacement | 20 | 16,800 | 336,000 |
| Pavement Removal | 150 | 16,800 | 2,520,000 |
| Barrier Wall, Concrete, Remove | 25 | 12,500 | 313,000 |
| Concrete Median Barrier, Modified | 100 | 12,500 | 1,250,000 |
| Lighting, Markings, ITS | 150,000 | 1 | 150,000 |
| Casting, Adjust to Grade | 65,000 | 1 | 65,000 |
| Pavement Improvements (Alternative 3) | | | 1,940,000 |
| Joint Repair (inside and outside shoulders) | 60 | 32,240 | 1,940,000 |
| Drainage Improvements (Alternative 5) | | | 1,900,000 |
| Pavement Removal | 50 | 3,400 | 170,000 |
| Pavement Patching | 350 | 3,400 | 1,190,000 |
| Casting, Adjust to Grade | 260,000 | 1 | 260,000 |
| Clean Inlet | 260,000 | 1 | 260,000 |
| Inlet, Patching | 125 | 110 | 13,800 |
| Cantilevers (for EB 65 Lane merge) | 125,000 | 5 | 625,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 16,000,000 | 1 | 16,000,000 |
| Noise Barrier Modifications (Provision) | 3,663,000 | 1 | 3,670,000 |
| **Civil Infrastructure - Subtotal** | | | **28,800,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 64 | 10,900,000 |
| Cantilever equipment/cabling | 16,000 | 64 | 1,030,000 |
| Lane control signs | 30,000 | 64 | 1,920,000 |
| CCTV cameras | 8,000 | 64 | 512,000 |
| Cabinets, handholes, power service, communications | 61,750 | 64 | 3,960,000 |
| Central ATM software | 400,000 | 1 | 400,000 |
| CAD Integration | 150,000 | 1 | 150,000 |
| Center to Center Integration | 150,000 | 1 | 150,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Interagency Fiber Connections and Networking | 200,000 | 1 | 200,000 |
| Center to Center Software | 250,000 | 1 | 250,000 |
| Integration and testing (2% of construction cost) | 398,760 | 1 | 399,000 |
| **Systems Subtotal** | | | **20,400,000** |
| TRIP Program Deployment | | | 150,000 |
| Startup Support | | | 350,000 |
| Design (10%) | | | 4,910,000 |
| Project Management (5%) | | | 2,460,000 |
| **Subtotal** | | | **57,000,000** |
| Contingency (30%) | | | 17,100,000 |
| **Total** | | | **74,100,000** |
| Yearly software, maintenance, TRIP, and enhanced clearance program | | | 1,560,000 |

## Table E.2a: Alternative 2 – Base Package + Ramp Metering Implementation Costs (TSMO Only) – Indiana

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 3,680,000 |
| Pavement Replacement | 20 | 13,400 | 268,000 |
| Pavement Removal | 150 | 13,400 | 2,010,000 |
| Barrier Wall, Concrete, Remove | 25 | 10,000 | 250,000 |
| Concrete Median Barrier, Modified | 100 | 10,000 | 1,000,000 |
| Lighting, Markings, ITS | 100,000 | 1 | 100,000 |
| Casting, Adjust to Grade | 50,000 | 1 | 50,000 |
| Pavement Improvements (Alternative 3) | | | 1,780,000 |
| Joint Repair (inside and outside shoulders) | 60 | 29,600 | 1,780,000 |
| Drainage Improvements (Alternative 5) | | | 1,800,000 |
| Pavent Removal | 50 | 3,200 | 160,000 |
| Pavment Patching | 350 | 3,200 | 1,120,000 |
| Casting, Adjust to Grade | 250,000 | 1 | 250,000 |
| Clean Inlet | 250,000 | 1 | 250,000 |
| Inlet, Patching | 125 | 100 | 12,500 |
| Ramp Metering Miscellaneous (guardrail, pavement patching, etc) | 1,085,000 | 1 | 1,090,000 |
| Cantilevers (for EB 65 Lane merge) | 125,000 | 5 | 625,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 13,750,000 | 1 | 13,800,000 |
| Noise Barrier Modifications (Provision) | 2,358,000 | 1 | 2,360,000 |
| **Civil Infrastructure - Subtotal** | | | **25,100,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 58 | 9,860,000 |
| Cantilever equipment/cabling | 16,000 | 58 | 928,000 |
| Lane control signs | 30,000 | 58 | 1,740,000 |
| CCTV cameras | 8,000 | 58 | 464,000 |
| Cabinets, handholes, power service, communications | 61,750 | 58 | 3,590,000 |
| Signal poles, heads, loops, cabling | 40,000 | 7 | 280,000 |
| Cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Ramp metering software | 150,000 | 7 | 1,050,000 |
| Central ATM software | 400,000 | 1 | 400,000 |
| CAD Integration | 150,000 | 1 | 150,000 |
| Center to Center Integration | 150,000 | 1 | 150,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Integration and testing (2% of construction cost) | 393,270 | 1 | 394,000 |
| **Systems Subtotal** | | | **20,100,000** |
| TRIP Program Deployment | | | 150,000 |
| Startup Support | | | 400,000 |
| Design (10%) | | | 4,520,000 |
| Project Management (5%) | | | 2,260,000 |
| **Subtotal** | | | **52,500,000** |
| Contingency (30%) | | | 15,800,000 |
| **Total** | | | **68,200,000** |
| Yearly software, maintenance, TRIP, and enhanced clearance program | | | 1,620,000 |

General Assumptions:

Cantilever structure over inside shoulder lane only

7 Interchanges metered

Package Includes Event Management (full) comprised of the following complimentary strategies:

- Provide Optimal ITS Device Deployment
- Leverage Data from New Field Equipment
- Optimize Data and Image Sharing
- Advanced Transit Operations Integration
- Maintenance and Emergency Response Agency Access to CCTV

Annual Cost Assumptions:

Annual cost for Big Rig Towing and Recovery Incentive Program (TRIP) is $365,000

Annual cost for enhanced incident clearance is $365,000

Hire two new operators and two new maintenance technicians at $70k/yr

Annual system support including software, equipment parts, and maintenance materials are average of 3% of the total systems cost per year

**Table E.2b: Alternative 2 – Base Package + Ramp Metering Implementation Costs (TSMO Only) – Illinois**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 956,000 |
| Pavement Replacement | 20 | 3,400 | 68,000 |
| Pavement Removal | 150 | 3,400 | 510,000 |
| Barrier Wall, Concrete, Remove | 25 | 2,500 | 62,500 |
| Concrete Median Barrier, Modified | 100 | 2,500 | 250,000 |
| Lighting, Markings, ITS | 50,000 | 1 | 50,000 |
| Casting, Adjust to Grade | 15,000 | 1 | 15,000 |
| Pavement Improvements (Alternative 3) | | | 159,000 |
| Joint Repair (inside and outside shoulders) | 60 | 2,640 | 159,000 |
| Drainage Improvements (Alternative 5) | | | 102,000 |
| Pavement Removal | 50 | 200 | 10,000 |
| Pavement Patching | 350 | 200 | 70,000 |
| Casting, Adjust to Grade | 10,000 | 1 | 10,000 |
| Clean Inlet | 10,000 | 1 | 10,000 |
| Inlet, Patching | 125 | 10 | 1,250 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 2,500,000 | 1 | 2,500,000 |
| Noise Barrier Modifications (Provision) | 1,305,000 | 1 | 1,310,000 |
| **Civil Infrastructure - Subtotal** | | | **5,030,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 6 | 1,020,000 |
| Cantilever equipment/cabling | 16,000 | 6 | 96,000 |
| Lane control signs (inside shoulder) | 30,000 | 6 | 180,000 |
| CCTV cameras | 8,000 | 6 | 48,000 |
| Cabinets, handholes, power service, communications | 61,750 | 6 | 371,000 |
| Interagency Fiber Connections and Networking | 200,000 | 1 | 200,000 |
| Center to Center Software | 250,000 | 1 | 250,000 |
| Integration and testing (2% of construction cost) | 43,290 | 1 | 43,300 |
| **Systems Subtotal** | | | **2,210,000** |
| TRIP Program Deployment | | | 0 |
| Startup Support | | | 0 |
| Design (10%) | | | 723,000 |
| Project Management (5%) | | | 362,000 |
| **Subtotal** | | | **8,320,000** |
| Contingency (30%) | | | 2,500,000 |
| **Total** | | | **10,900,000** |
| Yearly operations and maintenance | | | 66,300 |

Cantilever structure over inside shoulder lane only

Hire two new maintenance technicians

Maintenance parts and materials cost an average of 2% of the total systems cost per year

O and M assumed to be 3% of the total systems cost per year

**Table E.2c: Alternative 2 – Base Package + Ramp Metering Implementation Costs (TSMO Only) – Entire Corridor**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 4,640,000 |
| Pavement Replacement | 20 | 16,800 | 336,000 |
| Pavement Removal | 150 | 16,800 | 2,520,000 |
| Barrier Wall, Concrete, Remove | 25 | 12,500 | 313,000 |
| Concrete Median Barrier, Modified | 100 | 12,500 | 1,250,000 |
| Lighting, Markings, ITS | 150,000 | 1 | 150,000 |
| Casting, Adjust to Grade | 65,000 | 1 | 65,000 |
| Pavement Improvements (Alternative 3) | | | 1,940,000 |
| Joint Repair (inside and outside shoulders) | 60 | 32,240 | 1,940,000 |
| Drainage Improvements (Alternative 5) | | | 1,900,000 |
| Pavement Removal | 50 | 3,400 | 170,000 |
| Pavement Patching | 350 | 3,400 | 1,190,000 |
| Casting, Adjust to Grade | 260,000 | 1 | 260,000 |
| Clean Inlet | 260,000 | 1 | 260,000 |
| Inlet, Patching | 125 | 110 | 13,800 |
| Ramp Metering Miscellaneous (guardrail, pavement patching, etc) | 1,085,000 | 1 | 1,090,000 |
| Cantilevers (for EB 65 Lane merge) | 125,000 | 5 | 625,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 16,250,000 | 1 | 16,300,000 |
| Noise Barrier Modifications (Provision) | 3,663,000 | 1 | 3,670,000 |
| **Civil Infrastructure - Subtotal** | | | **30,100,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Cantilever Structures and Foundations | 170,000 | 64 | 10,900,000 |
| Cantilever equipment/cabling | 16,000 | 64 | 1,030,000 |
| Lane control signs | 30,000 | 64 | 1,920,000 |
| CCTV cameras | 8,000 | 64 | 512,000 |
| Cabinets, handholes, power service, communications | 61,750 | 64 | 3,960,000 |
| Signal poles, heads, loops, cabling | 40,000 | 7 | 280,000 |
| Cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Ramp metering software | 150,000 | 7 | 1,050,000 |
| Central ATM software | 400,000 | 1 | 400,000 |
| CAD Integration | 150,000 | 1 | 150,000 |
| Center to Center Integration | 150,000 | 1 | 150,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 50 | 500,000 |
| Interagency Fiber Connections and Networking | 200,000 | 1 | 200,000 |
| Center to Center Software | 250,000 | 1 | 250,000 |
| Integration and testing (2% of construction cost) | 436,560 | 1 | 437,000 |
| **Systems Subtotal** | | | **22,300,000** |
| TRIP Program Deployment | | | 150,000 |
| Startup Support | | | 400,000 |
| Design (10%) | | | 5,240,000 |
| Project Management (5%) | | | 2,620,000 |
| **Subtotal** | | | **60,800,000** |
| Contingency (30%) | | | 18,300,000 |
| **Total** | | | **79,000,000** |
| Yearly software, maintenance, TRIP, and enhanced clearance program | | | 1,680,000 |

## Table E.3a: Alternative 3 – Base Package + Mainline Safety Implementation Costs (TSMO Only) – Indiana

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 3,680,000 |
| Pavement Replacement | 20 | 13,400 | 268,000 |
| Pavement Removal | 150 | 13,400 | 2,010,000 |
| Barrier Wall, Concrete, Remove | 25 | 10,000 | 250,000 |
| Concrete Median Barrier, Modified | 100 | 10,000 | 1,000,000 |
| Lighting, Markings, ITS | 100,000 | 1 | 100,000 |
| Casting, Adjust to Grade | 50,000 | 1 | 50,000 |
| Pavement Improvements (Alternative 3) | | | 1,780,000 |
| Joint Repair (inside and outside shoulders) | 60 | 29,600 | 1,780,000 |
| Drainage Improvements (Alternative 5) | | | 1,800,000 |
| Pavent Removal | 50 | 3,200 | 160,000 |
| Pavment Patching | 350 | 3,200 | 1,120,000 |
| Casting, Adjust to Grade | 250,000 | 1 | 250,000 |
| Clean Inlet | 250,000 | 1 | 250,000 |
| Inlet, Patching | 125 | 100 | 12,500 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 13,750,000 | 1 | 13,800,000 |
| Cantilevers (for EB 65 Lane merge) | 125,000 | 5 | 625,000 |
| Noise Barrier Modifications (Provision) | 2,358,000 | 1 | 2,360,000 |
| **Civil Infrastructure - Subtotal** | | | **24,000,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Gantry structures and foundations | 220,000 | 58 | 12,800,000 |
| Gantry equipment/cabling | 35,000 | 58 | 2,030,000 |
| Lane control signs | 210,000 | 58 | 12,200,000 |
| Gantry mounted CCTV cameras | 8,000 | 58 | 464,000 |
| Cabinets, handholes, power service, communications | 61,750 | 64 | 3,960,000 |
| Gantry Mounted VSL's (all lanes) | 210,000 | 58 | 12,200,000 |
| Standalone VSL's | 40,000 | 6 | 240,000 |
| Microwave radar detector | 6,000 | 64 | 384,000 |
| Gantry mounted queue warning DMS | 75,000 | 15 | 1,130,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 100 | 1,000,000 |
| Center to Center Integration | 250,000 | 1 | 250,000 |
| CAD Integration | 150,000 | 1 | 150,000 |
| Complimentary Strategies | 500,000 | 1 | 500,000 |
| Central ATM software | 550,000 | 1 | 550,000 |
| Integration and testing (2% of construction cost) | 955,300 | 1 | 956,000 |
| **Systems Subtotal** | | | **48,800,000** |
| TRIP Program Deployment | | | 150,000 |
| Startup Support | | | 500,000 |
| Design (10%) | | | 7,270,000 |
| Project Management (5%) | | | 3,640,000 |
| **Subtotal** | | | **84,300,000** |
| Contingency (30%) | | | 25,300,000 |
| **Total** | | | **110,000,000** |
| Yearly software, maintenance, TRIP, and enhanced clearance program | | | 2,480,000 |

General Assumptions:

Full gantries with lane control signals in every lane and both shoulders

Package Includes Event Management (full) comprised of the following complimentary strategies:

- Provide Optimal ITS Device Deployment
- Leverage Data from New Field Equipment
- Optimize Data and Image Sharing
- Advanced Transit Operations Integration
- Maintenance and Emergency Response Agency Access to CCTV

Annual Cost Assumptions:

Annual cost for Big Rig Towing and Recovery Incentive Program (TRIP) is $365,000

Annual cost for enhanced incident clearance is $365,000

Hire two new operators and two new maintenance technicians at $70k/yr

Annual system support including software, equipment parts, and maintenance materials are average of 3% of the total systems cost per year

### Table E.3b: Alternative 3 – Base Package + Mainline Safety Implementation Costs (TSMO Only) – Illinois

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 956,000 |
| Pavement Replacement | 20 | 3,400 | 68,000 |
| Pavement Removal | 150 | 3,400 | 510,000 |
| Barrier Wall, Concrete, Remove | 25 | 2,500 | 62,500 |
| Concrete Median Barrier, Modified | 100 | 2,500 | 250,000 |
| Lighting, Markings, ITS | 50,000 | 1 | 50,000 |
| Casting, Adjust to Grade | 15,000 | 1 | 15,000 |
| Pavement Improvements (Alternative 3) | | | 159,000 |
| Joint Repair (inside and outside shoulders) | 60 | 2,640 | 159,000 |
| Drainage Improvements (Alternative 5) | | | 102,000 |
| Pavement Removal | 50 | 200 | 10,000 |
| Pavement Patching | 350 | 200 | 70,000 |
| Casting, Adjust to Grade | 10,000 | 1 | 10,000 |
| Clean Inlet | 10,000 | 1 | 10,000 |
| Inlet, Patching | 125 | 10 | 1,250 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 4,000,000 | 1 | 4,000,000 |
| Noise Barrier Modifications (Provision) | 1,305,000 | 1 | 1,310,000 |
| **Civil Infrastructure - Subtotal** | | | **6,530,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| EB Gantry structures and foundations | 220,000 | 5 | 1,100,000 |
| EB Gantry equipment/cabling | 25,000 | 5 | 125,000 |
| EB Lane control signs (all travel lanes and shoulders) | 210,000 | 5 | 1,050,000 |
| WB Cantilever Structures and Foundations | 170,000 | 3 | 510,000 |
| WB Cantilever equipment/cabling | 16,000 | 1 | 16,000 |
| WB Lane control signs (inside shoulder) | 30,000 | 1 | 30,000 |
| Gantry/Cantilever mounted CCTV cameras | 8,000 | 6 | 48,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Standalone VSL's | 40,000 | 3 | 120,000 |
| Cabinets, handholes, power service, communications | 61,750 | 11 | 680,000 |
| Interagency Fiber Connections and Networking | 200,000 | 1 | 200,000 |
| Center to Center Software | 300,000 | 1 | 300,000 |
| Microwave radar detector | 6,000 | 8 | 48,000 |
| Integration and testing (2% of construction cost) | 97,925 | 1 | 98,000 |
| **Systems Subtotal** | | | **5,000,000** |
| TRIP Program Deployment | | | 0 |
| Startup Support | | | 0 |
| Design (10%) | | | 1,160,000 |
| Project Management (5%) | | | 576,000 |
| **Subtotal** | | | **13,300,000** |
| Contingency (30%) | | | 3,980,000 |
| **Total** | | | **17,300,000** |
| Yearly operations and maintenance | | | 150,000 |

Full gantries with lane control signals in all travel lanes and both shoulders
Eastbound VSL only
Two vertically stacked lane control signs over all lanes for VSL and lane control
Ful lane control on eastbound lanes only, inside shoulder lane control for westbound lanes
Eastbound lane control limits are from just west of Torrence to state line
Westbound lane control limits are from state line to Wentworth
Hire 3 new maintenance technicians
O and M assumed to be 3% of the total systems cost per year

### Table E.3c: Alternative 3 – Base Package + Mainline Safety Implementation Costs (TSMO Only) – Entire Corridor

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 4,640,000 |
| Pavement Replacement | 20 | 16,800 | 336,000 |
| Pavement Removal | 150 | 16,800 | 2,520,000 |
| Barrier Wall, Concrete, Remove | 25 | 12,500 | 313,000 |
| Concrete Median Barrier, Modified | 100 | 12,500 | 1,250,000 |
| Lighting, Markings, ITS | 150,000 | 1 | 150,000 |
| Casting, Adjust to Grade | 65,000 | 1 | 65,000 |
| Pavement Improvements (Alternative 3) | | | 1,940,000 |
| Joint Repair (inside and outside shoulders) | 60 | 32,240 | 1,940,000 |
| Drainage Improvements (Alternative 5) | | | 1,900,000 |
| Pavement Removal | 50 | 3,400 | 170,000 |
| Pavement Patching | 350 | 3,400 | 1,190,000 |
| Casting, Adjust to Grade | 260,000 | 1 | 260,000 |
| Clean Inlet | 260,000 | 1 | 260,000 |
| Inlet, Patching | 125 | 110 | 13,800 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 17,750,000 | 1 | 17,800,000 |
| Cantilevers (for EB 65 Lane merge) | 125,000 | 5 | 625,000 |
| Noise Barrier Modifications (Provision) | 3,663,000 | 1 | 3,670,000 |
| **Civil Infrastructure - Subtotal** | | | **30,500,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Gantry structures and foundations (Indiana) | 220,000 | 58 | 12,800,000 |
| Gantry equipment/cabling (Indiana) | 35,000 | 58 | 2,030,000 |
| Lane control signs (Indiana) | 210,000 | 58 | 12,200,000 |
| EB Gantry structures and foundations (Illinois) | 220,000 | 5 | 1,100,000 |
| EB Gantry equipment/cabling (Illinois) | 25,000 | 5 | 125,000 |
| EB Lane control signs (all travel lanes and shoulders) (Illinois) | 210,000 | 5 | 1,050,000 |
| WB Cantilever Structures and Foundations (Illinois) | 170,000 | 3 | 510,000 |
| WB Cantilever equipment/cabling (Illinois) | 16,000 | 1 | 16,000 |
| WB Lane control signs (inside shoulder) (Illinois) | 30,000 | 1 | 30,000 |
| Gantry/Cantilever mounted CCTV cameras | 8,000 | 64 | 512,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Cabinets, handholes, power service, communications | 61,750 | 75 | 4,640,000 |
| Gantry Mounted VSL's (all lanes) | 210,000 | 58 | 12,200,000 |
| Standalone VSL's | 40,000 | 9 | 360,000 |
| Microwave radar detector | 6,000 | 72 | 432,000 |
| Gantry mounted queue warning DMS | 75,000 | 15 | 1,130,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 100 | 1,000,000 |
| Center to Center Integration | 250,000 | 1 | 250,000 |
| CAD Integration | 150,000 | 1 | 150,000 |
| Complimentary Strategies | 500,000 | 1 | 500,000 |
| Central ATM software | 550,000 | 1 | 550,000 |
| Interagency Fiber Connections and Networking | 200,000 | 1 | 200,000 |
| Center to Center Software | 300,000 | 1 | 300,000 |
| Integration and testing (2% of construction cost) | 1,053,225 | 1 | 1,060,000 |
| **Systems Subtotal** | | | **53,800,000** |
| TRIP Program Deployment | | | 150,000 |
| Startup Support | | | 500,000 |
| Design (10%) | | | 8,430,000 |
| Project Management (5%) | | | 4,220,000 |
| **Subtotal** | | | **97,500,000** |
| Contingency (30%) | | | 29,300,000 |
| **Total** | | | **127,000,000** |
| Yearly software, maintenance, TRIP, and enhanced clearance program | | | 2,630,000 |

## Table E.4a: Alternative 4 – Base Package + Mainline Safety + Ramp Metering Implementation Costs (TSMO Only) – Indiana

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 3,680,000 |
| Pavement Replacement | 20 | 13,400 | 268,000 |
| Pavement Removal | 150 | 13,400 | 2,010,000 |
| Barrier Wall, Concrete, Remove | 25 | 10,000 | 250,000 |
| Concrete Median Barrier, Modified | 100 | 10,000 | 1,000,000 |
| Lighting, Markings, ITS | 100,000 | 1 | 100,000 |
| Casting, Adjust to Grade | 50,000 | 1 | 50,000 |
| Pavement Improvements (Alternative 3) | | | 1,780,000 |
| Joint Repair (inside and outside shoulders) | 60 | 29,600 | 1,780,000 |
| Drainage Improvements (Alternative 5) | | | 1,800,000 |
| Pavent Removal | 50 | 3,200 | 160,000 |
| Pavment Patching | 350 | 3,200 | 1,120,000 |
| Casting, Adjust to Grade | 250,000 | 1 | 250,000 |
| Clean Inlet | 250,000 | 1 | 250,000 |
| Inlet, Patching | 125 | 100 | 12,500 |
| Ramp Metering Miscellaneous (guardrail, pavement patching, etc) | 1,085,000 | 1 | 1,090,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 14,500,000 | 1 | 14,500,000 |
| Cantilevers (for EB 65 Lane merge) | 125,000 | 5 | 625,000 |
| Noise Barrier Modifications (Provision) | 2,358,000 | 1 | 2,360,000 |
| **Civil Infrastructure - Subtotal** | | | **25,900,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Gantry structures and foundations | 220,000 | 58 | 12,800,000 |
| Gantry equipment/cabling | 35,000 | 58 | 2,030,000 |
| Lane control signs | 210,000 | 58 | 12,200,000 |
| Gantry mounted CCTV cameras | 8,000 | 58 | 464,000 |
| Cabinets, handholes, power service, communications | 61,750 | 64 | 3,960,000 |
| Gantry Mounted VSL's (all lanes) | 210,000 | 58 | 12,200,000 |
| Standalone VSL's | 40,000 | 6 | 240,000 |
| Microwave radar detector | 6,000 | 64 | 384,000 |
| Ramp metering Signal poles, heads, loops, cabling | 40,000 | 7 | 280,000 |
| Ramp metering cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Gantry mounted queue warning DMS | 75,000 | 15 | 1,130,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 100 | 1,000,000 |
| Center to Center Integration | 250,000 | 1 | 250,000 |
| CAD Integration | 150,000 | 1 | 150,000 |
| Complimentary Strategies | 500,000 | 1 | 500,000 |
| Ramp metering software | 150,000 | 1 | 150,000 |
| Central ATM software | 550,000 | 1 | 550,000 |
| Integration and testing (2% of construction cost) | 975,100 | 1 | 976,000 |
| **Systems Subtotal** | | | **49,800,000** |
| TRIP Program Deployment | | | 150,000 |
| Startup Support | | | 500,000 |
| Design (10%) | | | 7,560,000 |
| Project Management (5%) | | | 3,780,000 |
| **Subtotal** | | | **87,600,000** |
| Contingency (30%) | | | 26,300,000 |
| **Total** | | | **114,000,000** |
| Yearly software, maintenance, TRIP, and enhanced clearance program | | | 2,510,000 |

General Assumptions:

Full gantries with lane control signals in every lane and both shoulders

7 Interchanges metered

Package Includes Event Management (full) comprised of the following complimentary strategies:

- Provide Optimal ITS Device Deployment
- Leverage Data from New Field Equipment
- Optimize Data and Image Sharing
- Advanced Transit Operations Integration
- Maintenance and Emergency Response Agency Access to CCTV

Annual Cost Assumptions:

Annual cost for Big Rig Towing and Recovery Incentive Program (TRIP) is $365,000

Annual cost for enhanced incident clearance is $365,000

Hire two new operators and two new maintenance technicians at $70k/yr

Annual system support including software, equipment parts, and maintenance materials are average of 3% of the total systems cost per year

**Table E.4b: Alternative 4 – Base Package + Mainline Safety + Ramp Metering Implementation Costs (TSMO Only) – Illinois**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 956,000 |
| Pavement Replacement | 20 | 3,400 | 68,000 |
| Pavement Removal | 150 | 3,400 | 510,000 |
| Barrier Wall, Concrete, Remove | 25 | 2,500 | 62,500 |
| Concrete Median Barrier, Modified | 100 | 2,500 | 250,000 |
| Lighting, Markings, ITS | 50,000 | 1 | 50,000 |
| Casting, Adjust to Grade | 15,000 | 1 | 15,000 |
| Pavement Improvements (Alternative 3) | | | 159,000 |
| Joint Repair (inside and outside shoulders) | 60 | 2,640 | 159,000 |
| Drainage Improvements (Alternative 5) | | | 102,000 |
| Pavement Removal | 50 | 200 | 10,000 |
| Pavement Patching | 350 | 200 | 70,000 |
| Casting, Adjust to Grade | 10,000 | 1 | 10,000 |
| Clean Inlet | 10,000 | 1 | 10,000 |
| Inlet, Patching | 125 | 10 | 1,250 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 4,000,000 | 1 | 4,000,000 |
| Noise Barrier Modifications (Provision) | 1,305,000 | 1 | 1,310,000 |
| **Civil Infrastructure - Subtotal** | | | **6,530,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| EB Gantry structures and foundations | 220,000 | 5 | 1,100,000 |
| EB Gantry equipment/cabling | 25,000 | 5 | 125,000 |
| EB Lane control signs (all travel lanes and shoulders) | 210,000 | 5 | 1,050,000 |
| WB Cantilever Structures and Foundations | 170,000 | 3 | 510,000 |
| WB Cantilever equipment/cabling | 16,000 | 1 | 16,000 |
| WB Lane control signs (inside shoulder) | 30,000 | 1 | 30,000 |
| Gantry/Cantilever mounted CCTV cameras | 8,000 | 6 | 48,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Standalone VSL's | 40,000 | 3 | 120,000 |
| Cabinets, handholes, power service, communications | 61,750 | 11 | 680,000 |
| Interagency Fiber Connections and Networking | 200,000 | 1 | 200,000 |
| Center to Center Software | 300,000 | 1 | 300,000 |
| Microwave radar detector | 6,000 | 8 | 48,000 |
| Integration and testing (2% of construction cost) | 97,925 | 1 | 98,000 |
| **Systems Subtotal** | | | **5,000,000** |
| TRIP Program Deployment | | | 0 |
| Startup Support | | | 0 |
| Design (10%) | | | 1,160,000 |
| Project Management (5%) | | | 576,000 |
| **Subtotal** | | | **13,300,000** |
| Contingency (30%) | | | 3,980,000 |
| **Total** | | | **17,300,000** |
| Yearly operations and maintenance | | | 150,000 |

Full gantries with lane control signals in all travel lanes and both shoulders

Eastbound VSL only

Two vertically stacked lane control signs over all lanes for VSL and lane control

Ful lane control on eastbound lanes only, inside shoulder lane control for westbound lanes

Eastbound lane control limits are from just west of Torrence to state line

Westbound lane control limits are from state line to Wentworth

Hire 3 new maintenance technicians

O and M assumed to be 3% of the total systems cost per year

**Table E.4c: Alternative 4 – Base Package + Mainline Safety + Ramp Metering Implementation Costs (TSMO Only) – Entire Corridor**

| Civil Infrastructure | Unit Cost | Quantity | Cost (rounded) |
|---|---|---|---|
| Superelevation Correction | | | 4,640,000 |
| Pavement Replacement | 20 | 16,800 | 336,000 |
| Pavement Removal | 150 | 16,800 | 2,520,000 |
| Barrier Wall, Concrete, Remove | 25 | 12,500 | 313,000 |
| Concrete Median Barrier, Modified | 100 | 12,500 | 1,250,000 |
| Lighting, Markings, ITS | 150,000 | 1 | 150,000 |
| Casting, Adjust to Grade | 65,000 | 1 | 65,000 |
| Pavement Improvements (Alternative 3) | | | 1,940,000 |
| Joint Repair (inside and outside shoulders) | 60 | 32,240 | 1,940,000 |
| Drainage Improvements (Alternative 5) | | | 1,900,000 |
| Pavement Removal | 50 | 3,400 | 170,000 |
| Pavement Patching | 350 | 3,400 | 1,190,000 |
| Casting, Adjust to Grade | 260,000 | 1 | 260,000 |
| Clean Inlet | 260,000 | 1 | 260,000 |
| Inlet, Patching | 125 | 110 | 13,800 |
| Ramp Metering Miscellaneous (guardrail, pavement patching, etc) | 1,085,000 | 1 | 1,090,000 |
| Lump Sum (MOT, CE, Clearing, Mobilization/Demobilization) | 18,500,000 | 1 | 18,500,000 |
| Cantilevers (for EB 65 Lane merge) | 125,000 | 5 | 625,000 |
| Noise Barrier Modifications (Provision) | 3,663,000 | 1 | 3,670,000 |
| **Civil Infrastructure - Subtotal** | | | **32,400,000** |
| **Systems** | **Unit Cost** | **Quantity** | **Cost (rounded)** |
| Gantry structures and foundations (Indiana) | 220,000 | 58 | 12,800,000 |
| Gantry equipment/cabling (Indiana) | 35,000 | 58 | 2,030,000 |
| Lane control signs (Indiana) | 210,000 | 58 | 12,200,000 |
| EB Gantry structures and foundations (Illinois) | 220,000 | 5 | 1,100,000 |
| EB Gantry equipment/cabling (Illinois) | 25,000 | 5 | 125,000 |
| EB Lane control signs (all travel lanes and shoulders) (Illinois) | 210,000 | 5 | 1,050,000 |
| WB Cantilever Structures and Foundations (Illinois) | 170,000 | 3 | 510,000 |
| WB Cantilever equipment/cabling (Illinois) | 16,000 | 1 | 16,000 |
| WB Lane control signs (inside shoulder) (Illinois) | 30,000 | 1 | 30,000 |
| Gantry/Cantilver mounted CCTV cameras | 8,000 | 64 | 512,000 |
| Dynamic message sign on new dedicated gantry | 115,000 | 2 | 230,000 |
| DMS gantry structure and foundation | 220,000 | 2 | 440,000 |
| Cabinets, handholes, power service, communications | 61,750 | 75 | 4,640,000 |
| Gantry Mounted VSL's (all lanes) | 210,000 | 58 | 12,200,000 |
| Standalone VSL's | 40,000 | 9 | 360,000 |
| Microwave radar detector | 6,000 | 72 | 432,000 |
| Ramp metering Signal poles, heads, loops, cabling | 40,000 | 7 | 280,000 |
| Ramp metering cabinets, controllers, handholes, power service, communications | 80,000 | 7 | 560,000 |
| Gantry mounted queue warning DMS | 75,000 | 15 | 1,130,000 |
| Communications redundancy and protection of existing equipment | 10,000 | 100 | 1,000,000 |
| Center to Center Integration | 250,000 | 1 | 250,000 |
| CAD Integration | 150,000 | 1 | 150,000 |
| Complimentary Strategies | 500,000 | 1 | 500,000 |
| Ramp metering software | 150,000 | 1 | 150,000 |
| Central ATM software | 550,000 | 1 | 550,000 |
| Interagency Fiber Connections and Networking | 200,000 | 1 | 200,000 |
| Center to Center Software | 300,000 | 1 | 300,000 |
| Integration and testing (2% of construction cost) | 1,073,025 | 1 | 1,080,000 |
| **Systems Subtotal** | | | **54,800,000** |
| TRIP Program Deployment | | | 150,000 |
| Startup Support | | | 500,000 |
| Design (10%) | | | 8,710,000 |
| Project Management (5%) | | | 4,360,000 |
| **Subtotal** | | | **101,000,000** |
| Contingency (30%) | | | 30,300,000 |
| **Total** | | | **131,000,000** |
| Yearly software, maintenance, TRIP, and enhanced clearance program | | | 2,660,000 |

Table E.5: Alternative Cost Estimate Summary (TSMO and Non TSMO) [assume $0 for non TSMO O&M]

### Alternative 1 – Base Package

| | Implementation Cost | Operations and Maintenance (Annual Cost) | Operations and Maintenance (15 years at constant cost) |
|---|---|---|---|
| TSMO Strategies | $74,034,183 | $1,550,103 | $23,251,542 |
| Non TSMO Strategies | $8,343,296 | $0 | $0 |
| **Total** | **$82,377,479** | **$1,550,103** | **$23,251,542** |

### Alternative 2 – Base Package + Ramp Metering

| | Implementation Cost | Operations and Maintenance (Annual Cost) | Operations and Maintenance (15 years at constant cost) |
|---|---|---|---|
| TSMO Strategies | $78,977,069 | $1,677,937 | $25,169,052 |
| Non TSMO Strategies | $8,343,296 | $0 | $0 |
| **Total** | **$87,320,365** | **$1,677,937** | **$25,169,052** |

### Alternative 3 – Base Package + Mainline Safety

| | Implementation Cost | Operations and Maintenance (Annual Cost) | Operations and Maintenance (15 years at constant cost) |
|---|---|---|---|
| TSMO Strategies | $126,745,117 | $2,621,434 | $39,321,514 |
| Non TSMO Strategies | $8,343,296 | $0 | $0 |
| **Total** | **$135,088,413** | **$2,621,434** | **$39,321,514** |

### Alternative 4 – Base Package + Mainline Safety + Ramp Metering

| | Implementation Cost | Operations and Maintenance (Annual Cost) | Operations and Maintenance (15 years at constant cost) |
|---|---|---|---|
| TSMO Strategies | $130,998,093 | $2,651,728 | $39,775,924 |
| Non TSMO Strategies | $8,343,296 | $0 | $0 |
| **Total** | **$139,341,389** | **$2,651,728** | **$39,775,924** |

**Notes:**

All values in $2021

Non TSMO Improvement Strategies include:

- Broadway Interchange and I-65 Interchange Modifications $4.150M
- Signing Enhancements
  - Advance Warning Signs $0.598M
  - Interchange Sequence Signs $3.604M

Table E.6: Alternative 1 – Base Package

| STRATEGY INCLUDED | STRATEGY | | | | | ALTERNATIVE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cost [1] ($ Million) | | | Benefit ($ Million) | NPV BCR | Cost [1,2] ($ Million) | | | Benefit ($ Million) | NPV BCR |
| | Total | Capital | O&M | | | Total | Capital | O&M | | |
| **Dynamic Shoulder Lanes** | ($77.4) | ($71.0) | ($6.4) | $286.9 | NPV = $209.5<br>BCR = 3.71 | ($97.8) | ($81.8) | ($16.1) | $452.1 | NPV = **$354.3**<br>BCR = **4.62** |
| **Event Management (Light) ***<br>* (Applicable Complementary Strategies + TRIP and Hoosier Helpers) | ($10.8) | ($1.0) | ($9.7) | $16.7 | NPV = $5.9<br>BCR = 1.55 | | | | | |
| **Broadway Interchange and I-65 Interchange Modifications, and Signing Enhancements** | ($8.3) | ($8.3) | ($0.0) | $148.5 | NPV = $140.2<br>BCR = 17.89 | | | | | |
| **Key Advantages** | | | | | | | | | | |
| ▪ Significant improvement to traffic operations performance with dynamic shoulder lanes providing improved capacity to I-80/94 resulting in resolution of major recurrent bottlenecks.<br>▪ Improved event management through incident identification / response / mobilization is a cost-effective strategy that can utilize existing systems and processes.<br>▪ The Broadway interchange and I-65 interchange modifications and the resultant capacity improvements complement the TSMO strategies by resolving the downstream bottleneck near the I-65 eastbound exit ramp. | | | | | | | | | | |
| **Potential Impacts** | | | | | | | | | | |
| ▪ N/A | | | | | | | | | | |

**Notes:**

1 Present value (PV) costs over the analysis period extending from 2021 to 2040.

2 Although the combined cost estimates have been refined (see Appendix E – Alternative cost estimate tables), due to the conceptual level of planning completed at this stage of the project, the Alternative costs may include some duplication of individual elements associated with multiple TSMO strategies.

Table E.7: Alternative 2 – Base Package + Ramp Metering

| STRATEGY INCLUDED | STRATEGY | | | | | ALTERNATIVE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cost [1] ($ Million) | | | Benefit ($ Million) | NPV BCR | Cost [1,2] ($ Million) | | | Benefit ($ Million) | NPV BCR |
| | Total | Capital | O&M | | | Total | Capital | O&M | | |
| **Dynamic Shoulder Lanes + Ramp Metering** | ($83.2) | ($75.7) | ($7.4) | $334.6 | NPV = $251.4<br>BCR = 4.02 | ($104.1) | ($86.7) | ($17.4) | $499.8 | NPV = **$395.7**<br>BCR = **4.80** |
| **Event Management (Light) ***<br>* (Applicable Complementary Strategies + TRIP and Hoosier Helpers) | ($11.5) | ($1.0) | ($10.5) | $16.7 | NPV = $5.2<br>BCR = 1.45 | | | | | |
| **Broadway Interchange and I-65 Interchange Modifications, and Signing Enhancements** | ($8.3) | ($8.3) | ($0.0) | $148.5 | NPV = $140.2<br>BCR = 17.89 | | | | | |
| **Key Advantages** | | | | | | | | | | |
| ▪ Significant improvement to traffic operations performance with dynamic shoulder lanes providing improved capacity to I-80/94 resulting in resolution of major recurrent bottlenecks.<br>▪ Ramp metering limits the impact of high-volume entrance ramp locations from inducing turbulence to the I-80/94 mainline.<br>▪ Improved event management through incident identification / response / mobilization is a cost-effective strategy that can utilize existing systems and processes.<br>▪ The Broadway interchange and I-65 interchange modifications and the resultant capacity improvements complement the TSMO strategies by resolving the downstream bottleneck near the I-65 eastbound exit ramp. | | | | | | | | | | |
| **Potential Impacts** | | | | | | | | | | |
| ▪ Increased diversion to municipal network as ramp meters deter short distance interchange-to-interchange trips on I-80/94. | | | | | | | | | | |

**Notes:**

1 Present value (PV) costs over the analysis period extending from 2021 to 2040.

2 Although the combined cost estimates have been refined (see Appendix E – Alternative cost estimate tables), due to the conceptual level of planning completed at this stage of the project, the Alternative costs may include some duplication of individual elements associated with multiple TSMO strategies.

Table E.8: Alternative 3 - Base Package + Mainline Safety*

| STRATEGY INCLUDED | STRATEGY | | | | | ALTERNATIVE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cost [1] ($ Million) | | | Benefit ($ Million) | NPV BCR | Cost [1,2] ($ Million) | | | Benefit ($ Million) | NPV BCR |
| | Total | Capital | O&M | | | Total | Capital | O&M | | |
| **Dynamic Shoulder Lanes + Variable Speed Limits** | ($83.0) | ($76.3) | ($6.6) | Traffic Operations $354.6<br>VSL Safety $267.6 | NPV = $539.2<br>BCR = 7.50 | ($161.3) | ($134.1) | ($27.2) | $1078.8 | NPV = **$917.5**<br>BCR = **6.69** |
| **Event Management** (All Strategies) | ($11.5) | ($1.0) | ($10.5) | $296.7 | NPV = $201.6<br>BCR = 3.12 | | | | | |
| **Lane Control** | ($83.6) | ($75.4) | ($8.1) | N/A | | | | | | |
| **Queue Warning** | ($14.7) | ($13.5) | ($1.2) | $11.4 | NPV = ($3.3)<br>BCR = 0.78 | | | | | |
| **Broadway Interchange and I-65 Interchange Modifications, and Signing Enhancements** | ($8.3) | ($8.3) | ($0.0) | $148.5 | NPV = $140.2<br>BCR = 17.89 | | | | | |
| **Key Advantages** | | | | | | | | | | |
| ▪ Significant improvement to traffic operations performance with dynamic shoulder lanes providing improved capacity to I-80/94 resulting in resolution of major recurrent bottlenecks.<br>▪ Lane control can help reduce the potential for rear end crashes, which is the predominant crash type along the study corridor by providing drivers more time to respond and slow down.<br>▪ Variable speed limits provide significant improvement to corridor safety resulting in reduced crash frequency and severity.<br>▪ Queue warning provides improved traffic safety by reducing the potential for rear-end crashes or other secondary incidents and yielding a high BCR.<br>▪ Improved event management through incident identification / response / mobilization is a cost-effective strategy that can utilize existing systems and processes.<br>▪ The Broadway interchange and I-65 interchange modifications and the resultant capacity improvements complement the TSMO strategies by resolving the downstream bottleneck near the I-65 eastbound exit ramp. | | | | | | | | | | |
| **Potential Impacts** | | | | | | | | | | |
| ▪ The proposed queue warning system may increase PDO crashes while reducing injury related crashes. | | | | | | | | | | |

**Notes:**

1 Present value (PV) costs over the analysis period extending from 2021 to 2040.

2 Although the combined cost estimates have been refined (see Appendix E – Alternative cost estimate tables), due to the conceptual level of planning completed at this stage of the project, the Alternative costs may include some duplication of individual elements associated with multiple TSMO strategies.

*Mainline Safety refers to those improvement strategies that focused primarily on safety and not traffic operations, which include variable speed limits, dynamic lane control, and queue warning.

Table E.9: Alternative 4 - Base Package + Mainline Safety* + Ramp Metering

| STRATEGY INCLUDED | STRATEGY | | | | | ALTERNATIVE | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Cost [1] ($ Million) | | | Benefit ($ Million) | NPV BCR | Cost [1,2] ($ Million) | | | Benefit ($ Million) | NPV BCR |
| | Total | Capital | O&M | | | Total | Capital | O&M | | |
| **Dynamic Shoulder Lanes + Variable Speed Limits + Ramp Metering** | ($86.5) | ($78.9) | ($7.6) | Traffic Operations $355.3<br>VSL Safety $267.6 | NPV = $536.4<br>BCR = 7.20 | ($165.8) | ($138.3) | ($27.5) | $1079.5 | NPV = **$913.7**<br>BCR = **6.51** |
| **Event Management** (All Strategies) | ($11.5) | ($1.0) | ($10.5) | $296.7 | NPV = $201.6<br>BCR = 3.12 | | | | | |
| **Lane Control** | ($83.6) | ($75.4) | ($8.1) | N/A | | | | | | |
| **Queue Warning** | ($14.7) | ($13.5) | ($1.2) | $11.4 | NPV = ($3.3)<br>BCR = 0.78 | | | | | |
| **Broadway Interchange and I-65 Interchange Modifications, and Signing Enhancements** | ($8.3) | ($8.3) | ($0.0) | $148.5 | NPV = $140.2<br>BCR = 17.89 | | | | | |
| **Key Advantages** | | | | | | | | | | |
| ▪ Significant improvement to traffic operations performance with dynamic shoulder lanes providing improved capacity to I-80/94 resulting in resolution of major recurrent bottlenecks.<br>▪ Ramp metering limits the impact of high-volume entrance ramp locations from inducing turbulence to the I-80/94 mainline.<br>▪ Variable speed limits provide significant improvement to corridor safety resulting in reduced crash frequency and severity.<br>▪ Lane control can help reduce the potential for rear end crashes, which is the predominant crash type along the study corridor by providing drivers more time to respond and slow down.<br>▪ Improved event management through incident identification / response / mobilization is a cost-effective strategy that can utilize existing systems and processes.<br>▪ The Broadway interchange and I-65 interchange modifications and the resultant capacity improvements complement the TSMO strategies by resolving the downstream bottleneck near the I-65 eastbound exit ramp. | | | | | | | | | | |
| **Potential Impacts** | | | | | | | | | | |
| ▪ Increased diversion to municipal network as ramp meters deter short distance interchange-to-interchange trips on I-80/94.<br>▪ The proposed queue warning system may increase PDO crashes while reducing injury related crashes. | | | | | | | | | | |

**Notes:**

1 Present value (PV) costs over the analysis period extending from 2021 to 2040.

2 Although the combined cost estimates have been refined (see Appendix E – Alternative cost estimate tables), due to the conceptual level of planning completed at this stage of the project, the Alternative costs may include some duplication of individual elements associated with multiple TSMO strategies.

*Mainline Safety refers to those improvement strategies that focused primarily on safety and not traffic operations, which include variable speed limits, dynamic lane control, and queue warning.

# APPENDIX F

## BCR and NPV Sensitivity Analysis (Alternatives)

To support the business case of implementing one or more TSMO improvement strategies under consideration, a detailed benefit cost analysis was conducted in the Alternative Assessment report. The analysis focused on travel time and safety benefits since the primary purpose of the assessment was to demonstrate the feasibility or viability of the different TSMO strategies being contemplated. It is acknowledged that the Federal Highway Administration (FHWA) benefit cost analysis methodology includes other metrics or criteria, which if included, would only enhance the potential benefits already estimated. Therefore, the approach chosen in assessing the various TSMO strategies could be considered conservative in that other potential benefits have not been included. To demonstrate the conservativeness or robustness of the approach used the Alternative Assessment Report to estimate benefits, sensitivity analysis was conducted.

The FHWA Tool for Operations Benefit-Cost Analysis (TOPS-BC) provides recommended or default parameter values to quantify benefits which differ from the parameter values sourced in the Alternative Assessment report. The sensitivity analysis therefore considered the changes in the estimation of the benefits that would result if the FHWA default parameter values were applied. The sensitivity analysis focused on sample calculations for the four alternatives introduced in Section 7 of the Alternative Assessment Report.

## F1 COMPARISON OF INPUT PARAMETERS

To increase the accuracy of the analysis, the approach undertaken in the calculation of the benefits as summarized in the Alternative Analysis Report involved parameter values derived from regionally relevant data. For example, direct outputs from the purposely developed traffic operations model were preferred, followed by reports produced by agencies that track specific indices. Recommended parameter values from the U.S. Department of Transportation were used if other resources were not available. **Table F.1** presents the key parameters used in the calculation of the benefits and their respective data sources.

**Table F.1: Selected Parameter Values**

| METRIC | REPORT SELECTED VALUE | SOURCE |
|---|---|---|
| Discount Rate | 4% | Indiana Design Manual (Chapter 50 Economic Analysis, updated in April 2016) |
| VoT (Auto, $/hr) | $17.90 | 2019 dollars, US DOT Benefit Cost Analysis Guidance for Discretionary Grant Programs |
| VoT (Truck, $/hr) | $30.80 | 2019 dollars, US DOT Benefit Cost Analysis Guidance for Discretionary Grant Programs |
| VoT (Blended, $/hr) | $27.35 | Calculated based on 80% of VoT (auto) and 20% VoT (truck), combined with the peak occupancy rate. Peak occupancy for trucks is 1.0. |
| Occupancy (peak period) | 1.48 | US DOT Benefit Cost Analysis Guidance for Discretionary Grant Programs |
| Occupancy (non-peak periods) | 1.58 | US DOT Benefit Cost Analysis Guidance for Discretionary Grant Programs |
| Peak Hours to Daily Expansion | 2.45 | Obtained StreetLight Data. Custom ratio converting peak hours to the 6 AM to 9 PM period when TSMO strategies are likely to be active / effective. |
| Daily to Yearly Expansion (All Days) | 381 | Custom factor, based on corridor traffic data, accounting for all days of the year |
| Daily to Yearly Expansion (Weekday Only) | 261 | Number of working days in 2019, United States |

| METRIC | REPORT SELECTED VALUE | SOURCE |
|---|---|---|
| CPI Change | 1.06 | U.S. Bureau of Labor Statistics. Compounded inflation from June 2019 to June 2021. |
| Construction Cost Growth (Per Annum) | 3.7% | National Highway Construction Index |
| 2023 Costs | 50% | Construction to occur over 2 years (2023 and 2024) |
| 2024 Costs | 50% | Construction to occur over 2 years (2023 and 2024) |

Table F.2 presents the recommendations or default values from the FHWA TOPS-BC for the relevant parameters with the comparable values used in the benefit analysis in the Alternative Assessment Report.

**Table F.2: FHWA Recommended / Default Parameter Values and Report Selected Values**

| METRIC | FHWA TOPS-BC VALUE | REPORT SELECTED VALUE |
|---|---|---|
| Discount Rate | 7% | 4% |
| Percentage "On the Clock" Travel Purpose (Auto) | 20% | N/A |
| VoT (Auto "On the Clock", $/hr) | $37.58 | N/A |
| VoT (Auto other, $/hr) | $15.29 | N/A |
| VoT (Auto all, $/hr)* | $19.75 | $17.90 |
| VoT (Truck, $/hr) | $29.96 | $30.80 |
| Inflation** | 5.1% | 6% |
| Auto Occupancy | 1.67 | 1.48 (peak periods)<br>1.58 (non peak periods) |

*Calculated as 20% of "On the Clock" auto VoT and 80% of "other" auto VoT

**Compounded inflation over two years, from June 2019 to June 2021

## F2 SENSITIVITY ANALYSIS RESULTS

This section provides example calculations using the relevant recommended or default parameter values from FHWA TOPS-BC while maintaining other parameters as the previously selected values. Two different sensitivity analysis scenarios were undertaken as follows:

1. Apply FHWA TOPS-BC parameter values listed in Table F.2 with the exception of the discount rate (which is maintained at 4%)
2. Apply FHWA TOPS-BC parameter values listed in Table F.2 including the discount rate (7%)

This approach allows the changes in the benefits and BCR and NPV that are related directly to the discount rate to be isolated, recognizing the significant difference in the two values (4% vs 7%).

Calculations for the four alternative packages are shown in Table F.3 to Table F.6 with each table providing a comparison of the benefits, costs, BCR and NPV for each sensitivity analysis scenario against the results presented in the Alternative Assessment Report. For each sensitivity analysis scenario, the applicable outputs from the traffic operations model were used as the basis for calculating the benefits. Similarly, the cost estimates prepared for each alternative were used in the calculation of the BCR and NPV for each sensitivity analysis scenario.

**Table F.3: Alternative 1 Base Package**

| | ALTERNATIVE ASSESSMENT REPORT | SCENARIO 1 FHWA PARAMETER VALUES USING 4% DISCOUNT RATE | Δ | SCENARIO 2 FHWA PARAMETER VALUES USING 7% DISCOUNT RATE | Δ |
|---|---|---|---|---|---|
| Present Value Cost ($ Million) | ($97.8) | $ (97.8) | $0.0 | $ (88.1) | + $9.7 |
| Present Value Benefits ($ Million) | $452.1 | $ 512.8 | + $60.7 | $ 369.2 | - $82.9 |
| Net Present Value ($ Million) | $354.3 | $ 415.0 | + $60.7 | $ 281.1 | - $73.2 |
| Benefit Cost Ratio | 4.62 | 5.24 | + 0.62 | 4.19 | - 0.43 |

**Table F.4: Alternative 2 Base Package + Ramp Metering**

| | ALTERNATIVE ASSESSMENT REPORT | SCENARIO 1 FHWA PARAMETER VALUES USING 4% DISCOUNT RATE | Δ | SCENARIO 2 FHWA PARAMETER VALUES USING 7% DISCOUNT RATE | Δ |
|---|---|---|---|---|---|
| Present Value Cost ($ Million) | ($104.1) | $ (104.1) | $0.0 | $ (93.7) | + $10.4 |
| Present Value Benefits ($ Million) | $499.8 | $ 567.2 | + $67.4 | $ 407.1 | - $92.7 |
| Net Present Value ($ Million) | $395.7 | $ 463.1 | + $67.4 | $ 313.4 | - $82.3 |
| Benefit Cost Ratio | 4.80 | 5.45 | + 0.65 | 4.34 | - 0.46 |

**Table F.5: Alternative 3 Base Package + Mainline Safety***

| | ALTERNATIVE ASSESSMENT REPORT | SCENARIO 1 FHWA PARAMETER VALUES USING 4% DISCOUNT RATE | Δ | SCENARIO 2 FHWA PARAMETER VALUES USING 7% DISCOUNT RATE | Δ |
|---|---|---|---|---|---|
| Present Value Cost ($ Million) | ($161.3) | $ (161.3) | $0.0 | $(145.1) | + $16.2 |
| Present Value Benefits ($ Million) | $1,078.8 | $ 1198.1 | + $119.3 | $ 812.1 | - $266.7 |
| Net Present Value ($ Million) | $917.5 | $ 1036.8 | + $119.3 | $ 667.0 | - $250.5 |
| Benefit Cost Ratio | 6.69 | 7.43 | + 0.74 | 5.60 | - 1.09 |

Table F.6: Alternative 4 Base Package + Mainline Safety* + Ramp Metering

| | ALTERNATIVE ASSESSMENT REPORT | SCENARIO 1) FHWA PARAMETER VALUES USING 4% DISCOUNT RATE | Δ | SCENARIO 2) FHWA PARAMETER VALUES USING 7% DISCOUNT RATE | Δ |
|---|---|---|---|---|---|
| Present Value Cost ($ Million) | ($165.8) | $ (165.8) | $0.0 | $ (149.3) | + $16.5 |
| Present Value Benefits ($ Million) | $1,079.5 | $ 1198.9 | + $119.4 | $ 812.1 | - $267.4 |
| Net Present Value ($ Million) | $913.7 | $ 1033.1 | + $119. | $ 662.8 | - $250.9 |
| Benefit Cost Ratio | 6.51 | 7.23 | + 0.72 | 5.44 | -1.07 |

## F3 FINDINGS

As can be seen from the Scenario 1 results presented in the tables above, applying the FHWA TOPS-BC values to the relevant parameters used in calculating the present value (2021$) benefits, the estimated benefits for each Alternative increased as compared to the benefits calculated in the Alternative Assessment Report. This finding indicates that the values used in the Alternative Assessment report for the relevant parameters, could be considered conservative.

When applying the higher discount rate of 7% as in Scenario 2, the present value of the costs decreased somewhat with a noteworthy decrease in the benefits – as compared to the present value (2021$) benefits calculated in the Alternative Assessment Report. These noteworthy changes in the benefits resulted in both lower BCR and NPV values for all the Alternatives as compared to BCR and NPV values calculated in the Alternative Assessment Report. However, the resultant BCR and NPV values for each Alternative under Scenario 2 are still significant with BCR values ranging from approximately 4.1:1 to 5.6:1.