# Technical Memorandum

*To:* *Mr. Trent Epperson,*
*Assistant City Manager, City of Pearland*

*From:* *Ashish Loney*

*Date:* *January 5, 2015*

*Subject:* *SH 288 and FM 518 Traffic Analysis*

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## 1. Introduction

As part of the *Traffic Engineering Consultant* contract, CDM Smith was requested to perform traffic analysis study of the intersection of SH 288 and FM 518 in Pearland, Texas. The purpose of this study was to:

- Perform operational analyses for existing and future traffic conditions.
- Identify capacity needs to achieve acceptable traffic operations.
- Evaluate future traffic operations under proposed alternatives.

## 2. Methodology

The methodology employed in conducting the traffic analysis is outlined as follows:

- Conducted intersection turning movement counts at the study intersection on a typical weekday.
- Modeled existing traffic conditions using Synchro, version 8.0, a traffic operations software program.
- Determined future traffic growth rates using the Pearland Travel Demand Model.
- Developed future traffic volumes for years 2019 and 2035 using growth factors.
- Conducted traffic operational analyses using Synchro for future traffic conditions with existing geometry. This represents the No-Build scenario.
- Identified intersection capacity improvements needed to accommodate future traffic volumes at acceptable performance level. This represents the Build scenario.
- Documented traffic analysis results for the existing and future traffic volumes under the No-Build and Build conditions.

## 3. Traffic Operations Analysis

Capacity analyses were conducted for the study intersection to evaluate existing and future traffic operating conditions. The Highway Capacity Manual (2010) defines capacity at an intersection as the maximum hourly rate at which vehicles can reasonably be expected to pass through the intersection under prevailing traffic roadway and signalization conditions. The primary measures of effectiveness (MOEs) used in evaluating the traffic operations at the intersection were peak hour intersection control delay (measured in units of seconds per vehicle) and level-of-service (LOS).

Control delay is defined as that component of total delay caused by decelerating and accelerating at a traffic signal or stop sign. Level-of-service is a qualitative measure of operating conditions at an intersection based on control delay. LOS is a given a letter designation from A to F, where LOS A represents free-flow conditions and LOS F represents heavy congestion. The relationship between the various LOS classifications and control delay is summarized in **Table 1**.

**Table 1** Intersection Level-of-Service Criteria

| Level-of-Service | Average Control Delay (sec/veh) | Description |
|---|---|---|
| A | 0 - 10 | Very low vehicle delays, free traffic flow, signal progression extremely favorable, most vehicles arrive during given signal phase. |
| B | > 10 - 20 | Good traffic flow, good signal progression, more vehicles stop and experience higher delays than for LOS A. |
| C | > 20 - 35 | Stable traffic flow, fair signal progression, significant number of vehicles stop at signals. |
| D | >35 - 55 | Noticeable traffic congestion, longer delays and unfavorable signal progression, many vehicles stop at signals. |
| E | > 55 - 80 | Unstable traffic flow, poor signal progression, significant congestion, traffic near roadway capacity, frequent traffic signal cycle failures. |
| F | > 80 | Unacceptable delay, extremely unstable flow, heavy congestion, traffic exceeds roadway capacity, stop-and-go conditions. |

Source: Highway Capacity Manual, Transportation Research Board, 2010

## 4. Existing Traffic Operations

Intersection turning movement counts were conducted in November 2013 at the study intersection. The counts were conducted over a three-and-a-half-hour period (6:30 a.m. to 8:15 a.m. and 4:30 p.m. to 6:15 p.m.). Intersection turning movement counts details are provided in **Appendix A**. The evening peak hour traffic counts were found to be the highest and as such only the evening peak traffic counts were used in conducting analyses.

Analysis of existing conditions indicates that FM 518 and SH 288 Northbound Frontage Road intersection operates at acceptable LOS 'D', while the intersection of FM 518 at SH 288 Southbound Frontage Road operates at an unacceptable LOS 'E'. The intersection at SH 288 Northbound Frontage Road however, has its eastbound and northbound movements operating at unacceptable conditions. Level-of-service and delay measures for the study intersection are summarized in **Table 2**. Detailed *Synchro* output results are provided in **Appendix B**.

**Table 2 Existing Year 2013 Level-of-Service**

| Intersection/ Approach | Delay (s) | LOS |
|---|---|---|
| **FM 518 @ SH 288 SB Frontage Road** | | |
| Eastbound | 99.2 | F |
| Westbound | 4.2 | A |
| Southbound | 118.7 | F |
| **Intersection** | **72.0** | **E** |
| **FM 518 @ SH 288 NB Frontage Road** | | |
| Eastbound | 58.2 | E |
| Westbound | 42.7 | D |
| Northbound | 55.6 | E |
| **Intersection** | **51.5** | **D** |

Source: CDM Smith, using Synchro, Version 8

# 5. Future Traffic Operations

This section documents the traffic analysis of the following scenarios –

- 2019 and 2035 No-Build conditions (future traffic volumes with existing geometry)
- 2019 and 2035 Build conditions (future traffic volumes with proposed improvements)

## 5.1 Pearland Travel Demand Model

The Pearland Travel Demand Model was previously developed as part of the *Traffic Management Plan,* to evaluate transportation mobility needs for Pearland. It involved developing a refined travel demand model for Pearland using the *Cube Voyager* software and was based on the Houston-Galveston Area Council (H-GAC) Regional Travel Demand Model.

The Pearland model results were utilized to develop growth rates and future intersection traffic volumes for this study.

## 5.2 Year 2019 No-Build Traffic Conditions

Analysis of year 2019 conditions indicates that traffic operates at unacceptable level at both intersections of FM 518 at SH 288 Northbound Frontage Road and Southbound Frontage Road. The

southbound approach is projected to operate with significant delay (126 sec/veh) compared to other approaches. Year 2019 No-Build level-of-service results are summarized in **Table 3**. Detailed *Synchro* output results are documented in **Appendix B**.

**Table 3 Year 2019 LOS – No-Build Conditions**

| Intersection/ Approach | Delay (s) | LOS |
|---|---|---|
| **FM 518 @ SH 288 SB Frontage Road** | | |
| Eastbound | 101.0 | F |
| Westbound | 4.4 | A |
| Southbound | 125.9 | F |
| **Intersection** | **75.0** | **E** |
| **FM 518 @ SH 288 NB Frontage Road** | | |
| Eastbound | 62.5 | E |
| Westbound | 46.4 | D |
| Northbound | 57.8 | E |
| **Intersection** | **55.2** | **E** |

Source: CDM Smith, using Synchro, Version 8

## 5.3 Year 2035 No-Build Traffic Conditions

Similar to 2019 no-build conditions, analysis of 2035 no-build conditions indicates that traffic operations would continue to deteriorate at the study intersections, if no capacity improvements are made. All approaches, with the exception of westbound approach at SB Frontage Road, would operate at LOS 'F' with southbound approach operating with 231 sec/veh delay. Year 2035 No-build level-of-service results are summarized in **Table 4**. Detailed *Synchro* output results are documented in **Appendix B**.

**Table 4 Year 2035 LOS – No-Build Conditions**

| Intersection/ Approach | Delay (s) | LOS |
|---|---|---|
| **FM 518 @ SH 288 SB Frontage Road** | | |
| Eastbound | 169.0 | F |
| Westbound | 26.8 | C |
| Southbound | 230.6 | F |
| **Intersection** | **138.9** | **F** |
| **FM 518 @ SH 288 NB Frontage Road** | | |
| Eastbound | 168.2 | F |
| Westbound | 120.8 | F |
| Northbound | 101.2 | F |
| **Intersection** | **138.7** | **F** |

Source: CDM Smith, using Synchro, Version 8

# 6. Recommended Improvements

Based on the future traffic operations, intersection capacity improvements were developed to improve projected performance at acceptable level-of-service. The recommended improvements were identified as two alternatives as shown in **Table 5**. The screenshots of *Synchro* network showing the proposed intersection geometry are provided in **Appendix C**.

**Table 5 Recommended Improvements**

| Intersection/ Approach | Alternative 1 | Alternative 2 |
|---|---|---|
| **FM 518 @ SH 288 SB Frontage Road** | | |
| Eastbound | - | 4 thru lanes; 1 right-turn lane |
| Westbound | 3 thru lanes; dual left-turn lanes | 3 thru lanes; dual left-turn lanes |
| Southbound | - | 5 thru lanes plus U-turn lane |
| **FM 518 @ SH 288 NB Frontage Road** | | |
| Eastbound | 3 thru lanes; dual left-turn lanes | 3 thru lanes; dual left-turn lanes |
| Westbound | - | 4 thru lanes; dual right-turn lanes |
| Northbound | - | 4 thru lanes plus U-turn lane |

Source: CDM Smith

## 6.1 Year 2019 Build Traffic Conditions

Recommended intersection improvements under Alternatives 1 and 2 were evaluated using projected 2019 traffic volumes. Traffic analysis results are summarized in **Table 6** and detailed *Synchro* outputs are provided in **Appendix B**.

Alternative 2 provides the most desirable traffic operations with both intersections at FM 518 and SH 288 Frontage Road operating at LOS 'C' or better.

**Table 6 Year 2019 LOS – Build Conditions**

| Intersection/ Approach | Alternative 1 | | Alternative 2 | |
|---|---|---|---|---|
| | Delay (s) | LOS | Delay (s) | LOS |
| **FM 518 @ SH 288 SB Frontage Road** | | | | |
| Eastbound | 100.0 | F | 42.5 | D |
| Westbound | 3.2 | A | 1.3 | A |
| Southbound | 123.7 | F | 42.9 | D |
| **Intersection** | **73.6** | **E** | **28.1** | **C** |
| **FM 518 @ SH 288 NB Frontage Road** | | | | |
| Eastbound | 8.2 | A | 1.7 | A |
| Westbound | 56.2 | E | 33.9 | C |
| Northbound | 57.8 | E | 24.7 | C |
| **Intersection** | **35.4** | **D** | **18.3** | **B** |

Source: CDM Smith, using Synchro, Version 8

## 6.2 Year 2035 Build Traffic Conditions

Alternatives 1 and 2 with recommended intersection improvements were evaluated using projected 2035 traffic volumes. Traffic analysis results are summarized in **Table 7** and detailed *Synchro* outputs are provided in **Appendix B**.

Alternative 1 fails to provide adequate capacity to accommodate the 2035 travel demand with both intersections at FM 518 and SH 288 Frontage Road operating at LOS 'F'. Under Alternative 2, both intersections operate at acceptable LOS 'D' or better.

**Table 7 Year 2035 LOS – Build Conditions**

| Intersection/ Approach | Alternative 1 | | Alternative 2 | |
|---|---|---|---|---|
| | Delay (s) | LOS | Delay (s) | LOS |
| **FM 518 @ SH 288 SB Frontage Road** | | | | |
| Eastbound | 167.6 | F | 48.1 | D |
| Westbound | 4.0 | A | 1.4 | A |
| Southbound | 228.1 | F | 74.4 | E |
| **Intersection** | **129.5** | **F** | **40.1** | **D** |
| **FM 518 @ SH 288 NB Frontage Road** | | | | |
| Eastbound | 44.9 | D | 6.2 | A |
| Westbound | 131.9 | F | 50.9 | D |
| Northbound | 101.2 | F | 25.6 | C |
| **Intersection** | **89.0** | **F** | **27.4** | **C** |

Source: CDM Smith, using Synchro, Version 8

## 7. Summary

This section provides a snapshot of the traffic analysis results:

- Traffic operations analyses were conducted at the intersections of FM 518 and SH 288 Southbound and Northbound Frontage Roads.
- Existing year 2013 traffic operations analyses resulted in LOS 'E' and LOS 'D' for the intersections at SH 288 Southbound and Northbound Frontage Roads, respectively.
- Future Year 2019 No-Build (without improvements) traffic operations analyses resulted in LOS 'E' at both SH 288 Southbound and Northbound Frontage Roads.
- Future Year 2035 No-Build (without improvements) traffic operations analyses resulted in LOS 'F' at both SH 288 Southbound and Northbound Frontage Roads.
- Two alternatives with intersection capacity improvements were evaluated. Alternative 2 provided desirable LOS for future traffic conditions.
- Future Year 2019 Build (Alternative 2) traffic operations analyses resulted in LOS 'C' and LOS 'B' at SH 288 Southbound and Northbound Frontage Roads, respectively.
- Future Year 2035 Build (Alternative 2) traffic operations analyses resulted in LOS 'D' and LOS 'C' at SH 288 Southbound and Northbound Frontage Roads, respectively.

# APPENDIX A – TURNING MOVEMENT COUNTS

| | |
|---|---|
| **Study Name** | SH 288 SBFR @ FM 518 |
| **Start Date** | Tuesday, November 12, 2013 6:30 AM |
| **End Date** | Tuesday, November 12, 2013 6:30 PM |
| **Site Code** | 1A |

## Report Summary

| | | Southbound | | | | | | Westbound | | | | | Northbound | | | Eastbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time Period** | **Class.** | **L** | **T** | **R** | **U** | **I** | **O** | **L** | **T** | **U** | **I** | **O** | **U** | **I** | **O** | **T** | **R** | **U** | **I** | **O** | **Total** |
| **Peak 1** | Car | 560 | 15 | 177 | 88 | 840 | 88 | 207 | 645 | 0 | 852 | 1267 | 0 | 0 | 352 | 707 | 130 | 0 | 837 | 822 | 2529 |
| Specified Period | % | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 0% | 100% | 100% | 0% | 0% | 100% | 100% | 100% | 0% | 100% | 100% | 100% |
| 6:30 AM - 8:30 AM | **Total** | **560** | **15** | **177** | **88** | **840** | **88** | **207** | **645** | **0** | **852** | **1267** | **0** | **0** | **352** | **707** | **130** | **0** | **837** | **822** | **2529** |
| One Hour Peak | PHF | 0.9 | 0.75 | 0.69 | 0.71 | 0.9 | 0.71 | 0.88 | 0.96 | 0 | 0.97 | 0.95 | 0 | 0 | 0.86 | 0.99 | 0.76 | 0 | 0.97 | 0.89 | 0.96 |
| 7:30 AM - 8:30 AM | Approach % | | | | | 33% | 3% | | | | 34% | 50% | | 0% | 14% | | | | 33% | 33% | |
| **Peak 2** | Car | 1078 | 74 | 374 | 269 | 1795 | 269 | 390 | 1231 | 0 | 1621 | 2241 | 3 | 3 | 803 | 1163 | 336 | 0 | 1499 | 1605 | 4918 |
| Specified Period | % | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 0% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 0% | 100% | 100% | 100% |
| 4:30 PM - 6:30 PM | **Total** | **1078** | **74** | **374** | **269** | **1795** | **269** | **390** | **1231** | **0** | **1621** | **2241** | **3** | **3** | **803** | **1163** | **336** | **0** | **1499** | **1605** | **4918** |
| One Hour Peak | PHF | 0.95 | 0.88 | 0.89 | 0.84 | 0.98 | 0.84 | 0.89 | 0.92 | 0 | 0.96 | 0.94 | 0.38 | 0.38 | 0.92 | 0.93 | 0.92 | 0 | 0.93 | 0.94 | 0.97 |
| 5:00 PM - 6:00 PM | Approach % | | | | | 36% | 5% | | | | 33% | 46% | | 0% | 16% | | | | 30% | 33% | |

| | |
|---|---|
| **Study Name** | SH 288 NBFR @ FM 518 |
| **Start Date** | Tuesday, November 12, 2013 6:30 AM |
| **End Date** | Tuesday, November 12, 2013 6:30 PM |
| **Site Code** | 1B |

## Report Summary

| | | Southbound | | | Westbound | | | Northbound | | | | | | | Eastbound | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Time Period** | **Class.** | **U** | **I** | **O** | **T** | **R** | **U** | **I** | **O** | **L** | **T** | **R** | **U** | **I** | **O** | **L** | **T** | **U** | **I** | **O** | **Total** |
| **Peak 1** | Car | 88 | 88 | 1101 | 616 | 654 | 0 | 1270 | 1207 | 217 | 37 | 301 | 0 | 555 | 0 | 322 | 906 | 1 | 1229 | 834 | 3142 |
| Specified Period | % | 100% | 100% | 100% | 100% | 100% | 0% | 100% | 100% | 100% | 100% | 100% | 0% | 100% | 0% | 100% | 100% | 100% | 100% | 100% | 100% |
| 6:30 AM - 8:30 AM | **Total** | **88** | **88** | **1101** | **616** | **654** | **0** | **1270** | **1207** | **217** | **37** | **301** | **0** | **555** | **0** | **322** | **906** | **1** | **1229** | **834** | **3142** |
| One Hour Peak | PHF | 0.71 | 0.71 | 0.97 | 0.96 | 0.93 | 0 | 0.95 | 0.92 | 0.75 | 0.71 | 0.94 | 0 | 0.94 | 0 | 0.91 | 0.9 | 0.25 | 0.91 | 0.97 | 0.97 |
| 7:30 AM - 8:30 AM | Approach % | | 3% | 35% | | | | 40% | 38% | | | | | 18% | 0% | | | | 39% | 27% | |
| **Peak 2** | Car | 271 | 271 | 1454 | 1310 | 670 | 0 | 1980 | 2112 | 296 | 90 | 341 | 4 | 731 | 4 | 423 | 1771 | 0 | 2194 | 1606 | 5176 |
| Specified Period | % | 100% | 100% | 100% | 100% | 100% | 0% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 100% | 0% | 100% | 100% | 100% |
| 4:30 PM - 6:30 PM | **Total** | **271** | **271** | **1454** | **1310** | **670** | **0** | **1980** | **2112** | **296** | **90** | **341** | **4** | **731** | **4** | **423** | **1771** | **0** | **2194** | **1606** | **5176** |
| One Hour Peak | PHF | 0.83 | 0.83 | 0.97 | 0.94 | 0.88 | 0 | 0.94 | 0.96 | 0.91 | 0.9 | 0.92 | 0.33 | 0.93 | 0.33 | 0.9 | 0.96 | 0 | 0.95 | 0.96 | 0.98 |
| 5:00 PM - 6:00 PM | Approach % | | 5% | 28% | | | | 38% | 41% | | | | | 14% | 0% | | | | 42% | 31% | |

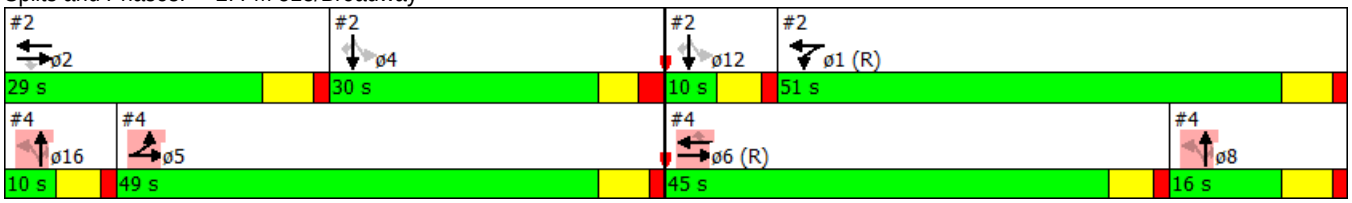
# APPENDIX B – SYNCHRO OUTPUTS

| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 0 | 1163 | 336 | 390 | 1231 | 0 | 0 | 0 | 0 | 1078 | 74 | 374 |
| Satd. Flow (prot) | 0 | 5085 | 1583 | 0 | 5024 | 0 | 0 | 0 | 0 | 1681 | 1697 | 1583 |
| Flt Permitted | | | | | 0.717 | | | | | 0.950 | 0.959 | |
| Satd. Flow (perm) | 0 | 5085 | 1583 | 0 | 3646 | 0 | 0 | 0 | 0 | 1681 | 1697 | 1583 |
| Satd. Flow (RTOR) | | | 272 | | | | | | | | | 182 |
| Lane Group Flow (vph) | 0 | 1251 | 365 | 0 | 1776 | 0 | 0 | 0 | 0 | 613 | 606 | 420 |
| Turn Type | | NA | Perm | Prot | NA | | | | | Perm | NA | Perm |
| Protected Phases | | 2 | | 1 | 2 1 | | | | | | 4 12 | |
| Permitted Phases | | | 2 | | | | | | | 4 12 | | 4 12 |
| Total Split (s) | | 29.0 | 29.0 | 51.0 | | | | | | | | |
| Total Lost Time (s) | | 4.0 | 4.0 | | | | | | | | | |
| Act Effct Green (s) | | 25.0 | 25.0 | | 72.0 | | | | | 36.0 | 36.0 | 34.0 |
| Actuated g/C Ratio | | 0.21 | 0.21 | | 0.60 | | | | | 0.30 | 0.30 | 0.28 |
| v/c Ratio | | 1.18 | 0.67 | | 0.76 | | | | | 1.22 | 1.19 | 0.73 |
| Control Delay | | 123.4 | 15.9 | | 3.5 | | | | | 151.6 | 141.7 | 29.7 |
| Queue Delay | | 0.1 | 0.0 | | 0.6 | | | | | 2.7 | 2.7 | 0.0 |
| Total Delay | | 123.5 | 15.9 | | 4.2 | | | | | 154.3 | 144.4 | 29.7 |
| LOS | | F | B | | A | | | | | F | F | C |
| Approach Delay | | 99.2 | | | 4.2 | | | | | | 118.7 | |
| Approach LOS | | F | | | A | | | | | | F | |

## Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 74 (62%), Referenced to phase 1:WBTL and 6:, Start of 1st Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.22
Intersection Signal Delay: 72.0 Intersection LOS: E
Intersection Capacity Utilization 96.0% ICU Level of Service F
Analysis Period (min) 15

Splits and Phases: 2: FM 518/Broadway

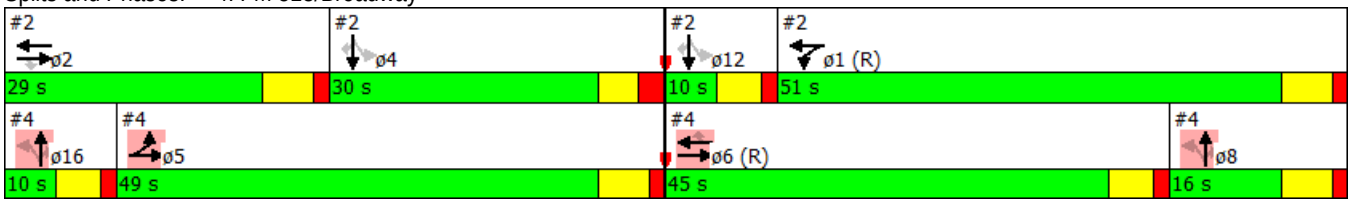


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 423 | 1771 | 0 | 0 | 1310 | 670 | 296 | 90 | 341 | 0 | 0 | 0 |
| Satd. Flow (prot) | 0 | 4531 | 0 | 0 | 4577 | 1425 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Flt Permitted | | 0.668 | | | | | 0.950 | 0.970 | | | | |
| Satd. Flow (perm) | 0 | 3057 | 0 | 0 | 4577 | 1425 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Satd. Flow (RTOR) | | | | | | 366 | | | 182 | | | |
| Lane Group Flow (vph) | 0 | 2315 | 0 | 0 | 1394 | 761 | 162 | 263 | 371 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Perm | NA | Perm | | | |
| Protected Phases | 5 | 6 5 | | | 6 | | | 8 16 | | | | |
| Permitted Phases | | | | | | 6 | 8 16 | | 8 16 | | | |
| Total Split (s) | 49.0 | | | | 45.0 | 45.0 | | | | | | |
| Total Lost Time (s) | | | | | 4.0 | 5.5 | | | | | | |
| Act Effct Green (s) | | 86.0 | | | 41.0 | 39.5 | 22.0 | 22.0 | 20.0 | | | |
| Actuated g/C Ratio | | 0.72 | | | 0.34 | 0.33 | 0.18 | 0.18 | 0.17 | | | |
| v/c Ratio | | 1.09 | | | 0.89 | 1.07 | 0.61 | 0.49 | 0.95 | | | |
| Control Delay | | 52.7 | | | 31.4 | 62.9 | 56.0 | 47.4 | 61.1 | | | |
| Queue Delay | | 5.4 | | | 0.3 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Total Delay | | 58.2 | | | 31.7 | 62.9 | 56.0 | 47.4 | 61.1 | | | |
| LOS | | E | | | C | E | E | D | E | | | |
| Approach Delay | | 58.2 | | | 42.7 | | | 55.6 | | | | |
| Approach LOS | | E | | | D | | | E | | | | |

## Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 74 (62%), Referenced to phase 1:WBTL and 6:, Start of 1st Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.22
Intersection Signal Delay: 51.5 Intersection LOS: D
Intersection Capacity Utilization 114.0% ICU Level of Service H
Analysis Period (min) 15

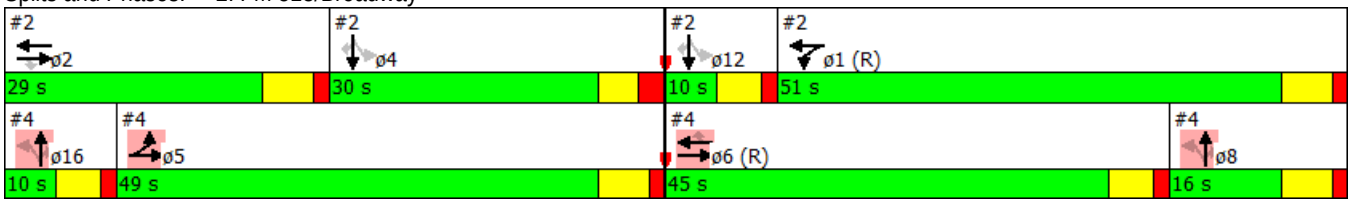
Splits and Phases: 4: FM 518/Broadway



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 0 | 1163 | 336 | 390 | 1231 | 0 | 0 | 0 | 0 | 1078 | 74 | 374 |
| Satd. Flow (prot) | 0 | 5085 | 1583 | 0 | 5024 | 0 | 0 | 0 | 0 | 1681 | 1697 | 1583 |
| Flt Permitted | | | | | 0.717 | | | | | 0.950 | 0.959 | |
| Satd. Flow (perm) | 0 | 5085 | 1583 | 0 | 3646 | 0 | 0 | 0 | 0 | 1681 | 1697 | 1583 |
| Satd. Flow (RTOR) | | | 272 | | | | | | | | | 182 |
| Lane Group Flow (vph) | 0 | 1276 | 373 | 0 | 1812 | 0 | 0 | 0 | 0 | 625 | 618 | 429 |
| Turn Type | | NA | Perm | Prot | NA | | | | | Perm | NA | Perm |
| Protected Phases | | 2 | | 1 | 2 1 | | | | | | 4 12 | |
| Permitted Phases | | | 2 | | | | | | | 4 12 | | 4 12 |
| Total Split (s) | | 29.0 | 29.0 | 51.0 | | | | | | | | |
| Total Lost Time (s) | | 4.0 | 4.0 | | | | | | | | | |
| Act Effct Green (s) | | 25.0 | 25.0 | | 72.0 | | | | | 36.0 | 36.0 | 34.0 |
| Actuated g/C Ratio | | 0.21 | 0.21 | | 0.60 | | | | | 0.30 | 0.30 | 0.28 |
| v/c Ratio | | 1.20 | 0.68 | | 0.77 | | | | | 1.24 | 1.21 | 0.74 |
| Control Delay | | 127.0 | 12.0 | | 3.7 | | | | | 160.8 | 150.6 | 30.8 |
| Queue Delay | | 0.1 | 0.0 | | 0.7 | | | | | 3.1 | 3.0 | 0.0 |
| Total Delay | | 127.1 | 12.0 | | 4.4 | | | | | 163.8 | 153.7 | 30.8 |
| LOS | | F | B | | A | | | | | F | F | C |
| Approach Delay | | 101.0 | | | 4.4 | | | | | | 125.9 | |
| Approach LOS | | F | | | A | | | | | | F | |

| Intersection Summary | |
|---|---|
| Cycle Length: 120 | |
| Actuated Cycle Length: 120 | |
| Offset: 74 (62%), Referenced to phase 1:WBTL and 6:, Start of 1st Green | |
| Control Type: Actuated-Coordinated | |
| Maximum v/c Ratio: 1.24 | |
| Intersection Signal Delay: 75.0 | Intersection LOS: E |
| Intersection Capacity Utilization 97.7% | ICU Level of Service F |
| Analysis Period (min) 15 | |

Splits and Phases: 2: FM 518/Broadway

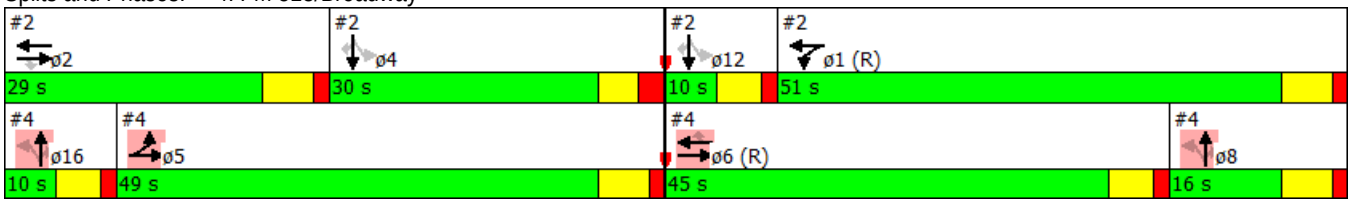


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 423 | 1771 | 0 | 0 | 1310 | 670 | 296 | 90 | 341 | 0 | 0 | 0 |
| Satd. Flow (prot) | 0 | 4531 | 0 | 0 | 4577 | 1425 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Flt Permitted | | 0.669 | | | | | 0.950 | 0.970 | | | | |
| Satd. Flow (perm) | 0 | 3062 | 0 | 0 | 4577 | 1425 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Satd. Flow (RTOR) | | | | | | 359 | | | 182 | | | |
| Lane Group Flow (vph) | 0 | 2361 | 0 | 0 | 1421 | 777 | 166 | 268 | 378 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Perm | NA | Perm | | | |
| Protected Phases | 5 | 6 5 | | | 6 | | | 8 16 | | | | |
| Permitted Phases | | | | | | 6 | 8 16 | | 8 16 | | | |
| Total Split (s) | 49.0 | | | | 45.0 | 45.0 | | | | | | |
| Total Lost Time (s) | | | | | 4.0 | 5.5 | | | | | | |
| Act Effct Green (s) | | 86.0 | | | 41.0 | 39.5 | 22.0 | 22.0 | 20.0 | | | |
| Actuated g/C Ratio | | 0.72 | | | 0.34 | 0.33 | 0.18 | 0.18 | 0.17 | | | |
| v/c Ratio | | 1.11 | | | 0.91 | 1.10 | 0.63 | 0.49 | 0.97 | | | |
| Control Delay | | 62.2 | | | 31.4 | 72.7 | 56.8 | 47.6 | 65.4 | | | |
| Queue Delay | | 0.3 | | | 0.6 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Total Delay | | 62.5 | | | 32.0 | 72.7 | 56.8 | 47.6 | 65.4 | | | |
| LOS | | E | | | C | E | E | D | E | | | |
| Approach Delay | | 62.5 | | | 46.4 | | | 57.8 | | | | |
| Approach LOS | | E | | | D | | | E | | | | |

## Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 74 (62%), Referenced to phase 1:WBTL and 6:, Start of 1st Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.24
Intersection Signal Delay: 55.2 Intersection LOS: E
Intersection Capacity Utilization 116.1% ICU Level of Service H
Analysis Period (min) 15

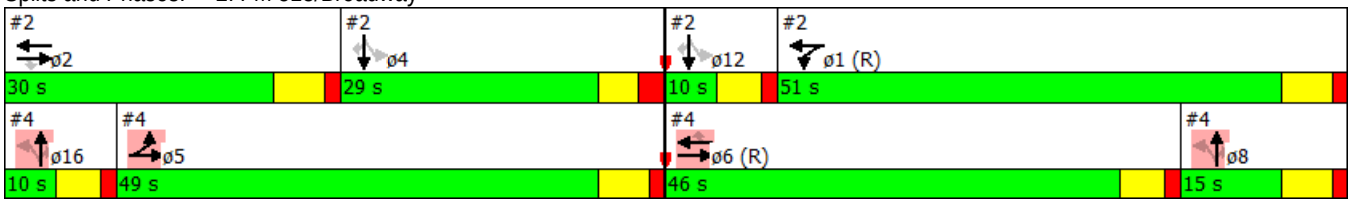
Splits and Phases: 4: FM 518/Broadway



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 0 | 1163 | 336 | 390 | 1231 | 0 | 0 | 0 | 0 | 1078 | 74 | 374 |
| Satd. Flow (prot) | 0 | 5085 | 1583 | 0 | 5024 | 0 | 0 | 0 | 0 | 1681 | 1697 | 1583 |
| Flt Permitted | | | | | 0.716 | | | | | 0.950 | 0.959 | |
| Satd. Flow (perm) | 0 | 5085 | 1583 | 0 | 3641 | 0 | 0 | 0 | 0 | 1681 | 1697 | 1583 |
| Satd. Flow (RTOR) | | | 275 | | | | | | | | | 182 |
| Lane Group Flow (vph) | 0 | 1563 | 457 | 0 | 2221 | 0 | 0 | 0 | 0 | 766 | 757 | 525 |
| Turn Type | | NA | Perm | Prot | NA | | | | | Perm | NA | Perm |
| Protected Phases | | 2 | | 1 | 2 1 | | | | | | 4 12 | |
| Permitted Phases | | | 2 | | | | | | | 4 12 | | 4 12 |
| Total Split (s) | | 30.0 | 30.0 | 51.0 | | | | | | | | |
| Total Lost Time (s) | | 4.0 | 4.0 | | | | | | | | | |
| Act Effct Green (s) | | 26.0 | 26.0 | | 73.0 | | | | | 35.0 | 35.0 | 33.0 |
| Actuated g/C Ratio | | 0.22 | 0.22 | | 0.61 | | | | | 0.29 | 0.29 | 0.28 |
| v/c Ratio | | 1.42 | 0.82 | | 0.94 | | | | | 1.56 | 1.53 | 0.93 |
| Control Delay | | 214.3 | 11.0 | | 7.6 | | | | | 294.5 | 281.3 | 51.5 |
| Queue Delay | | 0.9 | 0.0 | | 19.2 | | | | | 4.5 | 4.4 | 0.0 |
| Total Delay | | 215.2 | 11.0 | | 26.8 | | | | | 298.9 | 285.8 | 51.5 |
| LOS | | F | B | | C | | | | | F | F | D |
| Approach Delay | | 169.0 | | | 26.8 | | | | | | 230.6 | |
| Approach LOS | | F | | | C | | | | | | F | |

| Intersection Summary | |
|---|---|
| Cycle Length: 120 | |
| Actuated Cycle Length: 120 | |
| Offset: 75 (63%), Referenced to phase 1:WBTL and 6:, Start of 1st Green | |
| Control Type: Actuated-Coordinated | |
| Maximum v/c Ratio: 1.56 | |
| Intersection Signal Delay: 138.9 | Intersection LOS: F |
| Intersection Capacity Utilization 117.5% | ICU Level of Service H |
| Analysis Period (min) 15 | |

Splits and Phases: 2: FM 518/Broadway

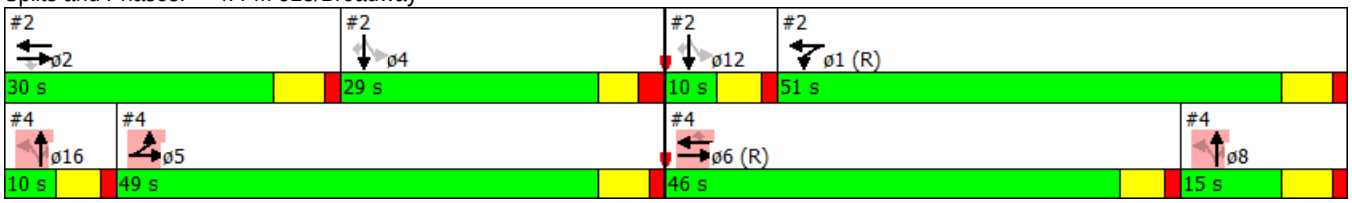


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 423 | 1771 | 0 | 0 | 1310 | 670 | 296 | 90 | 341 | 0 | 0 | 0 |
| Satd. Flow (prot) | 0 | 4531 | 0 | 0 | 4577 | 1425 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Flt Permitted | | 0.685 | | | | | 0.950 | 0.970 | | | | |
| Satd. Flow (perm) | 0 | 3135 | 0 | 0 | 4577 | 1425 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Satd. Flow (RTOR) | | | | | | 276 | | | 182 | | | |
| Lane Group Flow (vph) | 0 | 2894 | 0 | 0 | 1742 | 952 | 203 | 329 | 463 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Perm | NA | Perm | | | |
| Protected Phases | 5 | 6 5 | | | 6 | | | 8 16 | | | | |
| Permitted Phases | | | | | | 6 | 8 16 | | 8 16 | | | |
| Total Split (s) | 49.0 | | | | 46.0 | 46.0 | | | | | | |
| Total Lost Time (s) | | | | | 4.0 | 5.5 | | | | | | |
| Act Effct Green (s) | | 87.0 | | | 42.0 | 40.5 | 21.0 | 21.0 | 19.0 | | | |
| Actuated g/C Ratio | | 0.72 | | | 0.35 | 0.34 | 0.18 | 0.18 | 0.16 | | | |
| v/c Ratio | | 1.34 | | | 1.09 | 1.44 | 0.80 | 0.64 | 1.22 | | | |
| Control Delay | | 167.7 | | | 64.3 | 214.2 | 71.3 | 52.2 | 149.1 | | | |
| Queue Delay | | 0.4 | | | 5.4 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Total Delay | | 168.2 | | | 69.7 | 214.2 | 71.3 | 52.2 | 149.1 | | | |
| LOS | | F | | | E | F | E | D | F | | | |
| Approach Delay | | 168.2 | | | 120.8 | | | 101.2 | | | | |
| Approach LOS | | F | | | F | | | F | | | | |

## Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 75 (63%), Referenced to phase 1:WBTL and 6:, Start of 1st Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.56
Intersection Signal Delay: 138.7 Intersection LOS: F
Intersection Capacity Utilization 139.7% ICU Level of Service H
Analysis Period (min) 15

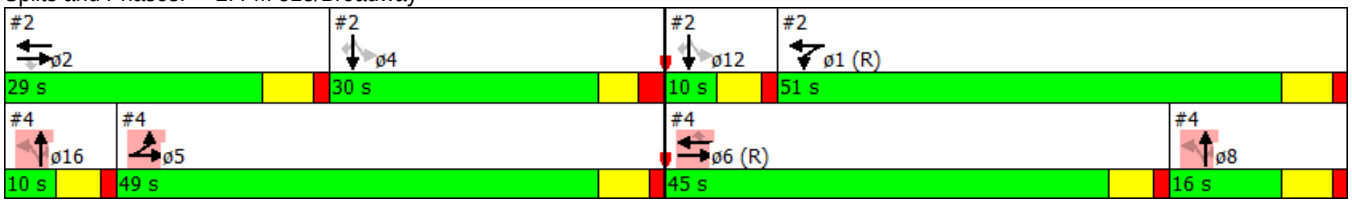
Splits and Phases: 4: FM 518/Broadway



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 0 | 1163 | 336 | 390 | 1231 | 0 | 0 | 0 | 0 | 1078 | 74 | 374 |
| Satd. Flow (prot) | 0 | 5085 | 1583 | 3433 | 5085 | 0 | 0 | 0 | 0 | 1681 | 1697 | 1583 |
| Flt Permitted | | | | 0.950 | | | | | | 0.950 | 0.959 | |
| Satd. Flow (perm) | 0 | 5085 | 1583 | 3433 | 5085 | 0 | 0 | 0 | 0 | 1681 | 1697 | 1583 |
| Satd. Flow (RTOR) | | | 333 | | | | | | | | | 182 |
| Lane Group Flow (vph) | 0 | 1276 | 373 | 447 | 1365 | 0 | 0 | 0 | 0 | 625 | 618 | 429 |
| Turn Type | | NA | Perm | Prot | NA | | | | | Perm | NA | Perm |
| Protected Phases | | 2 | | 1 | 2 1 | | | | | | 4 12 | |
| Permitted Phases | | | 2 | | | | | | | 4 12 | | 4 12 |
| Total Split (s) | | 29.0 | 29.0 | 51.0 | | | | | | | | |
| Total Lost Time (s) | | 4.0 | 4.0 | 4.0 | | | | | | | | |
| Act Effct Green (s) | | 25.0 | 25.0 | 47.0 | 76.0 | | | | | 36.0 | 36.0 | 34.0 |
| Actuated g/C Ratio | | 0.21 | 0.21 | 0.39 | 0.63 | | | | | 0.30 | 0.30 | 0.28 |
| v/c Ratio | | 1.20 | 0.63 | 0.33 | 0.42 | | | | | 1.24 | 1.21 | 0.74 |
| Control Delay | | 127.0 | 7.9 | 9.5 | 0.7 | | | | | 160.8 | 150.6 | 30.8 |
| Queue Delay | | 0.0 | 0.0 | 0.0 | 0.4 | | | | | 0.0 | 0.0 | 0.0 |
| Total Delay | | 127.0 | 7.9 | 9.5 | 1.1 | | | | | 160.8 | 150.6 | 30.8 |
| LOS | | F | A | A | A | | | | | F | F | C |
| Approach Delay | | 100.0 | | | 3.2 | | | | | | 123.7 | |
| Approach LOS | | F | | | A | | | | | | F | |

| Intersection Summary | |
|---|---|
| Cycle Length: 120 | |
| Actuated Cycle Length: 120 | |
| Offset: 74 (62%), Referenced to phase 1:WBTL and 6:, Start of 1st Green | |
| Control Type: Actuated-Coordinated | |
| Maximum v/c Ratio: 1.24 | |
| Intersection Signal Delay: 73.6 | Intersection LOS: E |
| Intersection Capacity Utilization 80.3% | ICU Level of Service D |
| Analysis Period (min) 15 | |

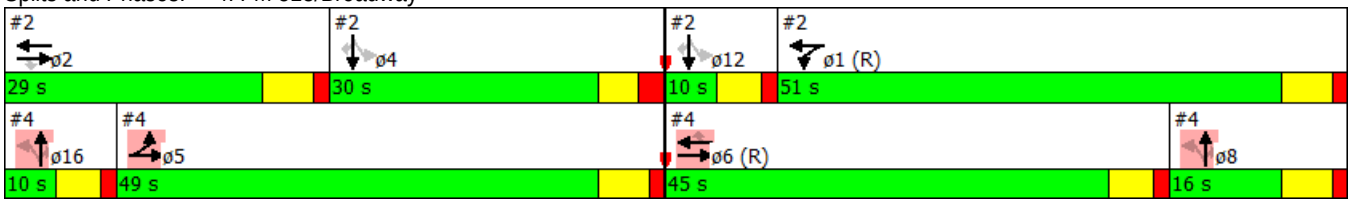
Splits and Phases: 2: FM 518/Broadway



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 423 | 1771 | 0 | 0 | 1310 | 670 | 296 | 90 | 341 | 0 | 0 | 0 |
| Satd. Flow (prot) | 3090 | 4577 | 0 | 0 | 4577 | 1425 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Flt Permitted | 0.950 | | | | | | 0.950 | 0.970 | | | | |
| Satd. Flow (perm) | 3090 | 4577 | 0 | 0 | 4577 | 1425 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Satd. Flow (RTOR) | | | | | | 298 | | | 182 | | | |
| Lane Group Flow (vph) | 479 | 1882 | 0 | 0 | 1421 | 777 | 166 | 268 | 378 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Perm | NA | Perm | | | |
| Protected Phases | 5 | 6 5 | | | 6 | | | 8 16 | | | | |
| Permitted Phases | | | | | | 6 | 8 16 | | 8 16 | | | |
| Total Split (s) | 49.0 | | | | 45.0 | 45.0 | | | | | | |
| Total Lost Time (s) | 4.0 | | | | 4.0 | 5.5 | | | | | | |
| Act Effct Green (s) | 45.0 | 90.0 | | | 41.0 | 39.5 | 22.0 | 22.0 | 20.0 | | | |
| Actuated g/C Ratio | 0.38 | 0.75 | | | 0.34 | 0.33 | 0.18 | 0.18 | 0.17 | | | |
| v/c Ratio | 0.41 | 0.55 | | | 0.91 | 1.16 | 0.63 | 0.49 | 0.97 | | | |
| Control Delay | 16.8 | 1.6 | | | 31.4 | 101.6 | 56.8 | 47.6 | 65.4 | | | |
| Queue Delay | 0.0 | 4.4 | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Total Delay | 16.8 | 6.0 | | | 31.4 | 101.6 | 56.8 | 47.6 | 65.4 | | | |
| LOS | B | A | | | C | F | E | D | E | | | |
| Approach Delay | | 8.2 | | | 56.2 | | | 57.8 | | | | |
| Approach LOS | | A | | | E | | | E | | | | |

| Intersection Summary | |
|---|---|
| Cycle Length: 120 | |
| Actuated Cycle Length: 120 | |
| Offset: 74 (62%), Referenced to phase 1:WBTL and 6:, Start of 1st Green | |
| Control Type: Actuated-Coordinated | |
| Maximum v/c Ratio: 1.24 | |
| Intersection Signal Delay: 35.4 | Intersection LOS: D |
| Intersection Capacity Utilization 80.3% | ICU Level of Service D |
| Analysis Period (min) 15 | |

Splits and Phases: 4: FM 518/Broadway

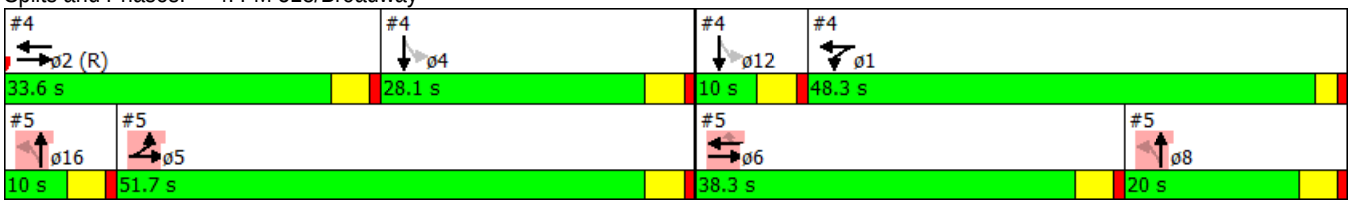


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 0 | 1163 | 336 | 390 | 1231 | 0 | 0 | 0 | 0 | 1078 | 74 | 374 |
| Satd. Flow (prot) | 0 | 6408 | 1583 | 3433 | 5085 | 0 | 0 | 0 | 0 | 4990 | 3097 | 0 |
| Flt Permitted | | | | 0.950 | | | | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 6408 | 1583 | 3433 | 5085 | 0 | 0 | 0 | 0 | 4990 | 3097 | 0 |
| Satd. Flow (RTOR) | | | 373 | | | | | | | | 65 | |
| Lane Group Flow (vph) | 0 | 1276 | 373 | 447 | 1365 | 0 | 0 | 0 | 0 | 1157 | 515 | 0 |
| Turn Type | | NA | Free | Prot | NA | | | | | Perm | NA | |
| Protected Phases | | 2 | | 1 | 2 1 | | | | | | 4 12 | |
| Permitted Phases | | | Free | | | | | | | 4 12 | | |
| Total Split (s) | | 33.6 | | 48.3 | | | | | | | | |
| Total Lost Time (s) | | 4.5 | | 3.0 | | | | | | | | |
| Act Effct Green (s) | | 30.1 | 120.0 | 44.3 | 77.4 | | | | | 33.6 | 33.6 | |
| Actuated g/C Ratio | | 0.25 | 1.00 | 0.37 | 0.64 | | | | | 0.28 | 0.28 | |
| v/c Ratio | | 0.80 | 0.24 | 0.35 | 0.42 | | | | | 0.83 | 0.88dr | |
| Control Delay | | 54.8 | 0.3 | 1.7 | 0.9 | | | | | 46.6 | 34.8 | |
| Queue Delay | | 0.0 | 0.0 | 0.0 | 0.3 | | | | | 0.0 | 0.0 | |
| Total Delay | | 54.8 | 0.3 | 1.7 | 1.2 | | | | | 46.6 | 34.8 | |
| LOS | | D | A | A | A | | | | | D | C | |
| Approach Delay | | 42.5 | | | 1.3 | | | | | | 42.9 | |
| Approach LOS | | D | | | A | | | | | | D | |

## Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 0.88
Intersection Signal Delay: 28.1 Intersection LOS: C
Intersection Capacity Utilization 60.3% ICU Level of Service B
Analysis Period (min) 15
dr Defacto Right Lane. Recode with 1 though lane as a right lane.

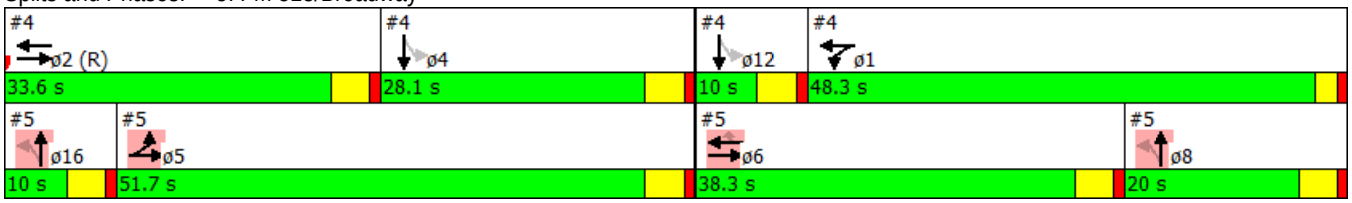
Splits and Phases: 4: FM 518/Broadway



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 423 | 1771 | 0 | 0 | 1310 | 670 | 296 | 90 | 341 | 0 | 0 | 0 |
| Satd. Flow (prot) | 3090 | 4577 | 0 | 0 | 5767 | 2508 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Flt Permitted | 0.950 | | | | | | 0.950 | 0.970 | | | | |
| Satd. Flow (perm) | 3090 | 4577 | 0 | 0 | 5767 | 2508 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Satd. Flow (RTOR) | | | | | | 605 | | | 270 | | | |
| Lane Group Flow (vph) | 479 | 1882 | 0 | 0 | 1421 | 777 | 166 | 268 | 378 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Perm | NA | Free | | | |
| Protected Phases | 5 | 5 6 | | | 6 | | | 8 16 | | | | |
| Permitted Phases | | | | | | 6 | 8 16 | | Free | | | |
| Total Split (s) | 51.7 | | | | 38.3 | 38.3 | | | | | | |
| Total Lost Time (s) | 4.5 | | | | 4.5 | 4.5 | | | | | | |
| Act Effct Green (s) | 47.2 | 85.5 | | | 33.8 | 33.8 | 25.5 | 25.5 | 120.0 | | | |
| Actuated g/C Ratio | 0.39 | 0.71 | | | 0.28 | 0.28 | 0.21 | 0.21 | 1.00 | | | |
| v/c Ratio | 0.39 | 0.58 | | | 0.88 | 0.68 | 0.54 | 0.43 | 0.27 | | | |
| Control Delay | 1.5 | 1.3 | | | 43.0 | 17.2 | 49.5 | 43.4 | 0.5 | | | |
| Queue Delay | 0.0 | 0.5 | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Total Delay | 1.5 | 1.8 | | | 43.0 | 17.2 | 49.5 | 43.4 | 0.5 | | | |
| LOS | A | A | | | D | B | D | D | A | | | |
| Approach Delay | | 1.7 | | | 33.9 | | | 24.7 | | | | |
| Approach LOS | | A | | | C | | | C | | | | |

| Intersection Summary | |
|---|---|
| Cycle Length: 120 | |
| Actuated Cycle Length: 120 | |
| Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green | |
| Control Type: Actuated-Coordinated | |
| Maximum v/c Ratio: 0.88 | |
| Intersection Signal Delay: 18.3 | Intersection LOS: B |
| Intersection Capacity Utilization 60.3% | ICU Level of Service B |
| Analysis Period (min) 15 | |

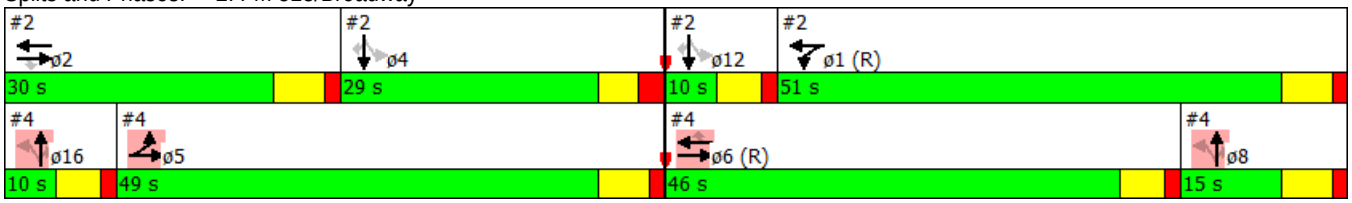
Splits and Phases: 5: FM 518/Broadway



| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 0 | 1163 | 336 | 390 | 1231 | 0 | 0 | 0 | 0 | 1078 | 74 | 374 |
| Satd. Flow (prot) | 0 | 5085 | 1583 | 3433 | 5085 | 0 | 0 | 0 | 0 | 1681 | 1697 | 1583 |
| Flt Permitted | | | | 0.950 | | | | | | 0.950 | 0.959 | |
| Satd. Flow (perm) | 0 | 5085 | 1583 | 3433 | 5085 | 0 | 0 | 0 | 0 | 1681 | 1697 | 1583 |
| Satd. Flow (RTOR) | | | 336 | | | | | | | | | 182 |
| Lane Group Flow (vph) | 0 | 1563 | 457 | 548 | 1673 | 0 | 0 | 0 | 0 | 766 | 757 | 525 |
| Turn Type | | NA | Perm | Prot | NA | | | | | Perm | NA | Perm |
| Protected Phases | | 2 | | 1 | 2 1 | | | | | | 4 12 | |
| Permitted Phases | | | 2 | | | | | | | 4 12 | | 4 12 |
| Total Split (s) | | 30.0 | 30.0 | 51.0 | | | | | | | | |
| Total Lost Time (s) | | 4.0 | 4.0 | 4.0 | | | | | | | | |
| Act Effct Green (s) | | 26.0 | 26.0 | 47.0 | 77.0 | | | | | 35.0 | 35.0 | 33.0 |
| Actuated g/C Ratio | | 0.22 | 0.22 | 0.39 | 0.64 | | | | | 0.29 | 0.29 | 0.28 |
| v/c Ratio | | 1.42 | 0.75 | 0.41 | 0.51 | | | | | 1.56 | 1.53 | 0.93 |
| Control Delay | | 214.3 | 7.7 | 11.1 | 0.7 | | | | | 294.5 | 281.3 | 51.5 |
| Queue Delay | | 0.0 | 0.0 | 0.0 | 0.9 | | | | | 1.1 | 1.1 | 0.0 |
| Total Delay | | 214.3 | 7.7 | 11.1 | 1.7 | | | | | 295.6 | 282.4 | 51.5 |
| LOS | | F | A | B | A | | | | | F | F | D |
| Approach Delay | | 167.6 | | | 4.0 | | | | | | 228.1 | |
| Approach LOS | | F | | | A | | | | | | F | |

| Intersection Summary | |
|---|---|
| Cycle Length: 120 | |
| Actuated Cycle Length: 120 | |
| Offset: 75 (63%), Referenced to phase 1:WBTL and 6:, Start of 1st Green | |
| Control Type: Actuated-Coordinated | |
| Maximum v/c Ratio: 1.56 | |
| Intersection Signal Delay: 129.5 | Intersection LOS: F |
| Intersection Capacity Utilization 158.0% | ICU Level of Service H |
| Analysis Period (min) 15 | |

Splits and Phases: 2: FM 518/Broadway

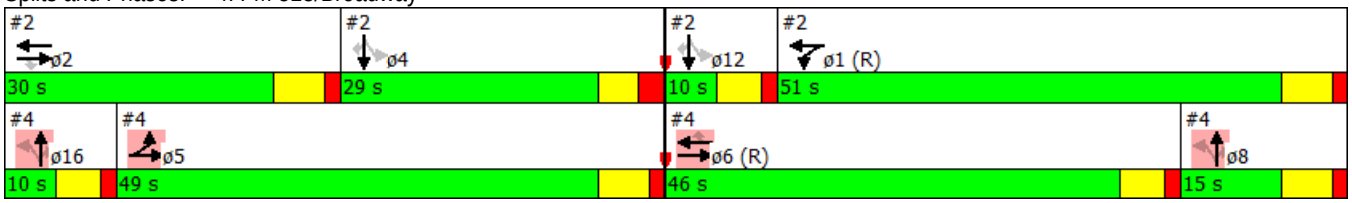


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 423 | 1771 | 0 | 0 | 1310 | 670 | 296 | 90 | 341 | 0 | 0 | 0 |
| Satd. Flow (prot) | 3090 | 4577 | 0 | 0 | 4577 | 1425 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Flt Permitted | 0.950 | | | | | | 0.950 | 0.970 | | | | |
| Satd. Flow (perm) | 3090 | 4577 | 0 | 0 | 4577 | 1425 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Satd. Flow (RTOR) | | | | | | 217 | | | 182 | | | |
| Lane Group Flow (vph) | 588 | 2306 | 0 | 0 | 1742 | 952 | 203 | 329 | 463 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Perm | NA | Perm | | | |
| Protected Phases | 5 | 6 5 | | | 6 | | | 8 16 | | | | |
| Permitted Phases | | | | | | 6 | 8 16 | | 8 16 | | | |
| Total Split (s) | 49.0 | | | | 46.0 | 46.0 | | | | | | |
| Total Lost Time (s) | 4.0 | | | | 4.0 | 5.5 | | | | | | |
| Act Effct Green (s) | 45.0 | 91.0 | | | 42.0 | 40.5 | 21.0 | 21.0 | 19.0 | | | |
| Actuated g/C Ratio | 0.38 | 0.76 | | | 0.35 | 0.34 | 0.18 | 0.18 | 0.16 | | | |
| v/c Ratio | 0.51 | 0.66 | | | 1.09 | 1.53 | 0.80 | 0.64 | 1.22 | | | |
| Control Delay | 18.2 | 4.2 | | | 64.3 | 255.6 | 71.3 | 52.2 | 149.1 | | | |
| Queue Delay | 0.0 | 47.5 | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Total Delay | 18.2 | 51.7 | | | 64.3 | 255.6 | 71.3 | 52.2 | 149.1 | | | |
| LOS | B | D | | | E | F | E | D | F | | | |
| Approach Delay | | 44.9 | | | 131.9 | | | 101.2 | | | | |
| Approach LOS | | D | | | F | | | F | | | | |

## Intersection Summary

Cycle Length: 120
Actuated Cycle Length: 120
Offset: 75 (63%), Referenced to phase 1:WBTL and 6:, Start of 1st Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.56
Intersection Signal Delay: 89.0 — Intersection LOS: F
Intersection Capacity Utilization 158.0% — ICU Level of Service H
Analysis Period (min) 15

Splits and Phases: 4: FM 518/Broadway

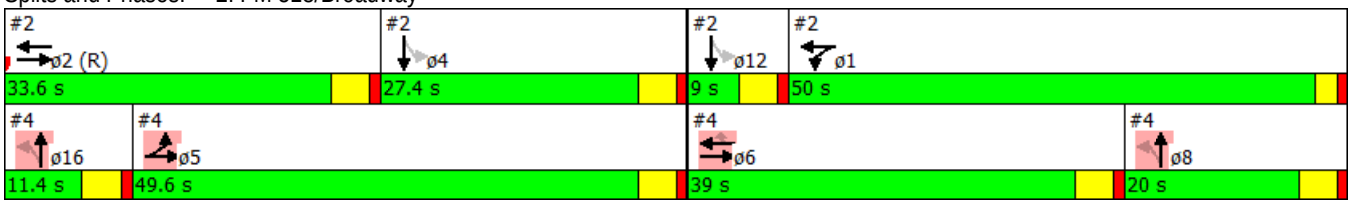


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 0 | 1163 | 336 | 390 | 1231 | 0 | 0 | 0 | 0 | 1078 | 74 | 374 |
| Satd. Flow (prot) | 0 | 6408 | 1583 | 3433 | 5085 | 0 | 0 | 0 | 0 | 4990 | 3097 | 0 |
| Flt Permitted | | | | 0.950 | | | | | | 0.950 | | |
| Satd. Flow (perm) | 0 | 6408 | 1583 | 3433 | 5085 | 0 | 0 | 0 | 0 | 4990 | 3097 | 0 |
| Satd. Flow (RTOR) | | | 423 | | | | | | | | 35 | |
| Lane Group Flow (vph) | 0 | 1563 | 457 | 548 | 1673 | 0 | 0 | 0 | 0 | 1418 | 630 | 0 |
| Turn Type | | NA | Free | Prot | NA | | | | | Perm | NA | |
| Protected Phases | | 2 | | 1 | 2 1 | | | | | | 4 12 | |
| Permitted Phases | | | Free | | | | | | | 4 12 | | |
| Total Split (s) | | 33.6 | | 50.0 | | | | | | | | |
| Total Lost Time (s) | | 4.5 | | 3.0 | | | | | | | | |
| Act Effct Green (s) | | 29.1 | 120.0 | 47.0 | 79.1 | | | | | 31.9 | 31.9 | |
| Actuated g/C Ratio | | 0.24 | 1.00 | 0.39 | 0.66 | | | | | 0.27 | 0.27 | |
| v/c Ratio | | 1.01 | 0.29 | 0.41 | 0.50 | | | | | 1.07 | 1.18dr | |
| Control Delay | | 62.2 | 0.0 | 1.3 | 0.8 | | | | | 87.8 | 44.2 | |
| Queue Delay | | 0.0 | 0.0 | 0.0 | 0.6 | | | | | 0.0 | 0.0 | |
| Total Delay | | 62.2 | 0.0 | 1.3 | 1.4 | | | | | 87.8 | 44.2 | |
| LOS | | E | A | A | A | | | | | F | D | |
| Approach Delay | | 48.1 | | | 1.4 | | | | | | 74.4 | |
| Approach LOS | | D | | | A | | | | | | E | |

| Intersection Summary | |
|---|---|
| Cycle Length: 120 | |
| Actuated Cycle Length: 120 | |
| Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green | |
| Control Type: Actuated-Coordinated | |
| Maximum v/c Ratio: 1.07 | |
| Intersection Signal Delay: 40.1 | Intersection LOS: D |
| Intersection Capacity Utilization 91.7% | ICU Level of Service F |
| Analysis Period (min) 15 | |

dr Defacto Right Lane. Recode with 1 though lane as a right lane.

Splits and Phases: 2: FM 518/Broadway

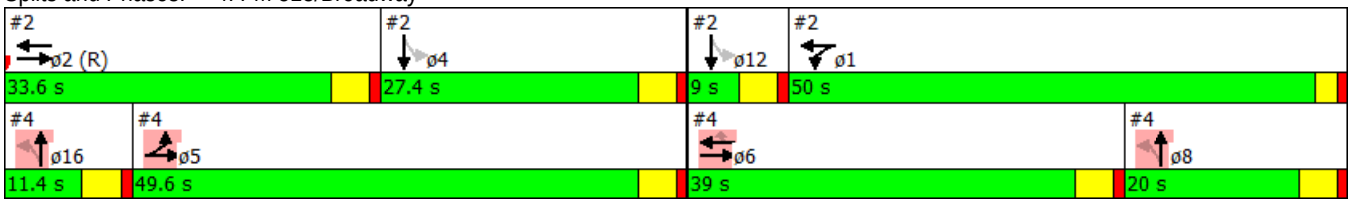


| Lane Group | EBL | EBT | EBR | WBL | WBT | WBR | NBL | NBT | NBR | SBL | SBT | SBR |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Lane Configurations | | | | | | | | | | | | |
| Volume (vph) | 423 | 1771 | 0 | 0 | 1310 | 670 | 296 | 90 | 341 | 0 | 0 | 0 |
| Satd. Flow (prot) | 3090 | 4577 | 0 | 0 | 5767 | 2508 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Flt Permitted | 0.950 | | | | | | 0.950 | 0.970 | | | | |
| Satd. Flow (perm) | 3090 | 4577 | 0 | 0 | 5767 | 2508 | 1449 | 2960 | 1425 | 0 | 0 | 0 |
| Satd. Flow (RTOR) | | | | | | 491 | | | 272 | | | |
| Lane Group Flow (vph) | 588 | 2306 | 0 | 0 | 1742 | 952 | 203 | 329 | 463 | 0 | 0 | 0 |
| Turn Type | Prot | NA | | | NA | Perm | Perm | NA | Free | | | |
| Protected Phases | 5 | 5 6 | | | 6 | | | 8 16 | | | | |
| Permitted Phases | | | | | | 6 | 8 16 | | Free | | | |
| Total Split (s) | 49.6 | | | | 39.0 | 39.0 | | | | | | |
| Total Lost Time (s) | 4.5 | | | | 4.5 | 4.5 | | | | | | |
| Act Effct Green (s) | 45.6 | 84.6 | | | 34.5 | 34.5 | 26.4 | 26.4 | 120.0 | | | |
| Actuated g/C Ratio | 0.38 | 0.70 | | | 0.29 | 0.29 | 0.22 | 0.22 | 1.00 | | | |
| v/c Ratio | 0.50 | 0.71 | | | 1.05 | 0.89 | 0.64 | 0.51 | 0.32 | | | |
| Control Delay | 1.9 | 2.4 | | | 66.8 | 22.0 | 52.6 | 44.1 | 0.6 | | | |
| Queue Delay | 0.0 | 5.0 | | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | | | |
| Total Delay | 1.9 | 7.3 | | | 66.8 | 22.0 | 52.6 | 44.1 | 0.6 | | | |
| LOS | A | A | | | E | C | D | D | A | | | |
| Approach Delay | | 6.2 | | | 50.9 | | | 25.6 | | | | |
| Approach LOS | | A | | | D | | | C | | | | |

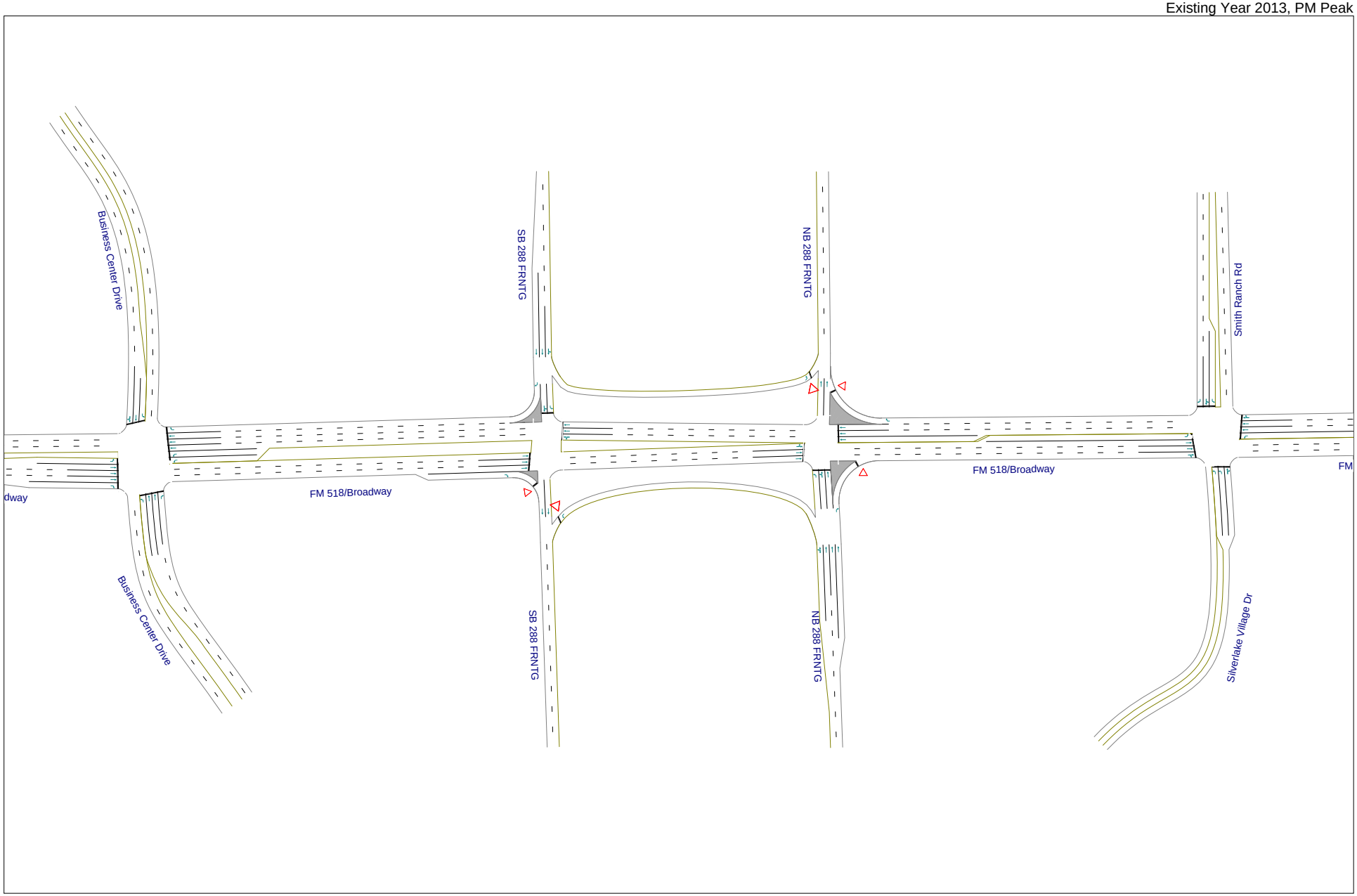
## Intersection Summary

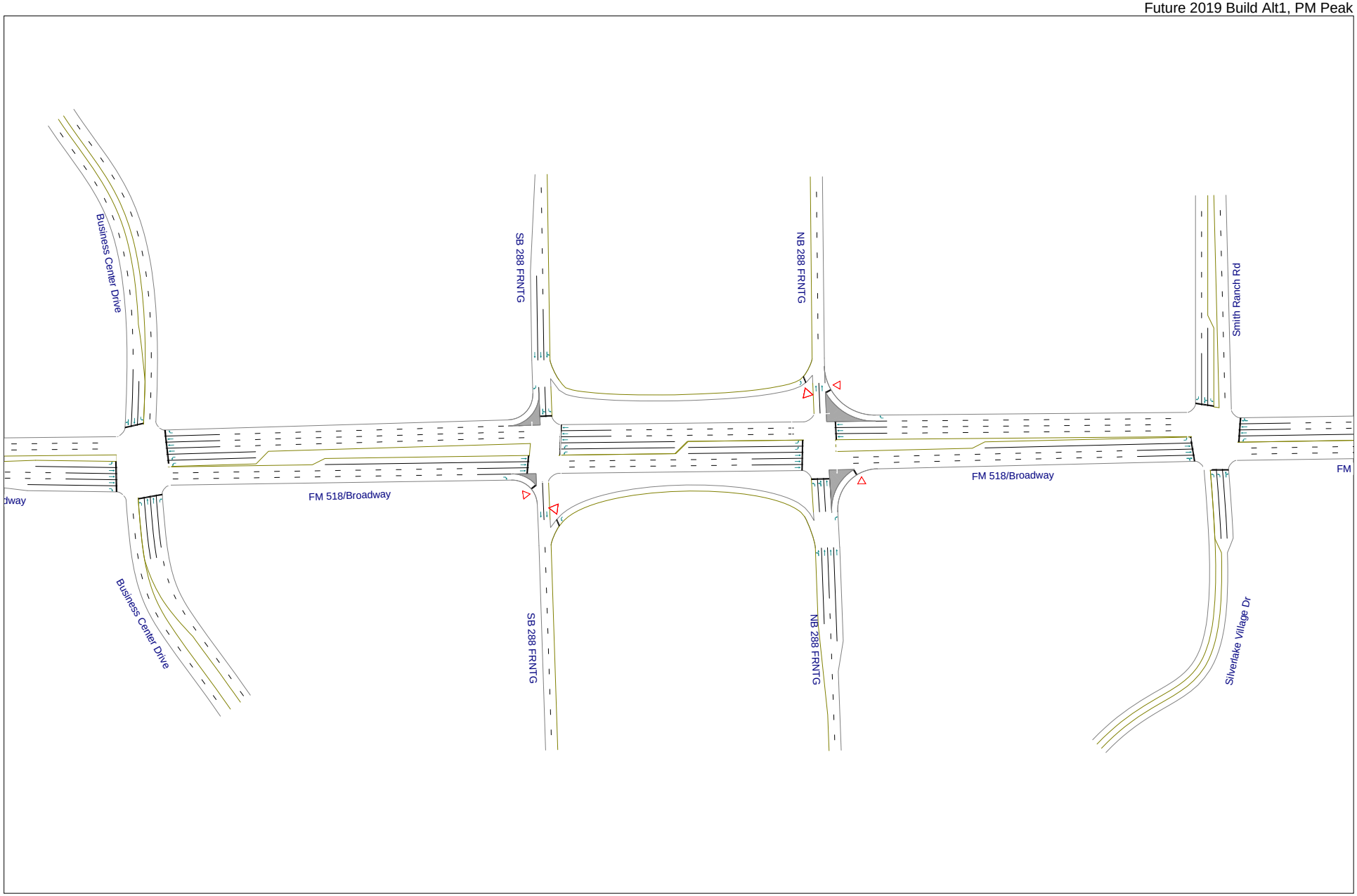
Cycle Length: 120
Actuated Cycle Length: 120
Offset: 0 (0%), Referenced to phase 2:EBWB, Start of Green
Control Type: Actuated-Coordinated
Maximum v/c Ratio: 1.07
Intersection Signal Delay: 27.4 — Intersection LOS: C
Intersection Capacity Utilization 91.7% — ICU Level of Service F
Analysis Period (min) 15

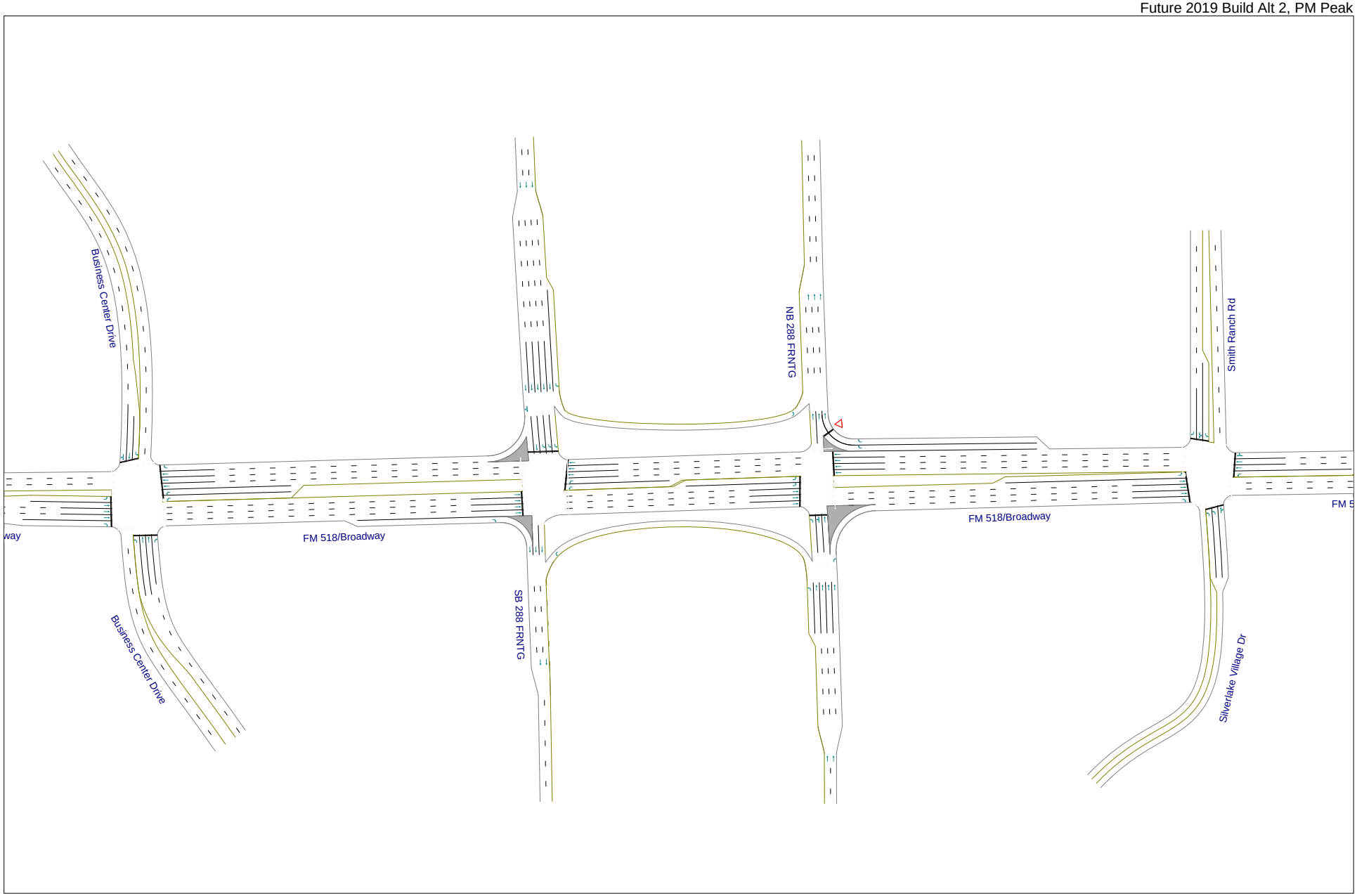
Splits and Phases: 4: FM 518/Broadway

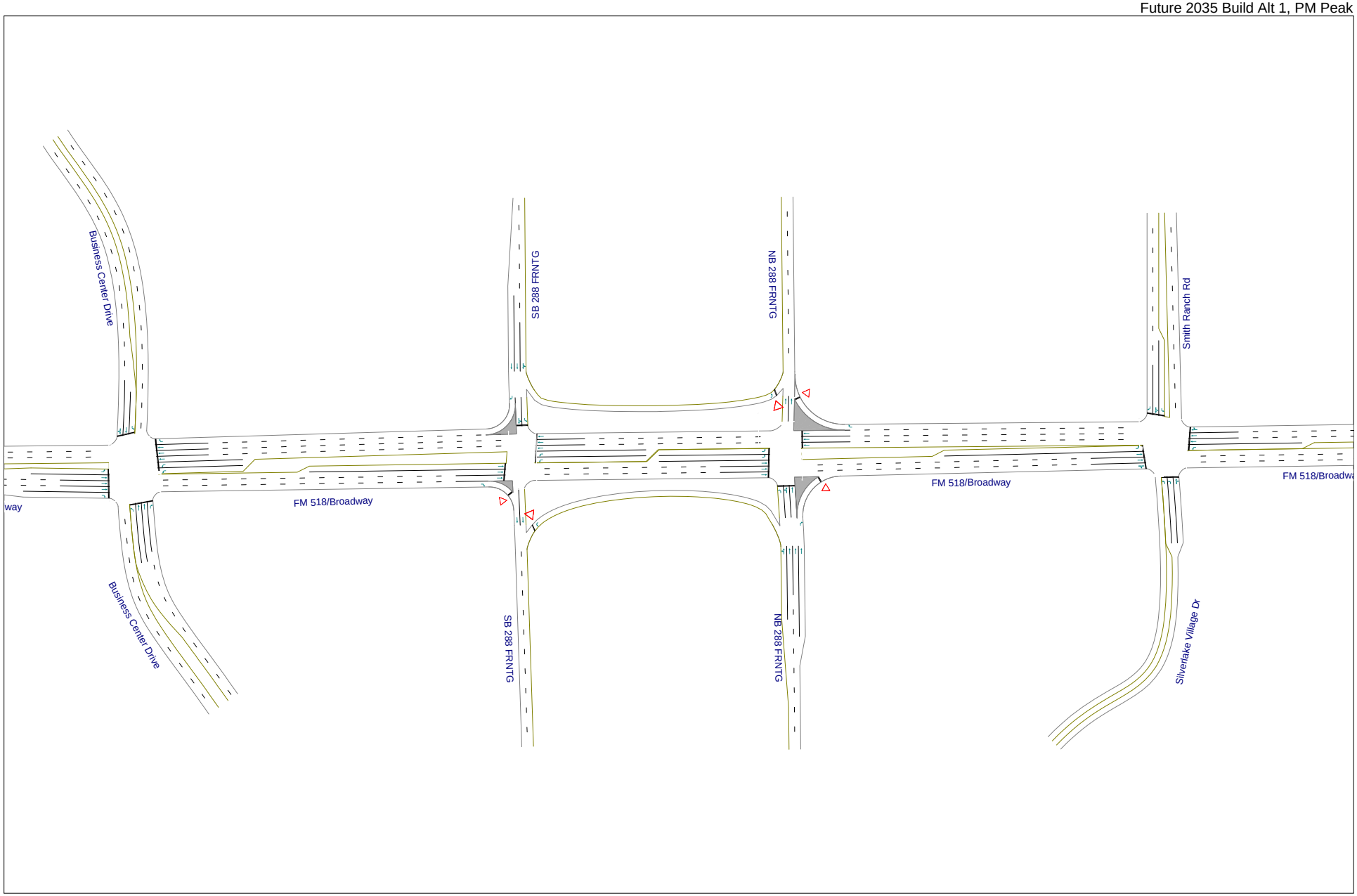


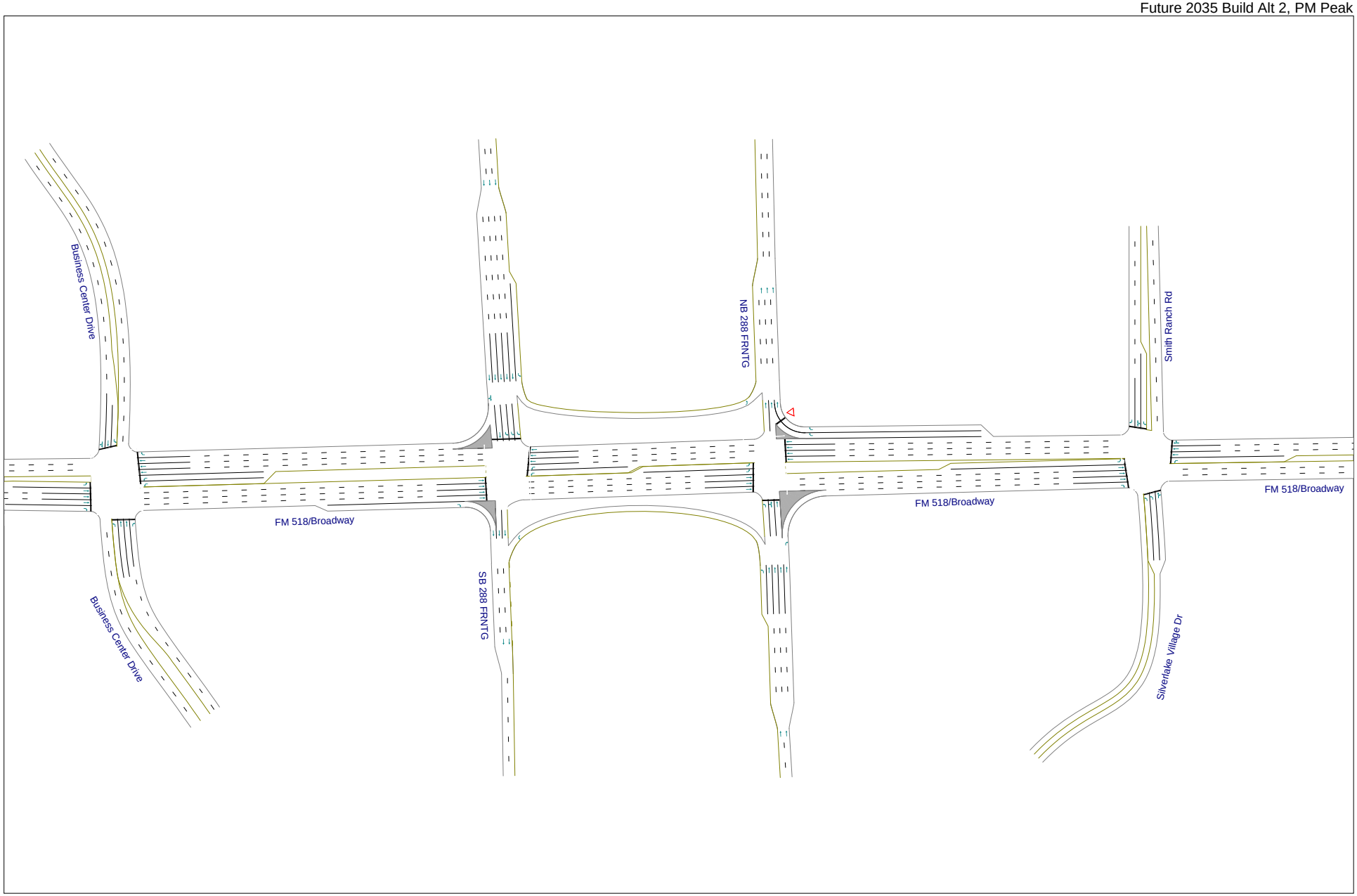
# APPENDIX C – NETWORK ALTERNATIVES


Business Center Drive
SB 288 FRNTG
NB 288 FRNTG
Smith Ranch Rd
dway
FM 518/Broadway
FM 518/Broadway
FM
Business Center Drive
SB 288 FRNTG
NB 288 FRNTG
Silverlake Village Dr


Business Center Drive
SB 288 FRNTG
NB 288 FRNTG
Smith Ranch Rd
FM 518/Broadway
FM 518/Broadway
FM
Business Center Drive
SB 288 FRNTG
NB 288 FRNTG
Silverlake Village Dr


Business Center Drive
NB 288 FRNTG
Smith Ranch Rd
FM 518/Broadway
FM 518/Broadway
SB 288 FRNTG
Business Center Drive
Silverlake Village Dr


Business Center Drive
SB 288 FRNTG
NB 288 FRNTG
Smith Ranch Rd
FM 518/Broadway
FM 518/Broadway
FM 518/Broadwa
way
Business Center Drive
SB 288 FRNTG
NB 288 FRNTG
Silverlake Village Dr


Business Center Drive
NB 288 FRNTG
Smith Ranch Rd
FM 518/Broadway
FM 518/Broadway
FM 518/Broadway
Business Center Drive
SB 288 FRNTG
Silverlake Village Dr