

Interstate Operations Study: Fargo-Moorhead Metropolitan Area

2015 Simulation Output

Technical Memorandum III July 2009

Prepared for: Fargo-Moorhead Council of Governments (Metro COG)

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EXECUTIVE SUMMARY

This document provides the simulation results for the 2015 planning horizon of the Fargo-Moorhead Interstate Operations Study. Previous material focused on the simulation development process (Technical Memorandum I) and the calibration process and the simulation results of the 2008 base cases (Technical Memorandum II). Major sections of this document include the network modifications, traffic demand, and simulation results for the 2015 peak-hour scenarios. The simulation analysis will produce numerical data and animation to evaluate freeway operations that incorporate several improvements from the 2008 base cases.

The simulation study area includes all of the freeway interchanges of I-29 and I-94 within the cities of Fargo, ND; West Fargo, ND; and Moorhead, MN. Ten interchanges were modeled with local roadways along the 15-mile portion of I-94 and 7 interchanges along the 9-mile portion of I-29. The simulation analysis was performed using PTV AG's VISSIM simulation program.

The freeway mainline densities that experienced congestion were generally along I-94 east of I-29. The highest density values for the 2015 AM scenario were along the westbound sections of I-94 from 34th St. (Moorhead, MN) to I-29, which exhibited densities between 29 pc/mi/ln to 36 pc/mi/ln (LOS D-E). For the 2015 PM scenario, the highest density values were along the eastbound sections of I-94 from 25th St. (Fargo, ND) to 8th St. (Moorhead, MN) with densities ranging from 29 pc/mi/ln to 32 pc/mi/ln (LOS D).

The I-29 & I-94 Interchange experienced a significant number of vehicles during the 2015 peak periods. Although the interchange did not experience congestion during the AM peak period, significant congestion developed at the tri-level merge area during the PM peak period. Over 2,200 vehicles from two ramps (tri-level and southeast ramps) merged into one lane during the PM peak-hour period, causing significant queue lengths to develop. During the 2008 PM scenario, the average maximum length was just over 2,000 ft, which grew to over 5,500 ft for the 2015 PM scenario. The congestion at this area during the 2008 PM occurred for 15 to 20 minutes, while the 2015 PM scenario experienced congestion throughout the entire peak hour.

The construction of the I-94 & 9th St/57th St. Interchange, which was included in the 2015 scenarios, improved the operations of both the I-94 & Sheyenne St. Interchange and I-94 and 45th St. Interchange. In addition, the construction of the auxiliary lanes between I-29 and 45th St. improved traffic operations during the PM peak period, which eliminated the queues that developed during the 2008 scenarios for the westbound section.

The I-94 & 8th St. (TH 75) Interchange was the only ramp terminal that experienced significant congestion for the 2015 scenarios. During the 2015 AM scenario, the north ramp experienced congestion due to the high number of vehicles making northbound left-turn and southbound right-turn movements (both of which are accessing westbound I-94). During the 2015 PM, the south ramp experienced congestion from the high number of vehicles traveling eastbound along I-94 and taking the 8th St. off-ramp. In addition to having a high delay time for the off-ramp traffic, the traffic queues back onto I-94 and had an average maximum queue length of over 5,600 ft.

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OVERVIEW

This document provides information related to the 2015 simulation scenario for the Fargo-Moorhead Interstate Operations Study (F-M IOS). Previous material focused on the simulation development process, calibration process, and the simulation results of the 2008 AM and PM base cases (Technical Memorandums I and II). The major sections of this document include the network modifications, traffic demand, and the simulation output for the 2015 AM and PM peak-hour scenarios.

2015 SIMULATION STUDY AREA

The simulation study area includes all of the freeway interchanges of Interstate 29 (I-29) and Interstate 94 (I-94) within the cities of Fargo, ND; West Fargo, ND; and Moorhead, MN (Figure 1). Ten interchanges will be modeled with local roadways along the 15 mile portion of I-94 and 7 interchanges along the 9 mile portion of I-29. The simulation analysis, which uses PTV AG's VISSIM 5.1, will produce numerical data and animation to evaluate the freeway operations that will incorporate several short-term improvements, which will be incorporated by 2015.

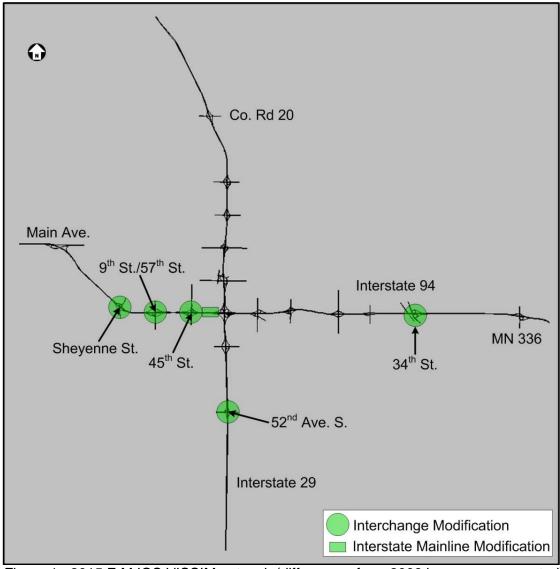


Figure 1. 2015 F-M IOS VISSIM network (differences from 2008 base case are noted)

NETWORK CONDITIONS

Several interchanges were modified to replicate the 2015 freeway conditions. The 2015 conditions include all of the freeway projects that were under construction in 2008 and those that are included in the F-M 2010-2013 Transportation Improvement Program (TIP). In 2008, the I-29 & 52nd Ave. S. Interchange was reconstructed and the I-94 & Sheyenne St. Interchange was changed to signalized control. In 2009, two interchanges will be constructed: I-94 & 9th St./57th St. and I-94 & 34th St. The I-94 & 34th St. Interchange will replace the existing I-94 & Main Ave. Interchange (Moorhead, MN). In 2010, the I-94 & 45th St. Interchange will be modified and auxiliary lanes will be constructed along I-94 between 45th St. and I-29.

Some speed limit zones will also be adjusted for this study area. The 75 mph zone on the west side of I-94 has been moved from west of 45th St. to west of Sheyenne St. This was performed due to the additional interchange at 9th St./57th St. In addition, the 75 mph zone on the south side of I-29 has been moved from south of 52nd Ave. S. to just south of 32nd Ave. S. Due to the reconstruction of the 52nd Ave. S. interchange in 2008, the work zone had a 55 mph speed limit.

Since this study's focus relates to evaluating the freeway operations, the details of the signal timing and arterial roadways are not critical to the study. However, these data will be beneficial for future simulation projects within the F-M area. Descriptions and VISSIM screenshots of the 2015 network are provided in the following sections.

I-29 & 52nd Ave. S. Interchange

- Updated Geometry: 52nd Ave. S., SB off-ramp, NB off-ramp
- New Geometry: SE loop-ramp, NW loop-ramp
- Updated Traffic Control: Signal phasing/timing, vehicle detectors (both ramp terminals)

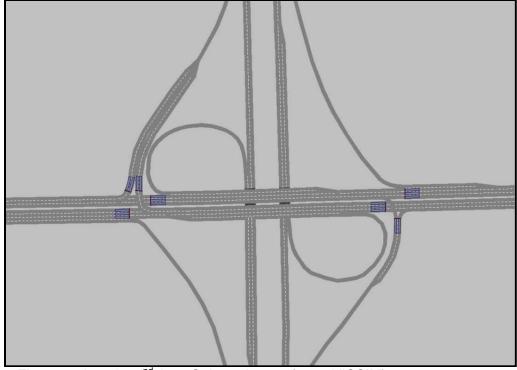


Figure 2. I-29 & 52nd Ave. S. Interchange (2015 VISSIM)

I-94 & Sheyenne St. Interchange

• Updated Traffic Control: Signal phasing/timing, vehicle detectors (both ramp terminals)



Figure 3. I-94 & Sheyenne St. Interchange (2015 VISSIM)

I-94 & 9th St./57th St. Interchange

- New Geometry: 9th St. overpass, EB off-ramp, WB off-ramp, NE loop-ramp, SW loop ramp
 New Traffic Control: Signal phasing/timing, vehicle detectors (both ramp terminals)

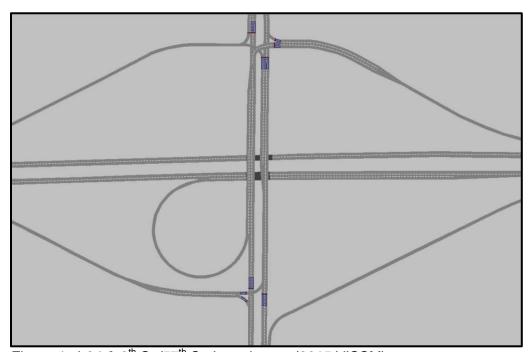


Figure 4. I-94 & 9th St./57th St. Interchange (2015 VISSM)

I-94 & 34th St. Interchange

- Updated/new Geometry: Main Ave. SE., 34th St., EB off-ramp, WB off-ramp, NE loop-ramp, SE loop-ramp
- Updated/new Traffic Control: Signal phasing/timing, vehicle detectors (both ramp terminals)

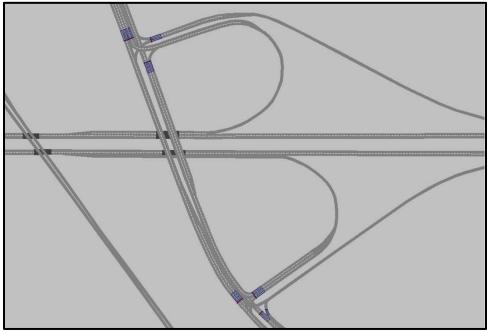


Figure 5. I-94 & 34th St. Interchange (2015 VISSIM)

I-94 & 45th St. Interchange

- New Geometry: 45th St. overpass, NE loop-ramp, WB off-ramp and left turn will have 2 lanes
- Updated Traffic Control: Signal phasing/timing, vehicle detectors (north ramp)

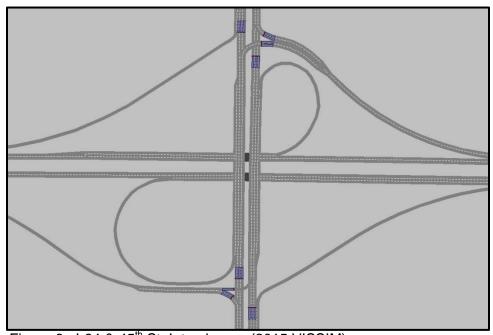


Figure 6. I-94 & 45th St. Interchange (2015 VISSIM)

I-94 between 45th St. and I-29

• Updated Geometry: Incorporate auxiliary lanes for eastbound and westbound traffic

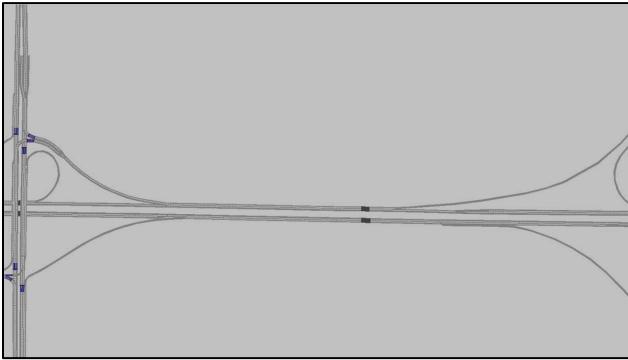


Figure 7. I-94 between 45th St. and I-29 (2015 VISSIM)

TRAFFIC CONTROL DEVICES

Most of the ramp terminals located within the metro area are controlled by traffic signals. The signal timing data for the 2008 AM and 2008 PM peak periods were used for the 2015 AM and 2015 PM simulation scenarios. In addition to modeling the original 23 traffic signals, new traffic signals were incorporated at the I-94 & 9th St./57th St. Interchange, I-94 & Sheyenne St. Interchange, and I-94 & 34th St. Interchange (note: signals at the I-94 & Main Ave. SE Interchange were removed from the network). In addition, the I-94 & 45th St. North Ramp had phase/timing modifications due to the geometric changes that will occur in 2010.

TRAFFIC VOLUME INFORMATION

Based on the projected socio-economic data, which include employment and household data, traffic volume will continue to increase within the F-M metro area, especially to the south and west. This is evident when comparing the average daily traffic (ADT) between the 2005 base case (which is the travel demand model's calibrated base case) and the 2015 forecast. Daily traffic volume increases along I-29 range from 3% to 50%, while I-94 volume increases range from 12% to 40% (Table 1).

Table 1. Interstate Mainline Average Daily Traffic Comparison (Modeled 2005 and 2015)

Interstate 29	Comb	Traffic	
Freeway Mainline	2005	2015	% Change
CR 20 - 19 th Ave. N	17,847	21,908	23%
19 th Ave. N - 12 th Ave. N	21,880	22,472	3%
12 th Ave. N - Main Ave.	33,088	37,995	15%
Main Ave 13 th Ave. S	41,569	46,073	11%
13 th Ave. S - I-94	58,436	61,036	4%
I-94 – 32 nd Ave. S	37,297	42,027	13%
32 nd Ave. S – 52 nd Ave. S	22,575	33,780	50%
Interstate 94	Comb	oined Mainline 1	Traffic
Freeway Mainline	2005	2015	% Change
Main Ave Sheyenne St.	17,781	22,499	27%
Sheyenne St. – 9 th St./57 th St.	-	26,266	-
9 th St./57 th St. – 45 th St.	26,512	32,905	24%
45 th St I-29	38,650	54,282	40%
I-29 – 25 th St.	59,277	71,027	20%
25 th St University Dr.	58,442	65,607	12%
University Dr. – 8 th St. (TH 75)	54,919	62,165	13%
8 th St. (TH 75) – 20 th St.	35,950	45,885	28%
20 th St. – 34 th St.	25,003	31,773	27%
34 th St MN 336	26,389	31,853	21%

Origin-Destination Demands

Several issues can develop when using travel demand models for performing peak-hour analyses. Most regional planning models are based on daily trip generation. Therefore, the hourly matrix is a percentage of the daily matrix. Based on past analysis of hourly traffic data, the daily traffic for F-M regional planning model is divided into the following groups: AM peak hour (7.5%), PM peak hour (8.5%), and off peak (6% for 14 hours). The PM peak-hour traffic portion of the daily traffic (8.5%) is an approximate percentage of traffic on a regional level; however, peak-hour percentages for different areas and facility types vary significantly. Based on reviewing hourly data along freeway portions of the F-M area, the PM peak hour represents about 10% of the ADT. If 8.5% of the daily traffic was used to represent the freeway traffic during the PM peak-hour conditions (rather than 10%), the travel demand model would under estimate traffic by almost 17.5%.

To overcome the peak-hour traffic issue and to evaluate different planning horizons, target values can be incorporated into the planning model. Most planning models are capable of performing this function by assigning the proper amount of traffic to the network (sub-area) based on traffic counts in the field. Evaluating future planning horizons may be difficult since the base model may not generate enough traffic to replicate peak-hour conditions. Therefore, future peak-hour targets (counts) may be required. It should be noted that the primary function of a travel demand model is to provide traffic conditions on a regional level based on socio-economic data and network changes. When corridor studies are conducted, which use a sub-

area network of the model, the accuracy of model output can be significantly improved by using field data.

The 2008 AM and PM simulation scenarios incorporated field counts into the regional travel demand model. Target values were based on AM and PM peak-hour counts, which were primarily conducted in April of 2008. The target values were incorporated into a sub-area network, which included all freeway interchanges and mainline sections of the travel demand model (2005 base year), to replicate the existing traffic levels. Coding was performed to incorporate Cube's Matrix Estimator (ME) logic, producing an O-D matrix that satisfied the target values for both the 2008 AM and PM scenarios. To achieve the study area's target values, which were on the freeway mainlines, ramps, and arterials intersecting the freeways, the sub-area's O-D matrices from the 2008 AM and PM using ME were higher than the 2005 base model by 11.9% and 40.0% (Table 2 and Table 3).

Table 2. Travel Demand Model Comparisons (2005 AM Base Case and 2005 AM ME)

AM Peak Hour Origin-Destination Matrix	Trips	% Change
2005 Base Model (Calibrated Base Case)	26,455	44.00/
2008 AM ME - 2005 Base Model with Target Values (2008 Field Counts) Using ME	29,593	11.9%

Table 3. Travel Demand Model Comparisons (2005 PM Base Case and 2005 PM ME)

PM Peak Hour Origin-Destination Matrix	Trips	% Change
2005 Base Model (Calibrated Base Case)	25,443	40.007
2008 PM ME - 2005 Base Model with Target Values (2008 Field Counts) Using ME	35,622	40.0%

The large difference between the 2005 PM case and the 2008 PM ME case can be explained by two reasons. First, the travel demand model is underestimating PM peak-hour traffic (at least for this study area consisting of the freeway facilities). Second, the traffic volume for the study area has increased since 2005. Therefore, using target values were essential in producing a realistic O-D matrix.

Unlike the 2008 AM and PM simulation scenarios, the 2015 AM and PM scenarios do not have target values based on field data. When comparing the sub-area network's O-D matrix between the 2005 base model and the forecasted traffic from the 2015 model, vehicle-trips increased 27.3% for the AM peak and 18.7% for the PM peak (Table 4 and Table 5). It should be noted that the 2008 PM case (which used field counts as targets) had more trips than the 2015 PM forecast.

Table 4. Travel Demand Model Comparisons (2005 AM Base Case and 2015 AM)

AM Peak Hour Origin-Destination Matrix	Trips	% Change
2005 Base Model (Calibrated Base Case)	26,455	07.00/
2015 Forecast – 2015 Model Network and Socio-economic Data	33,685	27.3%

Table 5. Travel Demand Model Comparisons (2005 PM Base Case and 2015 PM)

PM Peak Hour Origin-Destination Matrix	Trips	% Change
2005 Base Model (Calibrated Base Case)	25,443	40.70/
2015 Forecast – 2015 Model Network and Socio-economic Data	30,207	18.7%

To produce more realistic peak-hour traffic volume, target values were incorporated into the 2015 AM and 2015 PM travel demand model's sub-area networks. Initially, only the 2015 PM scenario was analyzed and documented; however, at the request of the study's steering review committee (SRC), the 2015 AM scenario was also analyzed. Since several network changes were introduced into the 2015 network, target values were used at the boundaries of the analysis network and areas adjacent to the I-29 & I-94 Interchange. Due to the significant level of development for the southern portion of the study area, a target value was not used for this boundary section. A list of the locations incorporating target values is as follows:

- CR 20 19th Ave. N (mainline sections, northern boundary)
- Main Ave. Sheyenne St. (mainline sections, western boundary)
- 34th St. MN 336 (mainline sections, eastern boundary)
- 13th Ave. S I-94 (mainline sections, north of I-29 & I-94 Interchange)
- I-94 32nd Ave. S (mainline sections, south of I-29 & I-94 Interchange)
- 45th St. I-29 (mainline sections, west of I-29 & I-94 Interchange)
- I-29 25th St. (mainline sections, east of I-29 & I-94 Interchange))
- Tri-level/SE Ramp (tri-level merge area)
- I-94 and 8th St. Interchange (eastbound off-ramp)
- I-94 and 25th St. Interchange (eastbound off-ramp)

Note: The 2015 AM scenario also included target values for all mainline, on-ramp, and off-ramp segments north and east of the I-29 and I-94 Interchange.

To account for conservative traffic growth from 2008 to 2015, an average growth rate of 1.75% was used for the 7 year period, providing a 12% increase to the 2008 field counts. The 2015 target volumes were entered into the sub-area networks and Cube's ME was used to provide updated O-D matrices. The target values produced sub-area O-D matrices for the 2015 AM and 2015 PM scenarios that deferred from the original 2015 AM and PM forecasts by -7.1% and 6.9%, respectively (Table 6 and 7).

Table 6. Travel Demand Model Comparisons (2015 AM Base Case and 2015 AM ME)

AM Peak Hour Origin-Destination Matrix	Trips	% Change
2015 AM Forecast	33,685	7.40/
2015 AM ME - 2015 Forecast with Target Values (2008 Field Counts With a Growth Factor) Using ME	31,278	-7.1%

Table 7. Travel Demand Model Comparisons (2015 PM Base Case and 2015 PM ME)

PM Peak Hour Origin-Destination Matrix	Trips	% Change
2015 PM Forecast	30,207	0.00/
2015 PM ME - 2015 Forecast with Target Values (2008 Field Counts With a Growth Factor) Using ME	32,305	6.9%

In contrast to the previous trip comparisons, the 2015 AM ME trips were lower than the 2015 AM Forecast. Although the PM peak-hour traffic is generally higher than the AM peak-hour traffic, the AM O-D matrices are higher than the PM O-D matrices for both the 2005 and 2015 regional models. Upon further review, the various peak-period factors of the F-M regional travel demand model, such as percentage of ADT that occurs in each peak hour based on trip type [home-based work (HBW), home-based other (HBO), and non-home based (NHB)] and the home-based school (HBS) trip generation rates, generate more trips during the AM peak hour than the PM peak hour. Therefore, the 2015 AM ME trips were lower than those of the 2015 AM Forecast while the 2015 PM ME trips were higher than those of the 2015 PM Forecast. For future peak-hour studies, the average peak-hour percentages of the ADT (7.53 for the AM peak and 8.52 for the PM peak) could be adjusted to more accurately reflect the peak-hour counts.

It should also be noted that the 2015 PM ME is less than the 2008 PM ME. This occurrence is due to the fact that target values with growth factors were not used for all of the sub-area's links, which is unlike the 2008 AM and 2008 PM scenarios. Since none of the arterial links were factored for the 2015 AM ME and PM ME runs, the overall O-D matrix can be significantly different.

After performing the ME procedure, the 2015 AM and PM peak-hour matrices were adjusted to account for pass-through trips based on the 2008 external O-D study. The higher of the two external-external freeway trip values between the ME O-D matrix and the O-D study matrix were used in the 2015 simulation scenarios.

Vehicle Composition

Similar to the 2008 AM and PM simulation scenarios, the 2015 AM and PM scenarios incorporated both passenger car and truck O-D matrices. The traffic composition for both 2015 simulation scenarios consisted of passenger cars (95%), tractor-trailer trucks (3%), and single-unit trucks (2%). These vehicle percentages were applied to the O-D matrices.

Peak Hour Origin-Destination Demand

To account for the variation in traffic demand within the peak-hour periods, the peak-hour O-D matrices were factored at 5-minute intervals. The 2015 simulation scenarios used the same O-D factors as their respective 2008 simulation scenario.

SIMULATION DURATION

The simulation duration followed the same procedure as the 2008 AM and PM scenarios. The major components of the two and a half hour simulation are as follows:

- 30-minute off-peak traffic to load traffic into the network (The numerical output will not be collected during this period)
- 60-minute peak-hour traffic with 12, 5-minute periods
- 30-minute off peak to clear any congestion from the peak-hour period (The duration of this period may increase based on the severity of congestion)
- 30-minutes of no traffic demand to ensure all vehicles complete their trip

SIMULATION ERROR CHECKING

Since most of the simulation network was already developed, error checking for the 2015 scenario focused on the modifications that were made to the original networks. Similar to the 2008 AM and PM scenarios, screen shots of the simulation network were captured and reviewed to ensure all of the network elements were incorporated. In addition, the simulation animation was reviewed, which primarily focused on traffic control and driving behavior.

Error checking also focused on the simulated traffic volume. The simulation output was reviewed to determine if the model was producing the desired traffic based on the O-D matrices. In addition, PTV AG's VISUM travel demand model was used to read/review the VISSIM O-D paths to ensure that invalid paths did not exist.

SIMULATION CALIBRATION

Calibration is the process of adjusting the simulation model's parameters to reproduce local driver behavior and traffic performance characteristics. The 2008 AM and PM simulation scenarios followed an extensive calibration process (Technical Memorandum II). The process primarily focused on VISSIM's driving behavior, which include car-following and lane-changing models. The 2015 simulation scenarios incorporated the calibration parameters of the 2008 scenarios.

Based on reviewing the simulation animation, two significant changes were incorporated into the 2015 PM simulation scenario. The eastbound off-ramp of the I-94 & 8th St. Interchange experienced significant congestion due to capacity constraints. To help alleviate some of the congestion, the traffic signal plan was adjusted to provide off-ramp traffic with 80 seconds of green time, which doubled the original green time. In addition, the driving behavior of the mainline link serving the eastbound off-ramp was changed to allow more realistic lane changing behavior (more aggressive). Otherwise, queues were observed from the 8th St. off-ramp back (upstream) to University Dr.

2015 VISSIM OUTPUT

Similar to the 2008 AM and PM base scenarios, several measures of effectiveness (MOE) were extracted from the 2015 simulation scenarios. The 2015 AM output is provided in Appendices A-C while the 2015 PM output is provided in Appendices D-F. The values reported for each MOE are averaged from the 30 runs. The project team identified several measures and locations which are summarized as follows:

- Overall Network vehicle trips, travel time, delay time, etc.
- Interchange Ramps turning movement volume, delay time, queue length, etc.
- Routes/Locations vehicle trips, travel time, speed, etc.

Since the O-D matrices were significantly different between the 2008 scenarios and the 2015 scenarios, direct comparisons related to the overall network and interchange node data should not be performed. In addition, the speed limit changes made to portions of I-94 and I-29 for the 2015 network will affect the travel time output for the pass-through trips. However, comparisons related to freeway queue lengths and mainline data collection (especially those with target values) will be performed in this report.

2015 AM Output

Freeway queue length was measured at the tri-level merge area and westbound I-94 between 45th St. and I-29 primarily because these two freeway locations experienced congestion during the 2008 PM scenario. Similar to the 2008 AM scenario, the 2015 AM scenario does not experience congestion at these locations (Table 8). To improve traffic operations for I-94 westbound traffic between I-29 and 45th St., an auxiliary lane will be constructed in 2010. The auxiliary lane will provide more benefits for the PM peak period.

Table 8. Freeway Queue Measurement Locations (2008 AM and 2015 AM)

Simulation Tri-Level Merge			J-9	94 WB (45th \$	St)	
Scenario	Avg. (ft)	Max. (ft)	Stops	Avg. (ft)	Max. (ft)	Stops
2008 PM	0	98	1	0	31	1
2015 PM	1	174	3	0	0	0

The freeway densities of the 2015 AM scenario were higher than those of the 2008 AM scenario (Table 9). Density values for I-94 and I-29 ranged from 4 pc/mi/ln to 36 pc/mi/ln and 5 pc/mi/ln to 27 pc/mi/ln, respectively. The highest density values were along the section of I-94 from 34th St. to I-29, which exhibited densities between 29 pc/mi/ln to 36 pc/mi/ln (LOS D-E).

Table 9. Freeway Mainline Density (2008 AM and 2015 AM)

L 20 Francisco Mainline	Northboun	d (pc/mi/ln)	Southboun	d (pc/mi/ln)	
I-29 Freeway Mainline	2008 AM	2015 AM	2008 AM	2015 AM	
CR 20 - 19th Ave. N	4	5	8	9	
19th Ave. N - 12th Ave. N	9	10	10	11	
12th Ave. N - Main Ave.	18	20	11	12	
Main Ave 13th Ave. S	24	27	13	14	
13th Ave. S - I-94	23	26	10	11	
I-94 - 32nd Ave. S	19	22	9	10	
32nd Ave. S - 52nd Ave. S	17	21	5	12	
L 04 Fragway Mainline	Eastbound	d (pc/mi/ln)	Westbound (pc/mi/ln)		
I-94 Freeway Mainline	2008 AM	2015 AM	2008 AM	2015 AM	
Main Ave Sheyenne St.	3	4	6	7	
Sheyenne St 9th St/57th St.	12	11	9	10	
9th St/57th St 45th St.		19	9	12	
45th St I-29	27	20	24	17	
I-29 - 25th St.	19	21	27	31	
25th St University Dr.	20	23	28	31	
University Dr TH 75	17	19	29	33	
TH 75 - 20th St.	16	18	32	36	
20th St 34th St.	11	13	25	29	
34th St MN 336	4	6	15	17	

Note: The yellow highlighted sections represent a LOS D, orange sections represent a LOS E.

Density values for the 2015 AM scenario also increased for several ramps at the I-29 & I-94 Interchange, especially for the northeast ramp and southeast loop ramp (Figure 7). The northeast ramp had a high density value (39 pc/mi/ln) since it served the most vehicles (1,570) during the AM peak period. The southeast loop ramp reported a high density (49 pc/mi/ln) since it served 879 vehicles and had a low speed due to the geometric design of the loop ramp. When viewing the simulation's animation, congestion was not observed on the ramps. However, congestion would develop occasionally on the westbound weaving segment accessing the northeast ramp.

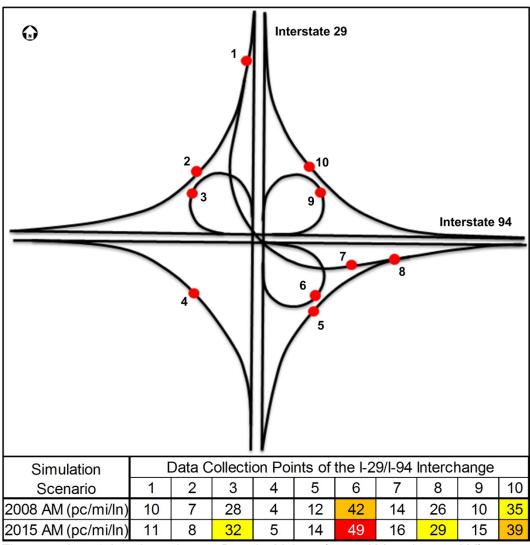


Figure 8. I-29 & I-94 Interchange Density Values (2008 AM and 2015 AM)

Note: LOS D (Yellow), LOS E (Orange), LOS F (Red) – Weaving Segment Methodology

During the 2008 AM scenario, some ramp terminals experienced congestion for at least one movement/approach. By 2015, several geometric and traffic control modifications will be performed to improve traffic operations. The 2008 AM congested areas that were improved in the 2015 AM network include the following:

• I-94 & Sheyenne St. North Ramp: Improved due to new traffic control and 9th St./57th St. interchange

• I-94 & Sheyenne St. South Ramp: southbound left-turn movement improved due to new traffic control and 9th St./57th St. interchange. Northbound approach incurs more delay due to signal installation.

Traffic congestion continued to be evident at the I-94 & 8th St. (TH 75) North Ramp during the 2015 AM scenario. A significant amount of traffic travels westbound from the ramp and significant queues develop for the northbound left-turn movement and the southbound right-turn movements.

2015 PM Output

As previously discussed, queue length measurements were collected at the tri-level merge area and westbound I-94 weaving section between 45th St. and I-29 based on congestion experienced during the 2008 PM peak-hour period. The tri-level merge area during the 2015 PM scenario experienced average and maximum queue lengths of 2,323 ft and 5,506 ft, respectively (Table 10). These queue lengths are significantly greater than the 2008 PM scenario, which was already experiencing oversaturated conditions for a portion of the peak hour. Therefore, the additional traffic (12% more than the 2008 PM peak-hour volume) modeled during the 2015 PM scenario created major operational issues.

To improve traffic operations for I-94 westbound traffic between I-29 and 45th St., an auxiliary lane will be constructed in 2010. The 2008 PM simulation scenario experienced some congestion at this area. Incorporating the auxiliary lane into the 2015 PM simulation scenario eliminated the queues that developed in the 2008 PM scenario (Table 10).

Table 10. Freeway Queue Measurement Locations (2008 PM and 2015 PM)

Simulation Tri-Level Merge		 - 9	94 WB (45th S	St)		
Scenario	Avg. (ft)	Max. (ft)	Stops	Avg. (ft)	Max. (ft)	Stops
2008 PM	184	2,027	454	19	439	49
2015 PM	2,323	5,506	3,201	0	0	0

The freeway densities of the 2015 PM scenario were generally higher than those of the 2008 PM scenario (Table 11). Density values for I-94 and I-29 ranged from 3 pc/mi/ln to 32 pc/mi/ln and 7 pc/mi/ln to 22 pc/mi/ln, respectively. The highest density values were along the section of I-94 from 8th St. (TH 75) to I-29, which exhibited densities between 29 pc/mi/ln to 32 pc/mi/ln (LOS D).

Table 11. Freeway Mainline Density (2008 PM and 2015 PM)

L 20 Fraguey Mainline	Northboun	d (pc/mi/ln)	Southboun	d (pc/mi/ln)
I-29 Freeway Mainline	2008 PM	2015 PM	2008 PM	2015 PM
CR 20 - 19th Ave. N	9	10	6	7
19th Ave. N - 12th Ave. N	11	9	9	8
12th Ave. N - Main Ave.	14	13	17	16
Main Ave 13th Ave. S	15	15	27	22
13th Ave. S - I-94	14	16	19	22
I-94 - 32nd Ave. S	13	15	10	11
32nd Ave. S - 52nd Ave. S	9	13	10	17
LO4 Francis Mainline	Eastbound	d (pc/mi/ln)	Westbound	d (pc/mi/ln)
I-94 Freeway Mainline	2008 PM	2015 PM	2008 PM	2015 PM
Main Ave Sheyenne St.	5	5	2	3
Sheyenne St 9th St/57th St.	8	9	10	7
9th St/57th St 45th St.	0	12	10	13
45th St I-29	25	17	26	17
I-29 - 25th St.	26	29	22	23
25th St University Dr.	24	29	21	22
University Dr TH 75	26	32	20	23
TH 75 - 20th St.	24	27	19	22
20th St 34th St.	19	16	15	12
34th St MN 336	10	11	7	7

Note: The highlighted sections represent a LOS D.

Density values for the 2015 PM scenario also increased for several ramps at the I-29 & I-94 Interchange, especially for the tri-level and southeast ramp. The highest density and most congested area for the 2015 PM scenario (which was the same for the 2008 PM scenario) occurred at the tri-level merge area (Figure 8). Over 2,200 vehicles from two ramps (tri-level and southeast ramps) merged into one lane during the 2015 PM peak-hour analysis period, creating a density of 71 pc/mi/ln. The congestion at this area occurred throughout the PM peak.

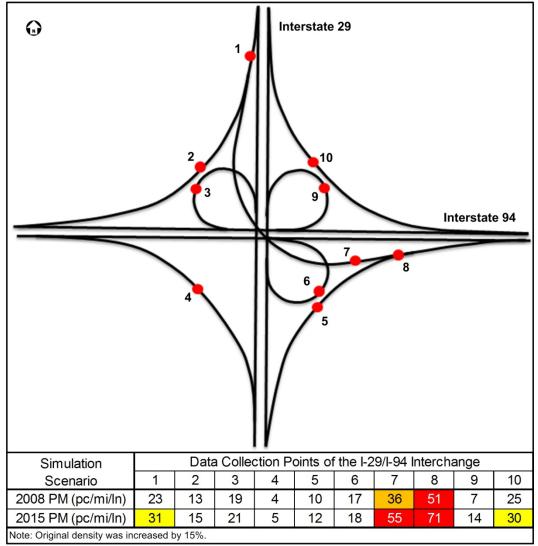


Figure 9. I-29 & I-94 Interchange Density Values (2008 PM and 2015 PM)

Note: LOS D (Yellow), LOS E (Orange), LOS F (Red) – Weaving Segment Methodology

During the 2008 PM scenario, several ramp terminals experienced congestion for at least one movement/approach. Most of these locations were along I-94 between Sheyenne St. and I-29. By 2015, the NDDOT will perform several geometric and traffic control modifications within this area to improve traffic operations. The 2008 PM congested areas that were significantly improved in the 2015 PM network include the following:

- I-94 & Sheyenne St. North Ramp: Improved due to new traffic control and 9th St./57th St. interchange
- I-94 & 45th St. North Ramp: Improved due to modified traffic control and geometry, as well as the 9th St./57th St. interchange
- I-94 & 45th St. South Ramp: Improved due to modified traffic control and geometry, as well as the 9th St./57th St. interchange

Traffic congestion increased at the I-94 & 8th St. (TH 75) Interchange during the 2015 PM scenario. Congestion for the eastbound off-ramp existed during the 2008 PM scenario, which was compounded due to the increased traffic volume in the 2015 PM scenario (12% growth

from 2008). Traffic queued significantly at the ramp signal throughout the peak-hour period. In addition the southbound right-turn and northbound left-turn movements at the north ramp experienced significant congestion.

SUMMARY

This document provided the simulation output of the 2015 AM and PM scenarios for the Fargo-Moorhead Interstate Operations Study. These scenarios provide insight into potential traffic operational issues that may occur in the 2015 planning horizon. Based on the simulation output, the proposed near-term improvements to the freeway system reduced congestion along I-94 west of I-29 during the PM peak-hour period. However, congestion at the tri-level merge area (average maximum queue of 5,506 ft) and the I-94 & 8th St. (TH 75) eastbound off-ramp (average maximum queue of 5,647 ft) increased significantly from the 2008 PM scenario.

During the 2015 AM scenario, the highest density values were along the westbound portion of I-94 from 34th St. to I-29, which exhibited densities between 29 pc/mi/ln to 36 pc/mi/ln (LOS D-E). Some congestion also developed on the westbound I-94 weaving segment accessing the northeast ramp of the I-29 & I-94 Interchange due to number of vehicles traveling westbound to northbound during the AM peak-hour period (1,570).

For the 2015 PM scenario, the highest density values were along the eastbound portion of I-94 from I-29 to 8th St. (TH 75), which exhibited densities between 29 pc/mi/ln to 32 pc/mi/ln (LOS D). The highest density for both peak periods occurred at the tri-level ramp and southeast ramp merge area. Over 2,200 vehicles from two ramps (tri-level and southeast ramps) merged into one lane during the PM peak-hour analysis period, creating a density of 71 pc/mi/ln. In addition, congestion at this area occurred throughout the PM peak period compared to 15 to 20 minutes during the 2008 PM scenario.

Appendix A: 2015 AM Simulation Output (Network Performance, Travel Time, Freeway Queues)

Network Performance

Total Delay Time (hr)	402
Total Travel Time (hr)	3,747
Number of Active Vehicles	0
Number of Arrived Vehicles	44,524
Total Stopped Delay (hr)	150
Total Distance Traveled (mi)	182,640

Queue Measurement

Time	Tr	i-Level Mer	ge	1-9	4 WB (45th	St)
Time	Avg.	Max.	Stop	Avg.	Max.	Stop
AM Peak	1	174	3	0	0	0

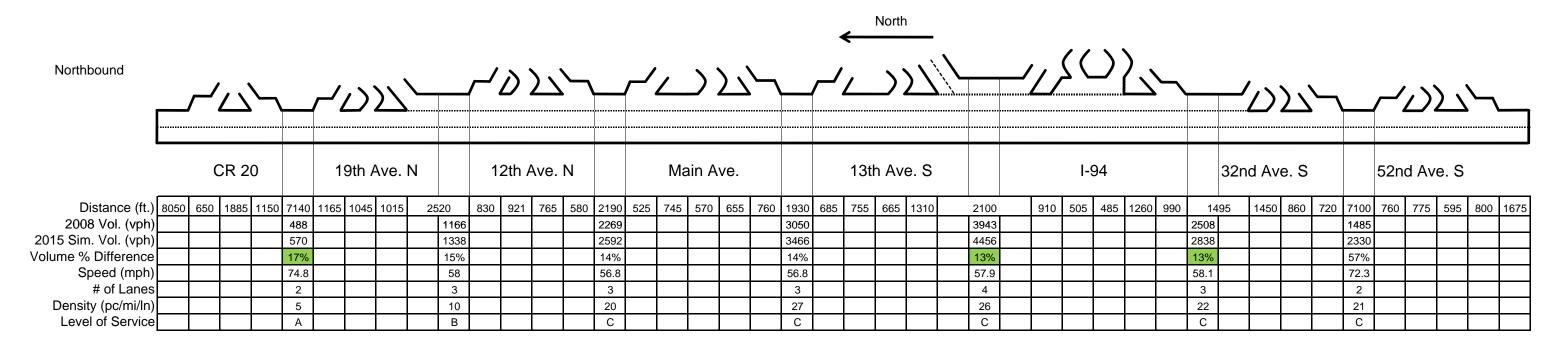
Travel Time (Network)

				Destir	-			
`			I-29) SB	I-94	EB	I-29	NB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	12.3	3	15.1	3	15.7	3
	I-94 EB	1645-1700	12.1	3	15.2	3	15.7	3
		1700-1715	12.3	4	15.3	4	15.8	4
		1715-1730	12.2	3	15.2	3	15.9	3
			I-29) SB	I-94	WB	I-29	NB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	15.5	4	14.9	6	17.2	6
	I-94 WB	1645-1700	15.4	4	14.9	6	17.2	5
1 _		1700-1715	15.7	5	15.1	7	17.6	6
Origin		1715-1730	15.9	6	15.2	8	18.1	7
O		,		WB	I-29	NB	I-94	EB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	13.1	3	14.6	5	14.6	3
	I-29 NB	1645-1700	13.0	3	14.6	5	14.9	3
		1700-1715	13.4	4	14.7	7	14.9	4
		1715-1730	13.3	3	14.8	6	14.7	4
		,	I-94	WB	I-29	SB	I-94	EB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	14.7	3	14.5	8	17.5	4
	I-29 SB	1645-1700	14.8	3	14.5	8	17.4	4
		1700-1715	14.8	4	14.6	11	17.6	5
		1715-1730	14.9	3	14.5	10	17.6	5

Appendix B: 2015 AM Simulation Output (Data Collection Points)

I-29 Data Collection: 2015 AM Peak Hour

Southbound		(CR2	0		,	19th	Ave.	N		1	2th /	٩ve.	N			Ma	ain A	ve.		1;	3th Av	/e. S			I-	94					32n	d Av	e. S			;	52nc	l Ave	e. S	
Distance (ft.)	8050	650	1885	1150	7550	0 570	1015	5 1030	104	0 1715	680	835	840	765	2240	455	735	230	1215	740	1230 945	840		3840	0	1300	640	1150	285	2325	285	950	1395	625	720	0	620	670	960	510 190	00
2008 Vol. (vph)					899	_				1315					1459						1580			1674						1505						447					
2015 Sim. Vol. (vph)					1029	9				1493	3				1650						1788			1876						1694					1	1303					
Volume % Difference					14%	0				14%					13%						13%			12%						13%					1	192%					
Speed (mph)					74.4	1				59.2					59.1						57.6			58.9						59.2						73.8					
# of Lanes					2					3					3						3			4						4						2					
Density (pc/mi/ln)					9					11					12						14			11						10						12					
Level of Service					Α					В					В						В			В						Α						В					
																					_	S	outh	•																	_
		\	,\\\\	اــر'		\	,\\	7	7,-		1		~~	'ـــر			\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	` (لــر 7		\	~			\\\\\			7_		1	Ź	7	`,/		_	_,	~~	(7,]



Note: Density values were adjusted using the following data:

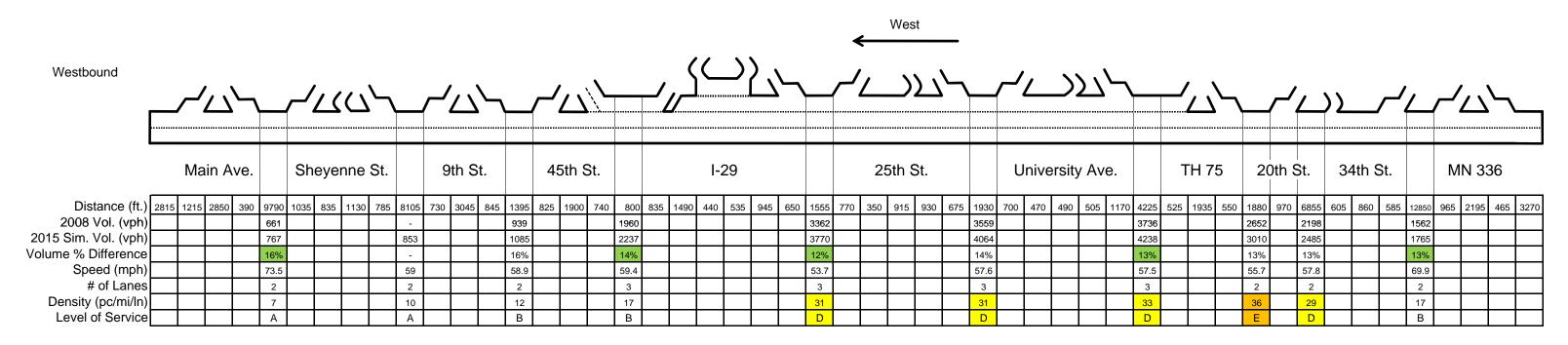
Peak-hour factor = .78

Heavy vehicle percent = 5

This data increased the original density by 25%.

I-94 Data Collection: 2015 AM Peak Hour

Eastbound	N	Лаin А	ve.	5	Shey	enn'	ne St	i .	(9th S	St.			45	ith S	st.				[-	-29			25	ith S	St.		L	nive	rsity	Dr.			Т	H 7	5	201	th St.	3,	4th S	St.		1M	N 336	
Distance (ft.)	2660	575 10	05 144	0 11770	755	2050	1040	7520	765 1	1650 1	800	835 1	475	705 93	30 145	50 61	5 157	0 76	60 465	5 134	5 1365	1415		795	930	990	261	0 96	740	1050	1125	42	25	520	2005	840 17	740	455 5645	410	955	585	12850	710	1365 10	80 2170
2008 Vol. (vph)				325				-					298				233						2471				2645						2250			14	406	1015				504			
2015 Sim. Vol. (vph)				399				954				1	622				266	0					2786				2995						2555			16	611	1169				593			
Volume % Difference				23%				-				2	25%				149	6					13%				13%						14%			15	5%	15%	Ш.		<u> </u>	18%			
Speed (mph)				75.2				59				5	58.3				58.	4					59				58.3						58.4			58	8.2	58.6	Ш.		<u> </u>	70			
# of Lanes				2				2					2				3						3				3						3			2	2	2	Ш.		<u> </u>	2			
Density (pc/mi/ln)				4				11					19				20						21				23						19			1	18	13	<u> </u>		<u> </u>	6	<u> </u>		
Level of Service				Α				В					В				С						С				С						В			Е	В	В				Α	i		
																							•		Ea	st	→																<u> </u>		
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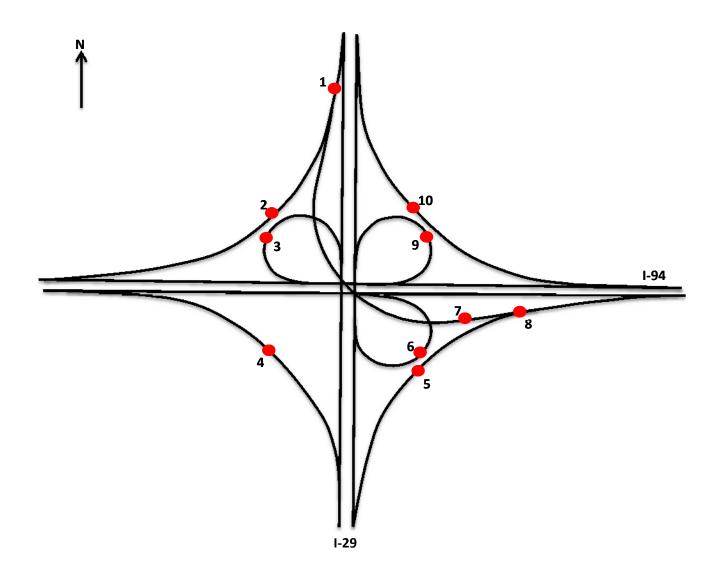


Note: Density values were adjusted using the following data:

Peak-hour factor = .78

Heavy vehicle percent = 5

This data increased the original density by 25%.



2015 AM: Data Collection Points (I-29/I-94 Interchange)

· ·										
	1	2	3	4	5	6	7	8	9	10
2008 Vol. (vph)	854	287	510	175	498	754	567	1065	183	1362
2015 Sim. Vol. (vph)	978	336	589	203	561	881	644	1204	282	1570
Volume % Difference	15%	17%	16%	16%	13%	17%	13%	13%	54%	15%
Speed (mph)	58	54	24	55	54	24	54	55	25	53
# of Lanes	2	1	1	1	1	1	1	1	1	1
Density (pc/mi/ln)	11	8	32	5	14	49	16	29	15	39

This data increased the original density by 25%.

Appendix C: 201	5 AM Simulation	Output (Node	Evaluations)
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_	Node L	.ocation	1:	I-94 &	Sheyen	ne St (N	l. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume			71			224	155	272			605	50
Delay Time/Veh. (s)			6.9			3.4	5.8	0.4			3.6	2.0
Max Queue (ft)			122			3	163	32			307	0
Avg. Queue (ft)			3			3	3	0			12	0
				-			Int	ersectio	n Delay	/ (sec/v	eh)	11.7
	Node L	.ocation	:	I-94 &	Sheyen	ne St (S	. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	9	0	33					417	170	424	252	
Delay Time/Veh. (s)	26.7	0	5.5					15.4	6.8	17.2	1.2	
Max Queue (ft)	111	0	111					540	131	458	124	
Avg. Queue (ft)	2	0	2					56	1	60	1	
710g. Queue (10)	_	U	_				Int		on Delay			11.7
	Node I	.ocation		1-94 &	9th St (ا (N. Side		Croccic	on Belay	(300, 1	City	11.7
Ī		Approa			3 Appro			Approa	ach	SR	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	202	25.	LDI	118		229	44	332	11011	332	498	66
Delay Time/Veh. (s)				35.9		5.8	40.0	2.9			5.8	2.4
Max Queue (ft)				171		163	145	145			199	0
Avg. Queue (ft)				24		15	13	13			11	0
7108. Queue (10)				'		13			n Dolar	/ (sec/v		6.6
							11111	ersechi	บบบคเลง			
	Node L	ocation	ı :	I-94 &	9th St (:	S. Side)	IIIL	ersectio	on Delay	/ (SEC/ V	CII)	0.0
Ī		ocation			9th St (
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
Volume	EBL		ech EBR					Approa NBT	ach NBR		Approa SBT	ach SBR
Volume Delay Time/Veh (s)	EB EBL 27	Approa	ech EBR 76	WE	3 Appro	ach	NB	Approa NBT 348	ach NBR 532	SB	Approa SBT 381	SBR 237
Delay Time/Veh. (s)	EB EBL 27 35.5	Approa	EBR 76 4.3	WE	3 Appro	ach	NB	Approa NBT 348 2.1	ach NBR 532 3.4	SB	Approa SBT 381 2.5	sech SBR 237 0.8
Delay Time/Veh. (s) Max Queue (ft)	EBL 27 35.5 118	Approa	76 4.3	WE	3 Appro	ach	NB	Approx NBT 348 2.1 137	nach NBR 532 3.4	SB	Approa SBT 381 2.5 160	sch SBR 237 0.8 237
Delay Time/Veh. (s)	EBL 27 35.5 118	Approa	EBR 76 4.3	WE	3 Appro	ach	NBL	Approx NBT 348 2.1 137 3	NBR 532 3.4 0	SB SBL	Approa SBT 381 2.5 160 4	sech SBR 237 0.8 237 5
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 27 35.5 118 6	Approa EBT	76 4.3 128	WBL	Appro WBT	wBR	NBL NBL	Approx NBT 348 2.1 137 3	nach NBR 532 3.4	SB SBL	Approa SBT 381 2.5 160 4	sch SBR 237 0.8 237
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 27 35.5 118 6	Approa EBT	76 4.3 128 5	WBL	Appro WBT WBT 45th St	ach WBR	NBL NBL Int	Approa NBT 348 2.1 137 3 ersectio	ach NBR 532 3.4 0 0 on Delay	SB SBL / (sec/v	Approa SBT 381 2.5 160 4 eh)	och SBR 237 0.8 237 5 2.6
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 27 35.5 118 6 Node L	Approa EBT .ocation	76 4.3 128 5	WE WBL	Appro WBT 45th St	ach WBR (N. Side	NBL NBL Int	Approa NBT 348 2.1 137 3 ersection	ach NBR 532 3.4 0 0 on Delay	SB SBL / (sec/v	Approa SBT 381 2.5 160 4 eh)	och SBR 237 0.8 237 5 2.6
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	EB EBL 27 35.5 118 6	Approa EBT	76 4.3 128 5	I-94 & WE	45th St WBT	(N. Side	NBL NBL Int	Approa NBT 348 2.1 137 3 ersection	ach NBR 532 3.4 0 0 on Delay	SB SBL / (sec/v	Approa SBT 381 2.5 160 4 eh)	237 0.8 237 5 2.6
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	EB EBL 27 35.5 118 6 Node L	Approa EBT .ocation	76 4.3 128 5	I-94 & WBL 308	45th St 3 Appro WBT 45th St 3 Appro WBT 0	(N. Side ach WBR	NBL NBL Int	Approa NBT 348 2.1 137 3 ersection NBT 547	ach NBR 532 3.4 0 0 on Delay ach NBR 54	SB SBL / (sec/v	Approa SBT 381 2.5 160 4 eh)	237 0.8 237 5 2.6 ach SBR 135
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EB EBL 27 35.5 118 6 Node L	Approa EBT .ocation	76 4.3 128 5	I-94 & WE WBL 308 36.0	45th St 3 Appro 45th St 3 Appro WBT 0	(N. Side ach WBR 1035 12.3	NBL NBL Int	Approx NBT 348 2.1 137 3 ersection Approx NBT 547 6.5	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5	SB SBL / (sec/v	Approa SBT 381 2.5 160 4 eh) Approa SBT 433 10.0	237 0.8 237 5 2.6 2.6 SBR 135
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EBL 27 35.5 118 6 Node L EB EBL	Approa EBT .ocation	76 4.3 128 5	I-94 & WBL 308 36.0 383	45th St 3 Appro 45th St 3 Appro WBT 0 0	(N. Side ach WBR 1035 12.3 31	NBL NBL Int	Approx NBT 348 2.1 137 3 ersection Approx NBT 547 6.5 227	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5 228	SB SBL / (sec/v	Approa SBT 381 2.5 160 4 eh) Approa SBT 433 10.0 314	237 0.8 237 5 2.6 2.6 SBR 135 1.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EBL 27 35.5 118 6 Node L EB EBL	Approa EBT .ocation	76 4.3 128 5	I-94 & WE WBL 308 36.0	45th St 3 Appro 45th St 3 Appro WBT 0	(N. Side ach WBR 1035 12.3	NBL NBL	Approx NBT 348 2.1 137 3 ersection NBT 547 6.5 227 12	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5 228 11	SB SBL / (sec/v	Approa SBT 381 2.5 160 4 eh) Approa SBT 433 10.0 314 24	ach SBR 237 0.8 237 5 2.6 3ch SBR 135 1.7 314 24
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EB EBL 27 35.5 118 6 Node L EB EBL	Approa EBT ocation Approa EBT	128 5 128 5 EBR	I-94 & WBL 308 36.0 383 49	45th St 3 Appro 45th St 3 Appro 0 0 0	(N. Side ach WBR 1035 12.3 31 0	NBL Int	Approx NBT 348 2.1 137 3 ersection NBT 547 6.5 227 12	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5 228	SB SBL / (sec/v	Approa SBT 381 2.5 160 4 eh) Approa SBT 433 10.0 314 24	237 0.8 237 5 2.6 2.6 SBR 135 1.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EBL 27 35.5 118 6 Node L EB EBL	.ocation Approa	EBR 76 4.3 128 5 EBR EBR	I-94 & WBL 308 36.0 383 49	45th St 3 Appro WBT 45th St 0 0 0 0 45th St	(N. Side ach WBR 1035 12.3 31 0	NBL Int	Approx NBT 348 2.1 137 3 ersection NBT 547 6.5 227 12 ersection	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5 228 11 on Delay	SB SBL / (sec/v SB SBL	Approa SBT 381 2.5 160 4 eh) Approa SBT 433 10.0 314 24 eh)	ach SBR 237 0.8 237 5 2.6 3ch SBR 135 1.7 314 24 11.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EB EBL 27 35.5 118 6 Node L EB EBL	Approa EBT ocation Approa ocation Approa	128 5 128 5 128 5	I-94 & WBL 308 36.0 383 49	45th St 3 Appro WBT 0 0 0 0 45th St 3 Appro	(N. Side ach WBR 1035 12.3 31 0 (S. Side ach	NBL Int	Approx NBT 348 2.1 137 3 ersection Approx 12 ersection	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5 228 11 on Delay	SB SBL / (sec/v SB SBL	Approa SBT	sch SBR 237 0.8 237 5 2.6 SBR 135 1.7 314 24 11.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	EB EBL 27 35.5 118 6 Node L EB EBL EBL EBL	ocation Approa EBT ocation Approa EBT	EBR 76 4.3 128 5 :: ach EBR	I-94 & WBL 308 36.0 383 49	45th St 3 Appro WBT 45th St 0 0 0 0 45th St	(N. Side ach WBR 1035 12.3 31 0	NBL Int	Approx NBT 348 2.1 137 3 ersection NBT 547 6.5 227 12 ersection	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5 228 11 on Delay ach NBR	SB SBL / (sec/v SB SBL	Approa SBT 381 2.5 160 4 eh) Approa SBT 433 10.0 314 24 eh)	ach SBR 237 0.8 237 5 2.6 ach SBR 135 1.7 314 24 11.0 ach SBR
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	EB EBL 27 35.5 118 6	Approa EBT Ocation Approa EBT O	EBR 76 4.3 128 5 :: ach EBR :: ach EBR 7	I-94 & WBL 308 36.0 383 49	45th St 3 Appro WBT 0 0 0 0 45th St 3 Appro	(N. Side ach WBR 1035 12.3 31 0 (S. Side ach	NBL Int	Approa NBT 348 2.1 137 3 ersection NBT 547 6.5 227 12 ersection NBT 434	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5 228 11 on Delay ach NBR 883	SB SBL / (sec/v SB SBL	Approa SBT 433 10.0 314 24 eh) Approa SBT 432 4 420	ach SBR 237 0.8 237 5 2.6 SBR 135 1.7 314 24 11.0 SBR 322
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EB EBL 27 35.5 118 6 Node L EB EBL EBL 167 37.9	ocation Approa EBT ocation Approa EBT ocation Approa EBT 0	EBR 76 4.3 128 5 :: ach EBR EBR 7 6.8	I-94 & WBL 308 36.0 383 49	45th St 3 Appro WBT 0 0 0 0 45th St 3 Appro	(N. Side ach WBR 1035 12.3 31 0 (S. Side ach	NBL Int	Approx NBT 348 2.1 137 3 ersection NBT 547 6.5 227 12 ersection NBT 434 24.3	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5 228 11 on Delay ach NBR 883 30.2	SB SBL / (sec/v SB SBL	Approa SBT 381 2.5 160 4 eh) Approa SBT 433 10.0 314 24 eh) Approa SBT 420 12.0	sch SBR 237 0.8 237 5 2.6 SBR 135 1.7 314 24 11.0 SCh SBR 322 1.4
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EB EBL Node L EB EBL Node L EB EBL Node L EB EBL 167 37.9 258	ocation Approa EBT ocation Approa EBT ocation Approa EBT o 0 0	EBR 76 4.3 128 5 EBR EBR 76 6.8 134	I-94 & WBL 308 36.0 383 49	45th St 3 Appro WBT 0 0 0 0 45th St 3 Appro	(N. Side ach WBR 1035 12.3 31 0 (S. Side ach	NBL Int	Approx NBT 348 2.1 137 3 ersection Approx NBT 547 6.5 227 12 ersection Approx NBT 434 24.3 588	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5 228 11 on Delay ach NBR 883 30.2 588	SB SBL / (sec/v SB SBL	Approa SBT 433 10.0 314 24 eh) Approa SBT 430 12.0 220	sch SBR 237 0.8 237 5 2.6 SBR 135 1.7 314 24 11.0 SBR 322 1.4 234
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EB EBL 27 35.5 118 6 Node L EB EBL EBL 167 37.9	ocation Approa EBT ocation Approa EBT ocation Approa EBT 0	EBR 76 4.3 128 5 :: ach EBR EBR 7 6.8	I-94 & WBL 308 36.0 383 49	45th St 3 Appro WBT 0 0 0 0 45th St 3 Appro	(N. Side ach WBR 1035 12.3 31 0 (S. Side ach	NBL Int) NBL	Approx NBT 348 2.1 137 3 ersection Approx NBT 547 6.5 227 12 ersection NBT 434 24.3 588 146	ach NBR 532 3.4 0 0 on Delay ach NBR 54 0.5 228 11 on Delay ach NBR 883 30.2	SB SBL / (sec/v SB SBL	Approa SBT 381 2.5 160 4 eh) Approa SBT 433 10.0 314 24 eh) Approa SBT 420 12.0 220 15	sch SBR 237 0.8 237 5 2.6 SBR 135 1.7 314 24 11.0 SCh SBR 322 1.4

2015 Alvi Peak - Kamp	ermina	ii Data										
	Node L	ocation	ı:	I-94 &	25th St	(N. Side	<u>e)</u>					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				206	0	532		900	266		414	167
Delay Time/Veh. (s)				44.9	0	19.6		8.9	1.7		8.1	9.0
Max Queue (ft)				321	0	571		442	211		279	279
Avg. Queue (ft)				60	0	84		37	34		23	23
			•	-	•		Int	ersectio	n Delay	y (sec/v	eh)	11.9
	Node L	ocation	ı:	I-94 &	25th St	(S. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	80	114	92	43	12	311	295	772	3	75	373	174
Delay Time/Veh. (s)	39.1	40.7	5.0	46.2	41.0	11.1	11.2	8.5	8.1	6.7	5.7	2.2
Max Queue (ft)	296	296	128	145	145	271	431	451	4	115	159	303
Avg. Queue (ft)	50	50	3	13	13	24	23	33	0	2	9	3
				-			Int	ersectio	n Delay	y (sec/v	eh)	10.9
	Node L	ocation	ı:	I-94 &	Univers	ity Dr (I	N. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Appro	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				362		450		1088	260		378	364
Delay Time/Veh. (s)				40.9		14.0		9.1	1.2		5.2	0.6
Max Queue (ft)				270		389		467	294		215	0
Avg. Queue (ft)				60		65		39	1		9	0
							Int	ersectio	n Delay	y (sec/v	eh)	10.9
	Node L	ocation	ı:	I-94 &	Univers	ity Dr (S	S. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	634		308					724	315		562	173
Delay Time/Veh. (s)	41.5		8.2					7.0	0.5		4.3	0.5
Max Queue (ft)	415		213					249	0		245	205
Avg. Queue (ft)	104		24					19	0		9	15
							Int	ersectio	n Delay	y (sec/v	eh)	13.1
	Node L	ocation	ı:	I-94 &	8th St/	TH75 (N	. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				52	0	239	675	1806			259	832
Delay Time/Veh. (s)				29.5	0	16.3	22.6	7.2			36.4	35.0
Max Queue (ft)				134	0	6	933	761			616	12
Avg. Queue (ft)				9	0	6	205	63			52	12
							Int	ersectio	n Delay	y (sec/v	eh)	16.3
	Node L	ocation	ı:	I-94 &	8th St/	ГН75 (S.	Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	nch
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	951		273					1528	173	97	214	
Delay Time/Veh. (s)	36.1		6.3					82.4	54.8	35.4	11.9	
Max Queue (ft)	1275		192					2611	176	223	193	
Avg. Queue (ft)	172		13					1052	6	14	10	
Avg. Queue (11)												

55.1

Intersection Delay (sec/veh)

Avg. Queue (ft)

2015 AM Peak - Ramp 7	ermina	ii Data										
	Node L	ocation	ı:	I-94 &	20th St	(N. Side	e)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Appro	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				30	5	20	203	525	77	31	122	284
Delay Time/Veh. (s)				3.2	1.5	4.1	2.7	0.8	0.9	5.3	0.4	2.7
Max Queue (ft)				43	43	43	180	180	180	0	0	0
Avg. Queue (ft)				0	0	0	26	26	26	0	0	0
								ersectio	on Delay	y (sec/v	eh)	1.7
Ī		ocation				(S. Side						
		Approa			Appro			Appro			Approa	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	346		104					459			127	
Delay Time/Veh. (s)	12.9		4.6 7					9.9			16.0	
Max Queue (ft) Avg. Queue (ft)	284 31		7					432 37			181 13	
Avg. Queue (It)	31		/				Int		n Dela	y (sec/v		10.8
	Node I	.ocation	ı.	I-94 &	34th St	(N. Side		Cracette	on Dela	y (3CC) v	CIII	10.0
		Approa		_	3 Appro	·		Appro	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				48		140		715	478	418	123	0 - 1.1
Delay Time/Veh. (s)				21.4		6.6		6.5	29.7	1.5	8.2	
Max Queue (ft)				139		24		239	516	128	128	
Avg. Queue (ft)				9		0		56	89	0	5	
							Int	ersectio	n Delay	y (sec/v	eh)	11.1
	Node L	.ocation	ı:	I-94 &	34th St	(S. Side		ersectio	n Dela	y (sec/v	eh)	11.1
		ocation Approa			34th St 3 Appro)	ersection	,		eh) Approa	
)		,		•	
Volume	EB EBL	Approa	ach	WE	3 Appro	ach) NB	Appro	ach	SB SBL 9	Approa SBT 161	ach
Delay Time/Veh. (s)	EBL	Approa	ach	WBL 225 60.3	3 Appro	wBR 418 10.9) NB	Approx NBT 775 8.7	ach NBR	SB SBL 9 71.6	Approa SBT 161 7.3	ach
Delay Time/Veh. (s) Max Queue (ft)	EBL	Approa	ach	WBL 225 60.3 387	3 Appro	wbr 418 10.9 387) NB	Approx NBT 775 8.7 313	nech NBR 50 2.0 94	SB SBL 9 71.6 126	Approx SBT 161 7.3 126	ach
Delay Time/Veh. (s)	EBL	Approa	ach	WBL 225 60.3	3 Appro	wBR 418 10.9) NBL	Approx NBT 775 8.7 313 26	NBR 50 2.0 94 1	SB SBL 9 71.6 126 7	Approa SBT 161 7.3 126	ach SBR
Delay Time/Veh. (s) Max Queue (ft)	EBL	Approa EBT	EBR	WBL 225 60.3 387 77	Appro WBT	wBR 418 10.9 387 77	NBL	Approx NBT 775 8.7 313 26	NBR 50 2.0 94 1	SB SBL 9 71.6 126	Approa SBT 161 7.3 126	ach
Delay Time/Veh. (s) Max Queue (ft)	EB EBL Node L	Approa EBT	EBR	WBL 225 60.3 387 77	Appro WBT	wBR 418 10.9 387 77) NBL Int	Approa NBT 775 8.7 313 26 ersectio	NBR 50 2.0 94 1 on Delay	SB SBL 9 71.6 126 7 y (sec/v	Approa SBT 161 7.3 126 7 eh)	SBR SBR 15.7
Delay Time/Veh. (s) Max Queue (ft)	EBL EBL Node L	Approa EBT ocation	EBR	WBL 225 60.3 387 77 I-94 & WE	MN 336	wBR 418 10.9 387 77 6 (N. Sid) NBL Intel E) NB	Approx NBT 775 8.7 313 26 ersection	ach NBR 50 2.0 94 1 on Delay	SB SBL 9 71.6 126 7 y (sec/v	Approa SBT 161 7.3 126 7 eh)	ach SBR 15.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	EB EBL Node L	Approa EBT	EBR	WBL 225 60.3 387 77 I-94 & WBL	MN 336 WBT	ach WBR 418 10.9 387 77 6 (N. Sidach WBR	NBL Int e) NBL	Approa NBT 775 8.7 313 26 ersection	NBR 50 2.0 94 1 on Delay	SB SBL 9 71.6 126 7 y (sec/v	Approa SBT 161 7.3 126 7 eh)	ach SBR 15.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	EBL EBL Node L	Approa EBT ocation	EBR	WBL 225 60.3 387 77 I-94 & WE WBL 18	MN 336 3 Appro WBT	ach WBR 418 10.9 387 77 6 (N. Sidach WBR 64	Intelled	Approx NBT 775 8.7 313 26 ersection Approx NBT 255	ach NBR 50 2.0 94 1 on Delay	SB SBL 9 71.6 126 7 y (sec/v	Approa SBT 161 7.3 126 7 eh) Approa SBT 73	ach SBR 15.7 ach SBR 625
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EBL EBL Node L	Approa EBT ocation	EBR	WBL 225 60.3 387 77 I-94 & WE WBL 18 7.4	MN 336 3 Appro WBT 0	ach WBR 418 10.9 387 77 6 (N. Sid ach WBR 64 7.0) NBL Int e) NBL 45 0.7	Approx NBT 775 8.7 313 26 ersection Approx NBT 255 0.1	ach NBR 50 2.0 94 1 on Delay	SB SBL 9 71.6 126 7 y (sec/v	Approa SBT 161 7.3 126 7 eh) Approa SBT 73 1.4	15.7 ach 15.7 ach SBR 625 2.5
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EBL Node L EBL	Approa EBT ocation	EBR	WBL 225 60.3 387 77 I-94 & WBL 48 7.4 8	MN 336 3 Appro WBT 0 0	ach WBR 418 10.9 387 77 6 (N. Sid ach WBR 64 7.0 8	NBL	Approx NBT 775 8.7 313 26 ersection Approx NBT 255 0.1	ach NBR 50 2.0 94 1 on Delay	SB SBL 9 71.6 126 7 y (sec/v	Approa SBT 161 7.3 126 7 eh) Approa SBT 73 1.4	15.7 ach 15.7 ach SBR 625 2.5 0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EBL Node L EBL	Approa EBT ocation	EBR	WBL 225 60.3 387 77 I-94 & WE WBL 18 7.4	MN 336 3 Appro WBT 0	ach WBR 418 10.9 387 77 6 (N. Sid ach WBR 64 7.0) NBL Int e) NBL 45 0.7 0	Approx NBT 775 8.7 313 26 ersection NBT 255 0.1 0	ach NBR 50 2.0 94 1 on Delay	SB SBL 9 71.6 126 7 y (sec/v SB SBL	Approa SBT 73 1.4 0 0	15.7 SBR 15.7 SBR 625 2.5 0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	ocation Approa EBT	ech EBR :: ach EBR	WBL 225 60.3 387 77 I-94 & WBL 18 7.4 8	MN 336 3 Appro WBT 0 0 0	ach WBR 418 10.9 387 77 6 (N. Sid ach WBR 64 7.0 8	NB NBL	Approx NBT 775 8.7 313 26 ersection NBT 255 0.1 0	ach NBR 50 2.0 94 1 on Delay	SB SBL 9 71.6 126 7 y (sec/v	Approa SBT 73 1.4 0 0	15.7 ach 15.7 ach SBR 625 2.5 0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	ocation Approa EBT	EBR : ach EBR	WBL 225 60.3 387 77 I-94 & WBL 18 7.4 8 8	MN 336 WBT MN 336 WBT O O O MN 336	ach WBR 418 10.9 387 77 6 (N. Sidach WBR 64 7.0 8 8) NBL Int e) NBL 45 0.7 0 Int e)	Approx NBT 775 8.7 313 26 ersection NBT 255 0.1 0 0 ersection	ach NBR 50 2.0 94 1 on Delay ach NBR	SB SBL 9 71.6 126 7 (sec/v SB SBL)	Approa SBT 73 1.4 0 0 eh)	15.7 15.7 ach SBR 625 2.5 0 0 2.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	ocation Approa EBT	EBR : ach EBR	WBL 225 60.3 387 77 I-94 & WBL 18 7.4 8 8	MN 336 3 Appro WBT 0 0 0	ach WBR 418 10.9 387 77 6 (N. Sidach WBR 64 7.0 8 8) NBL Int e) NBL 45 0.7 0 Int e)	Approx NBT 775 8.7 313 26 ersection NBT 255 0.1 0	ach NBR 50 2.0 94 1 on Delay ach NBR	SB SBL 9 71.6 126 7 (sec/v SB SBL)	Approa SBT 73 1.4 0 0	15.7 15.7 ach SBR 625 2.5 0 0 2.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EBL Node L EBL	ocation Approa EBT ocation Approa Ocation Approa	EBR EBR EBR Each	WE WBL 225 60.3 387 77 1-94 & WE WBL 18 7.4 8 8	MN 336 3 Appro WBT 0 0 0 0	ach WBR 418 10.9 387 77 6 (N. Sidach WBR 64 7.0 8 8) NBL Int e) NBL 45 0.7 0 Int e) NBC	Approx NBT 775 8.7 313 26 ersection NBT 255 0.1 0 0 ersection	ach NBR 50 2.0 94 1 on Delay ach NBR	SB SBL 9 71.6 126 7 (sec/v SB SBL SBL SBL SBL SBL SBL SBL SBL SBL	Approa SBT 73 1.4 0 0 eh)	15.7 15.7 ach SBR 625 2.5 0 0 2.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB Node L EB EBL	ocation Approa EBT ocation Approa Ocation Approa	EBR EBR EBR Each	WE WBL 225 60.3 387 77 I-94 & WBL 18 7.4 8 8 I-94 & WE WBL	MN 336 3 Appro WBT 0 0 0 0	ach WBR 418 10.9 387 77 6 (N. Sid ach WBR 64 7.0 8 8 8 6 (S. Side ach WBR) NBL Int e) NBL 45 0.7 0 Int e) NBC	Approx NBT 775 8.7 313 26 ersection NBT 255 0.1 0 0 ersection	ach NBR 50 2.0 94 1 on Delay ach NBR NBR	SB SBL 9 71.6 126 7 (sec/v SBL	Approa SBT 161 7.3 126 7 eh) Approa SBT 73 1.4 0 0 eh)	15.7 15.7 ach SBR 625 2.5 0 0 2.0

0

Intersection Delay (sec/veh)

	Node L	.ocation	ı :	I-29 &	CR 20 (\	N. Side))					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		211	75	125	169					126		175
Delay Time/Veh. (s)		0.8	1.8	1.3	1.1					11.9		9.2
Max Queue (ft)		0	0	28	28					10		10
Avg. Queue (ft)		0	0	0	0					10		10
							Int	ersectio	n Delay	/ (sec/v	eh)	4.3
	Node L	ocation	:	I-29 &	CR 20 (I	. Side)						
	EB	Approa	ach	WE	3 Appro	ach	NB	Appro	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	74	262			233	64	61		121			
Delay Time/Veh. (s)	1.1	0.9			0.6	1.4	11.2		9.3			
Max Queue (ft)	74	74			0	0	9		9			
Avg. Queue (ft)	0	0			0	0	9		9			
	<u></u>						Int	ersectio	n Delay	/ (sec/v	eh)	2.9
	Node L	ocation	:	I-29 &	19 Ave	N (W. S	ide)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	29	536			347	568				134		2
Delay Time/Veh. (s)	2.8	4.6			4.6	3.3				12.0		0.8
Max Queue (ft)	0	181			200	289				169		0
Avg. Queue (ft)	0	10			6	1				11		0
							Int	ersectio	on Delay	/ (sec/v	eh)	4.7
	Node L	ocation	:	I-29 &	19 Ave	N (E. Sid	de)					
	EB	Approa	ach	\ / /F	3 Appro		• • •					
			-	V V L	Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	ach WBR	NBL NBL	Approa NBT	ach NBR	SB SBL	Approa SBT	sbR
Volume	EBL	EBT 650										
Volume Delay Time/Veh. (s)			EBR		WBT	WBR	NBL		NBR			
		650	EBR 22		WBT 866	WBR 31	NBL 48		NBR 779			
Delay Time/Veh. (s)		650 9.2	EBR 22 0.3		WBT 866 9.3	WBR 31 0.9	NBL 48 22.7		NBR 779 10.1			
Delay Time/Veh. (s) Max Queue (ft)		650 9.2 246	EBR 22 0.3 208		WBT 866 9.3 361	WBR 31 0.9 0	NBL 48 22.7 168 7	NBT	NBR 779 10.1 246	SBL	SBT	
Delay Time/Veh. (s) Max Queue (ft)		650 9.2 246	22 0.3 208 5	WBL	WBT 866 9.3 361	WBR 31 0.9 0	NBL 48 22.7 168 7	NBT	NBR 779 10.1 246 43	SBL	SBT	SBR
Delay Time/Veh. (s) Max Queue (ft)	Node L	9.2 246 22	EBR 22 0.3 208 5	WBL	WBT 866 9.3 361 42	WBR 31 0.9 0 0	NBL 48 22.7 168 7 Int	NBT	NBR 779 10.1 246 43 on Delay	SBL / (sec/v	SBT	9.6
Delay Time/Veh. (s) Max Queue (ft)	Node L	9.2 246 22 ocation	EBR 22 0.3 208 5	WBL	WBT 866 9.3 361 42	WBR 31 0.9 0 0	NBL 48 22.7 168 7 Int	NBT ersection	NBR 779 10.1 246 43 on Delay	SBL / (sec/v	SBT eh)	9.6
Delay Time/Veh. (s) Max Queue (ft)	Node L	650 9.2 246 22 ocation	EBR 22 0.3 208 5	WBL	WBT 866 9.3 361 42 12th Av 3 Appro	WBR 31 0.9 0 0 e N (W.	NBL 48 22.7 168 7 Int Side)	NBT ersection	NBR 779 10.1 246 43 on Delay	SBL / (sec/v	SBT eh)	9.6
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L	650 9.2 246 22 ocation Approa	EBR 22 0.3 208 5 ::	WBL	WBT 866 9.3 361 42 12th Av 3 Appro WBT	WBR 31 0.9 0 0 we N (W. ach WBR	NBL 48 22.7 168 7 Int Side)	NBT ersection	NBR 779 10.1 246 43 on Delay	SBL / (sec/v	SBT eh)	9.6 SBR
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EB EBL	650 9.2 246 22 ocation Approa EBT 175	EBR 22 0.3 208 5 :: ach EBR 113	WBL	WBT 866 9.3 361 42 12th Av 3 Appro WBT 752	WBR 31 0.9 0 0 we N (W. ach WBR 278	NBL 48 22.7 168 7 Int Side)	NBT ersection	NBR 779 10.1 246 43 on Delay	SBL SBL SBL 142	SBT eh)	9.6 SBR 97
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EB EBL	650 9.2 246 22 ocation Approa EBT 175 2.8	22 0.3 208 5 :: ach EBR 113 0.6	WBL	WBT 866 9.3 361 42 12th Av 3 Appro WBT 752 4.1	WBR 31 0.9 0 0 e N (W.ach WBR 278 0.9	NBL 48 22.7 168 7 Int Side)	NBT ersection	NBR 779 10.1 246 43 on Delay	SBL / (sec/v SB SBL 142 33.4	SBT eh)	9.6 SBR 97 3.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	650 9.2 246 22 cocation Approx EBT 175 2.8 104	EBR 22 0.3 208 5 :: ach EBR 113 0.6	WBL	WBT 866 9.3 361 42 12th Av 3 Appro WBT 752 4.1 242	WBR 31 0.9 0 0 we N (W. ach WBR 278 0.9 105	NBL 48 22.7 168 7 Int Side) NB NBL	ersection Approx NBT	NBR 779 10.1 246 43 on Delay	SBL / (sec/vi SB SBL 142 33.4 207 32	eh) Approa	9.6 9.6 SBR 97 3.0 195
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	650 9.2 246 22 cocation Approx EBT 175 2.8 104	EBR 22 0.3 208 5 :: ach EBR 113 0.6 0	I-29 & WE WBL	WBT 866 9.3 361 42 12th Av 3 Appro WBT 752 4.1 242	WBR 31 0.9 0 0 e N (W. ach WBR 278 0.9 105 0	NBL 48 22.7 168 7 Int Side) NBL	ersection Approx NBT	NBR 779 10.1 246 43 on Delay ach NBR	SBL / (sec/vi SB SBL 142 33.4 207 32	eh) Approa	9.6 9.6 SBR 97 3.0 195
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	650 9.2 246 22 ocation Approa EBT 175 2.8 104 2	EBR 22 0.3 208 5 :: ach EBR 113 0.6 0	I-29 & WBL	WBT 866 9.3 361 42 12th Av 3 Appro WBT 752 4.1 242 14	WBR 31 0.9 0 0 0 e N (W.ach WBR 278 0.9 105 0	NBL 48 22.7 168 7 Int Side) NBL	ersection Approx NBT	NBR 779 10.1 246 43 on Delay ach NBR on Delay	SBL / (sec/vi	eh) Approa	9.6 9.6 97 3.0 195 7 5.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	650 9.2 246 22 ocation Approx EBT 175 2.8 104 2	EBR 22 0.3 208 5 :: ach EBR 113 0.6 0	I-29 & WBL	WBT 866 9.3 361 42 12th Av NBT 752 4.1 242 14 12th Av	WBR 31 0.9 0 0 0 e N (W.ach WBR 278 0.9 105 0	NBL 48 22.7 168 7 Int Side) NBL	ersection NBT	NBR 779 10.1 246 43 on Delay ach NBR on Delay	SBL / (sec/vi	eh) Approa SBT	9.6 9.6 97 3.0 195 7 5.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL Node L	ocation Approa EBT 175 2.8 104 2 ocation	EBR 22 0.3 208 5 :: ach EBR 113 0.6 0 0	I-29 & WBL	WBT 866 9.3 361 42 12th Av Appro WBT 752 4.1 242 14 12th Av Appro	WBR 31 0.9 0 0 e N (W.ach WBR 278 0.9 105 0 e N (E.:ach	NBL 48 22.7 168 7 Int Side) NBL	ersection Approa	NBR 779 10.1 246 43 on Delay ach NBR on Delay	SBL / (sec/v) SB SBL 142 33.4 207 32 / (sec/v) SB	eh) Approa	9.6 9.7 3.0 195 7 5.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL Node L	650 9.2 246 22 ocation Approx EBT 175 2.8 104 2 ocation Approx EBT	EBR 22 0.3 208 5 : ach EBR 113 0.6 0 0 : ach EBR	I-29 & WBL	WBT 866 9.3 361 42 12th Av NBT 752 4.1 242 14 12th Av Appro WBT	WBR 31 0.9 0 0 e N (W.ach WBR 278 0.9 105 0 e N (E.sach WBR	NBL 48 22.7 168 7 Int. Side) NBL Int. Side) NBL	ersection Approa	NBR 779 10.1 246 43 on Delay ach NBR on Delay	SBL / (sec/v) SB SBL 142 33.4 207 32 / (sec/v) SB	eh) Approa	9.6 9.7 3.0 195 7 5.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EB EBL Node L EB EBL	ocation Approa EBT 175 2.8 104 2 ocation Approa EBT 282	EBR 22 0.3 208 5 :: ach EBR 113 0.6 0 0 :: ach EBR 36	I-29 & WBL	WBT 866 9.3 361 42 12th Av Appro WBT 752 4.1 242 14 12th Av Appro WBT 506	WBR 31 0.9 0 0 0 e N (W.ach WBR 278 0.9 105 0 e N (E.sach WBR 55	NBL 48 22.7 168 7 Int Side) NBL Int Side) NBL Side) NBL Side)	ersection Approa	NBR 779 10.1 246 43 on Delay ach NBR on Delay ach NBR 830	SBL / (sec/v) SB SBL 142 33.4 207 32 / (sec/v) SB	eh) Approa	9.6 9.7 3.0 195 7 5.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EB EBL Node L EB EBL	650 9.2 246 22 cocation Approx EBT 175 2.8 104 2 cocation Approx EBT 282 3.9	EBR 22 0.3 208 5 :: ach EBR 113 0.6 0 0 :: ach EBR 36 0.2	I-29 & WBL	WBT 866 9.3 361 42 12th Av NBT 752 4.1 242 14 12th Av NBT SAppro WBT 506 8.8	WBR 31 0.9 0 0 0 e N (W. ach WBR 278 0.9 105 0 e N (E. sach WBR 55	NBL 48 22.7 168 7 Int Side) NBL Int Side) NBL 523 26.7	ersection Approa	NBR 779 10.1 246 43 on Delay ach NBR NBR NBR NBR NBR 830 9.6	SBL / (sec/v) SB SBL 142 33.4 207 32 / (sec/v) SB	eh) Approa	9.6 9.7 3.0 195 7 5.7

Intersection Delay (sec/veh)

Avg. Queue (ft)

18

15

109

28

87

7 59 59 Intersection Delay (sec/veh)

15 AM Peak - Ramp 1	Termina	al Data										
	Node L	ocation	:	I-29 &	Main A	ve (W. S	ide)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		923	212		807	182				93	0	166
Delay Time/Veh. (s)		3.3	4.0		1.5	0.6				41.7	0.0	6.3
Max Queue (ft)		207	207		131	257				154	0	139
Avg. Queue (ft)		11	11		4	1		_		19	0	7
				. 20.0		/F 6:		ersectio	on Delay	y (sec/v	eh)	4.3
,		ocation.			Main A	,				65		
		Approa			Appro			Approa			Approa	
Maliona	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		862	152 0.4		595 5.7	56 6.8	395 38.2	0	703 9.6			
Delay Time/Veh. (s) Max Queue (ft)		4.9 277	248		193	193	266	0.0	259			
Avg. Queue (ft)		15	1		193	193	60	0	48			
Avg. Queue (It)		13			12	12				y (sec/v	eh)	10.8
	Node I	.ocation		I-29 &	38th St		1110	Crocciic	on Belay	, (3CC) V	CIII	10.0
		Approa			3 Appro	ach	NP	Approa	ach	SR	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				303	0	27	0	99	166	105	26	00
Delay Time/Veh. (s)				15.4	0	4.4	0.0	4.3	1.6	4.8	4.2	
Max Queue (ft)				174	0	112	0	117	110	132	132	
Avg. Queue (ft)				21	0	2	0	2	0	3	3	
				•	1		Int	ersectio	n Delay	y (sec/v	eh)	8.3
	Node L	ocation	:	I-29 &	13th Av	e S (E. S	Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	67	848	170		909	256	270	260	541			
Delay Time/Veh. (s)	41.9	9.4	0.1		16.0	5.8	29.1	41.3	13.0			
Max Queue (ft)	156	292	149		370	0	412	411	416			
Avg. Queue (ft)	17	26	0		49	0	76	82	86			
								ersectio	on Delay	y (sec/v	eh)	15.8
		ocation			32nd Av				,	-		
		Approa			3 Appro			Approa			Approa	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		568	172	227	1000					347		453
Delay Time/Veh. (s)		13.6	2.5	48.8	8.4					40.0		10.8
Max Queue (ft)		292	0	507	523					298		312
Avg. Queue (ft)		32	0	77	35		l n t		n Dolo	59	a b \	50
	Noda!	ocatio:		1 20 0	2 2 nd 4.	10 C / F		ersectio	יוו Dela\	y (sec/v	enj	16.8
Ī		ocation			32nd Av	•		Annre	a ch	CD	Annes	a ch
	EBL	Approa EBT	EBR	WBL	Appro WBT	acn WBR	NBL	Approa NBT	n NBR	SBL	Approa SBT	sen SBR
Volume	EDL	710	208	VVDL	914	847	312	INDI	248	JDL	301	JOK
Delay Time/Veh. (s)		6.3	1.3		15.6	8.3	38.3		12.6			
belay fillie/ vell. (S)		0.5	1.5		13.0	0.5	JO.5	I	12.0			
Max Queue (ft)		328	294		968	215	420		422			

2015 AM Peak - Ramp Terminal Data

Node Location: I-29 & 52nd Ave S (W. Side)

	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ich
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		841	106		1174	97				254		516
Delay Time/Veh. (s)		6.5	1.2		5.6	1.1				29.3		1.5
Max Queue (ft)		217	217		266	277				204		0
Avg. Queue (ft)		15	15		18	3				33		0
							Int	ersectio	n Delav	/ (sec/v	eh)	6.8

Node Location: I-29 & 52nd Ave S (E. Side)

	EB	Approa	nch	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ıch
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		573	521		1109	864	161		100			
Delay Time/Veh. (s)		3.1	3.4		6.3	4.4	35.8		1.7			
Max Queue (ft)		196	236		402	402	253		0			
Avg. Queue (ft)		5	13		33	33	39		0			
							Int	ersectio	n Delay	/ (sec/v	eh)	6.1

Appendix D: 2015 PM Simulation Output (Network Performance, Travel Time, Freeway Queues)

Network Performance

Total Delay Time (hr)	494
Total Travel Time (hr)	4,189
Number of Active Vehicles	0
Number of Arrived Vehicles	48,262
Total Stopped Delay (hr)	164
Total Distance Traveled (mi)	201,592

Queue Measurement

Time	Tr	i-Level Mer	ge	I-9	4 WB (45th	St)
Time	Avg.	Max.	Stop	Avg.	Max.	Stop
PM Peak	2,323	5,506	3,201	0	0	0

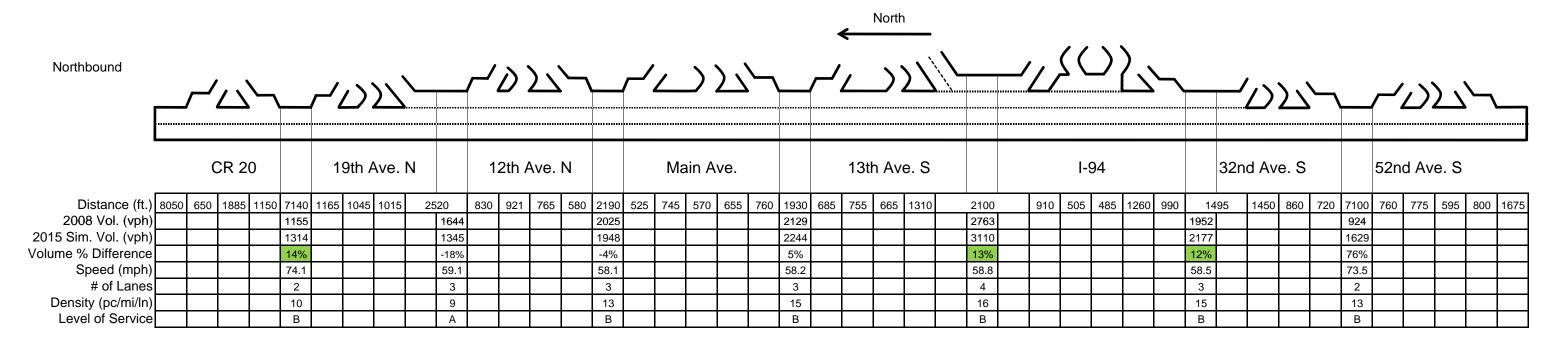
Travel Time (Network)

				Destir				
`		Ī	1.20			- FD	1 20	ND
		1		SB	I-94		I-29	
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	12.3	3	15.3	10	15.8	3
	I-94 EB	1645-1700	12.3	3	15.3	10	15.9	3
		1700-1715	12.4	3	15.3	11	15.8	3
		1715-1730	12.3	3	15.6	11	15.7	3
			I-29) SB	I-94	WB	I-29	NB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	15.4	4	14.8	7	17.2	5
	I-94 WB	1645-1700	15.4	4	14.9	7	17.2	5
		1700-1715	15.5	4	14.8	8	17.2	6
gin		1715-1730	15.4	4	14.8	8	17.1	6
Origin			I-94	WB	I-29	NB	I-94	EB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	13.1	3	14.7	7	15.0	3
	I-29 NB	1645-1700	13.2	3	14.6	7	15.0	3
		1700-1715	13.1	3	14.6	8	15.3	3
		1715-1730	13.1	3	14.6	7	15.7	3
			I-94	WB	I-29	SB	I-94	EB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	14.8	3	14.6	5	17.8	5
	I-29 SB	1645-1700	14.7	3	14.6	6	17.9	6
		1700-1715	15.0	3	14.7	6	18.7	5
		1715-1730	15.2	3	14.7	6	20.8	6

Appendix E: 2015 PM Simulation Output (Data Collection Points)

I-29 Data Collection: 2015 PM Peak Hour

Southbound		(CR20)		19	9th A	Ave.	N		1	2th A	۱ve.	N			Ma	ain A	ve.			1:	3th A	ve. S	3		-	94					321	nd Av	∕e. S	ı			52n	d Av	e. S	
Distance (ft.)	8050	650	1885	1150	7550	570	1015	1030	1040	1715	680	835	840	765	2240	455	735	230	1215	740	1230	945	84	0		3840	1300	640	1150	0 285	232	5 285	950	1395	625	72	200	620	670	960	510	1900
2008 Vol. (vph)					748					1317					2489						3411					3603					203	7					1021					
2015 Sim. Vol. (vph)					864					1238					2322						3091					4045					229	8					2068					
Volume % Difference					16%					-6%					-7%						-9%					12%					13%	ó				'	103%					
Speed (mph)					74.6					59.5					58.4						54.1					55.1					58.8	3				'	72.7					
# of Lanes					2					3					3						3					4					4			$oldsymbol{ol}}}}}}}}}}}}}}}}}$	<u> </u>	'	2	\square				
Density (pc/mi/ln)					7					8					16						22					22					11					<u> </u>	17	oxdot				
Level of Service					Α					Α					В						С					С					В						В	oxdot				
																						_	S	South	→																	
		<u> </u>	\	'سر			7				<u> </u>	\ <u>\</u>	7	'۔۔۔			\ <u>\</u>			ــر7			\	~				(7 ,-			7/		'۔۔	,		<u> </u>	\ <u>\</u>	7		



Note: Density values were adjusted using the following data:

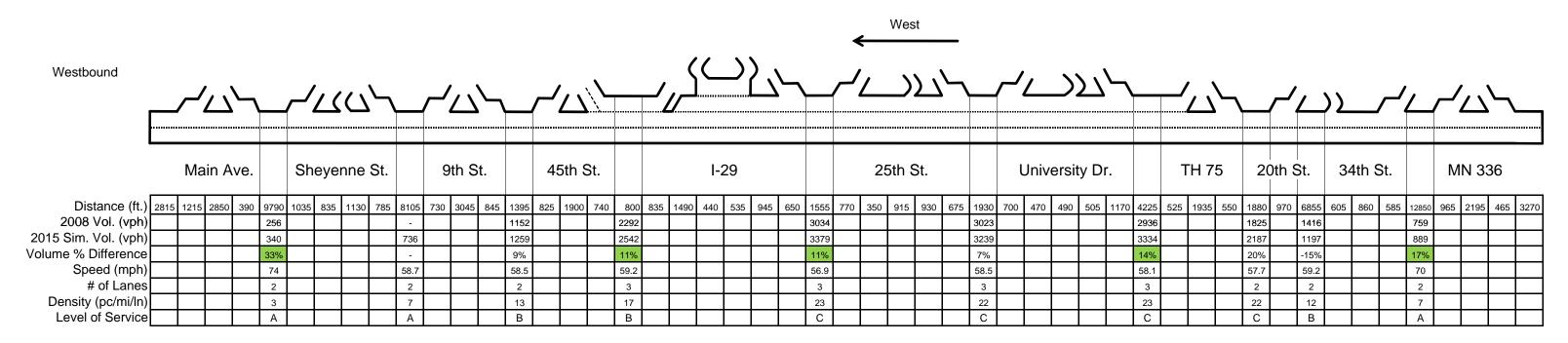
Peak-hour factor = .87

Heavy vehicle percent = 5

This data increased the original density by 15%.

I-94 Data Collection: 2015 PM Peak Hour

Eastbound	Main Ave.	Sh	eyeni	ne St	ı	9t	h St			4	.5th	St.				I	-29				2	5th S	t.		Un	iver	sity	Dr.			Т	H 75	20	th St		34tł	n St		N	/N 33	36	
Distance (ft.) 2008 Vol. (vph)	2660 575 1005 1440	11770 7	55 2050	1040	7520 7	765 165	180	0 835	1475 937	705	930 1	1450		570	760	465 134	45 136	55	1415	3794		930		2610 3678	960	740	1050	1125	42	25 3828	520	2005 840	1740 2297		645 4 851	10 9	55 5		350 710 92	1365	1080 21	70
2015 Sim. Vol. (vph)		642			929				1233					544						4154				4302						4273			2573		595			12				
Volume % Difference		21%			-				32%				•	1%						9%				17%						12%			12%	-1	14%			16	5%			
Speed (mph)		74.9			59.1				58.9					59						56.1				57.8						52.9			56.5	5	8.3			7	0			
# of Lanes		2			2				2					3						3				3						3			2		2				2			
Density (pc/mi/ln)		5			9				12					17						29				29						32			27	L	16			_	1			
Level of Service		Α			Α				В					В						D			L	D						D			С	_	В				3			
																						Ea	ct																			
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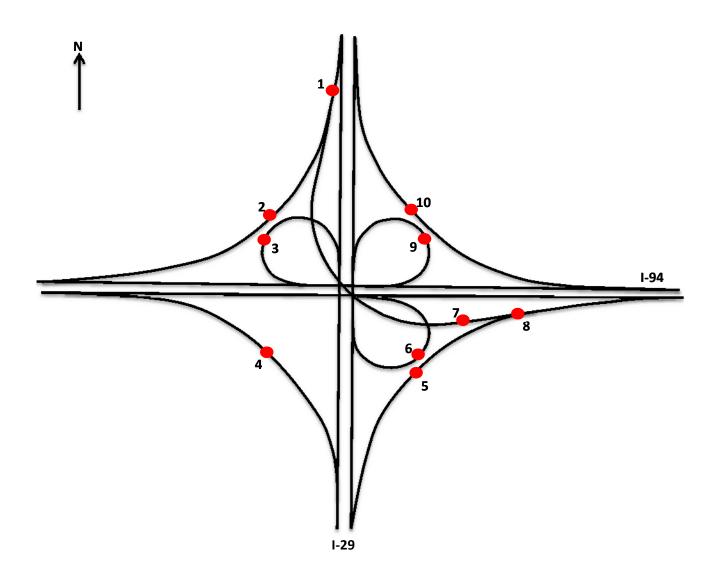


Note: Density values were adjusted using the following data:

Peak-hour factor = .87

This data increased the original density by 15%.

Heavy vehicle percent = 5



2015 PM: Data Collection Points (I-29/I-94 Interchange)

	1	2	3	4	5	6	7	8	9	10
2008 Vol. (vph)	2139	604	390	203	471	354	1542	2013	154	1135
2015 Sim. Vol. (vph)	2408	666	433	230	533	387	1701	2226	298	1373
Volume % Difference	13%	10%	11%	13%	13%	9%	10%	11%	94%	21%
Speed (mph)	46	54	25	55	54	25	36	37	25	53
# of Lanes	2	1	1	1	1	1	1	1	1	1
Density (pc/mi/ln)	31	15	21	5	12	18	55	71	14	30

This data increased the original density by 25%.

Appendix F: 2015 PM Simulation	n Output (Node Evaluati	ons)
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_	Node L	.ocation	ı:	I-94 &	Sheyen	ne St (N	. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume			123			322	40	152			435	10
Delay Time/Veh. (s)			6.5			3.3	2.7	0.2			4.2	1.0
Max Queue (ft)			143			183	63	0			230	0
Avg. Queue (ft)			5			12	0	0			10	0
		ı			ı		Int	ersectio	n Delay	y (sec/v	eh)	7.9
	Node L	.ocation	ı:	I-94 &	Sheyen	ا ne St (S	Side)			, , ,	•	
	EB	Approa	ach		Appro			Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	28	0	79					163	95	297	262	
Delay Time/Veh. (s)	18.8	0.0	6.5					11.5	1.6	13.5	2.8	
Max Queue (ft)	146	0	146					200	0	284	154	
Avg. Queue (ft)	6	0	6					11	0	30	3	
718. Queue (11)	Ü	U	Ü				Int			y (sec/v		7.9
	Node I	.ocation	1:	I-94 &	9th St (ا (N. Side		crocotic	,, Dela	, (300, 1	c,	, 13
Ī		Approa			3 Appro		NR	Approa	ach	SR	Approa	nch.
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	LDL		LDIX	161	VVDI	419	33	222	NDIN	JDL	443	23
Delay Time/Veh. (s)				34.4		8.8	39.7	3.2			6.4	2.4
Max Queue (ft)				233		232	134	134			176	0
Avg. Queue (ft)				42		37	10	10			11	0
7 Ng. Queue (11)				72		37			n Dela	y (sec/v		8.7
	Node I	ocation	1:	I-94 &	9th St (l S. Side)	1110	Crocciic	ni Dela	, (555, 1	/	0.,
,		ocation			9th St (
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ich
Volume	EBL		ech EBR		•			Approa NBT	ach NBR		Approa SBT	ach SBR
Volume Delay Time/Veh (s)	EBL 39	Approa	ech EBR 95	WE	3 Appro	ach	NB	Approa NBT 215	nch NBR 206	SB	Approa SBT 374	sbr 231
Delay Time/Veh. (s)	EB EBL 39 36.6	Approa	EBR 95 4.3	WE	3 Appro	ach	NB	Approa NBT 215 2.2	ach NBR 206 1.4	SB	Approa SBT 374 3.7	sbr 231 0.8
Delay Time/Veh. (s) Max Queue (ft)	EBL 39 36.6 126	Approa	ech EBR 95 4.3 132	WE	3 Appro	ach	NB	Approa NBT 215 2.2 108	nBR 206 1.4	SB	Approa SBT 374 3.7 180	sech SBR 231 0.8 247
Delay Time/Veh. (s)	EBL 39 36.6 126	Approa	EBR 95 4.3	WE	3 Appro	ach	NB NBL	Approx NBT 215 2.2 108 2	nach NBR 206 1.4 0	SB SBL	Approa SBT 374 3.7 180	och SBR 231 0.8 247 6
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 39 36.6 126 9	Approa EBT	95 4.3 132	WBL	Appro WBT	wBR	NBL NBL	Approx NBT 215 2.2 108 2	nach NBR 206 1.4 0	SB	Approa SBT 374 3.7 180	sech SBR 231 0.8 247
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 39 36.6 126 9	Approa EBT	95 4.3 132 6	WBL	Appro WBT 45th St	ach WBR	NBL NBL Int	Approa NBT 215 2.2 108 2 ersectio	ach NBR 206 1.4 0 0	SB SBL y (sec/v	Approa SBT 374 3.7 180 5 eh)	och SBR 231 0.8 247 6 2.7
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 39 36.6 126 9 Node L	Approa EBT .ocation	95 4.3 132 6	WE WBL	Appro WBT 45th St	ach WBR (N. Side	NBL NBL Int	Approx NBT 215 2.2 108 2 ersection	ach NBR 206 1.4 0 0 on Delay	SB SBL y (sec/v	Approa SBT 374 3.7 180 5 eh)	231 0.8 247 6 2.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	EB EBL 39 36.6 126 9	Approa EBT	95 4.3 132 6	I-94 & WBL	45th St WBT	(N. Side	NBL NBL Int	Approa NBT 215 2.2 108 2 ersection	nach NBR 206 1.4 0 0 on Delay	SB SBL y (sec/v	Approa SBT 374 3.7 180 5 eh)	231 0.8 247 6 2.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	EB EBL 39 36.6 126 9 Node L	Approa EBT .ocation	95 4.3 132 6	I-94 & WBL WBL 644	45th St WBT WBT 45th St WBT O	(N. Side ach WBR	NBL NBL Int	Approx NBT 215 2.2 108 2 ersection NBT 227	ach NBR 206 1.4 0 0 on Delay ach NBR 26	SB SBL y (sec/v	Approa SBT 374 3.7 180 5 eh)	231 0.8 247 6 2.7 ach SBR 178
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EB EBL 39 36.6 126 9 Node L	Approa EBT .ocation	95 4.3 132 6	I-94 & WEL 644 38.4	45th St WBT WBT 45th St WBT 0	(N. Side ach WBR 849 9.9	NBL NBL Int	Approx NBT 215 2.2 108 2 ersection Approx NBT 227 6.8	nch NBR 206 1.4 0 0 on Delay ach NBR 26 0.2	SB SBL y (sec/v	Approa SBT 374 3.7 180 5 eh) Approa SBT 1041 12.8	231 0.8 247 6 2.7 ech SBR 178 5.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EB EBL 39 36.6 126 9 Node L	Approa EBT .ocation	95 4.3 132 6	I-94 & WBL WBL 644 38.4 637	45th St 3 Appro WBT 0 0.0	(N. Side ach WBR 849 9.9 101	NBL NBL Int	Approx NBT 215 2.2 108 2 ersection NBT 227 6.8 118	ach NBR 206 1.4 0 0 n Delay ach NBR 26 0.2 201	SB SBL y (sec/v	Approa SBT 374 3.7 180 5 eh) Approa SBT 1041 12.8 750	231 0.8 247 6 2.7 ach SBR 178 5.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EB EBL 39 36.6 126 9 Node L	Approa EBT .ocation	95 4.3 132 6	I-94 & WEL 644 38.4	45th St WBT WBT 45th St WBT 0	(N. Side ach WBR 849 9.9	NBL NBL	Approx NBT 215 2.2 108 2 ersection NBT 227 6.8 118 6	ach NBR 206 1.4 0 0 on Delay ach NBR 26 0.2 201 4	SB SBL y (sec/v SB SBL	Approa SBT 374 3.7 180 5 eh) Approa SBT 1041 12.8 750 91	231 0.8 247 6 2.7 ech SBR 178 5.0 750
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EB EBL 39 36.6 126 9 Node L EB EBL	Approa EBT ocation Approa EBT	95 4.3 132 6	I-94 & WBL 644 38.4 637 108	45th St B Appro WBT 0 0.0 0	(N. Side ach WBR 849 9.9 101 0	NBL NBL Int	Approx NBT 215 2.2 108 2 ersection NBT 227 6.8 118 6	ach NBR 206 1.4 0 0 on Delay ach NBR 26 0.2 201 4	SB SBL y (sec/v	Approa SBT 374 3.7 180 5 eh) Approa SBT 1041 12.8 750 91	231 0.8 247 6 2.7 ach SBR 178 5.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EB EBL 39 36.6 126 9 Node L EB EBL	.ocation Approa	95 4.3 132 6 ::	I-94 & WBL 644 38.4 637 108	45th St 3 Appro WBT 0 0.0 0 0 45th St	(N. Side ach WBR 849 9.9 101 0	NBL Inter	Approx NBT 215 2.2 108 2 ersection Approx NBT 227 6.8 118 6 ersection	ach NBR 206 1.4 0 0 on Delay ach NBR 26 0.2 201 4 on Delay	SB SBL y (sec/v SB SBL	Approa SBT 374 3.7 180 5 eh) Approa SBT 1041 12.8 750 91 eh)	sech SBR 231 0.8 247 6 2.7 6 2.7 SBR 178 5.0 750 91 12.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EB EBL 39 36.6 126 9 Node L EB EBL	Approa EBT ocation Approa ocation Approa	ech EBR 95 4.3 132 6 :: ech	I-94 & WBL 644 38.4 637 108	45th St 3 Appro WBT 0 0.0 0 0 45th St	(N. Side ach WBR 9.9 101 0 (S. Side ach	NBL Int	Approx NBT 215 2.2 108 2 ersection Approx 6.8 118 6 ersection	ach NBR 206 1.4 0 0 on Delay ach NBR 26 0.2 201 4 on Delay	SB SBL y (sec/v SB SBL	Approa SBT 374 3.7 180 5 eh) Approa 5BT 1041 12.8 750 91 eh)	ach SBR 231 0.8 247 6 2.7 ach SBR 178 5.0 750 91 12.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	EB EBL 39 36.6 126 9 Node L EB EBL Node L EB EBL	ocation Approa EBT ocation Approa EBT EBT	EBR 95 4.3 132 6 EBR EBR EBR	I-94 & WBL 644 38.4 637 108	45th St 3 Appro WBT 0 0.0 0 0 45th St	(N. Side ach WBR 849 9.9 101 0	NBL Inter	Approx NBT 215 2.2 108 2 ersection NBT 227 6.8 118 6 ersection	ach NBR 206 1.4 0 0 on Delay ach NBR 26 0.2 201 4 on Delay ach NBR	SB SBL y (sec/v SB SBL	Approa SBT 374 3.7 180 5 eh) Approa SBT 1041 12.8 750 91 eh)	ach SBR 231 0.8 247 6 2.7 ach SBR 178 5.0 750 91 12.0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	EB EBL S9 Node L EB EBL S87	Approa EBT ocation Approa EBT O	ech	I-94 & WBL 644 38.4 637 108	45th St 3 Appro WBT 0 0.0 0 0 45th St	(N. Side ach WBR 9.9 101 0 (S. Side ach	NBL Int	Approx NBT 215 2.2 108 2 ersection NBT 227 6.8 118 6 ersection NBT 165	ach NBR 206 1.4 0 0 on Delay ach NBR 26 0.2 201 4 on Delay ach NBR 647	SB SBL y (sec/v SB SBL	Approa SBT 180 5 eh) Approa SBT 1041 12.8 750 91 eh) Approa SBT 932	ach SBR 231 0.8 247 6 2.7 6 2.7 SBR 178 5.0 750 91 12.0 sch SBR 750
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EB EBL 39 36.6 126 9 Node L EB EBL EBL 87 30.7	ocation Approa EBT ocation Approa EBT ocation Approa OCATION Approa	95 4.3 132 6 :: ech EBR 5 7.5	I-94 & WBL 644 38.4 637 108	45th St 3 Appro WBT 0 0.0 0 0 45th St	(N. Side ach WBR 9.9 101 0 (S. Side ach	NBL Int	Approx NBT 215 2.2 108 2 ersection NBT 227 6.8 118 6 ersection NBT 165 2.3	ach NBR 206 1.4 0 0 on Delay ach NBR 26 0.2 201 4 on Delay ach NBR 647 3.9	SB SBL y (sec/v SB SBL	Approa SBT 374 3.7 180 5 eh) Approa SBT 1041 12.8 750 91 eh) Approa SBT 1.9	sech SBR 231 0.8 247 6 2.7 sech SBR 178 5.0 750 91 12.0 sech SBR 750 3.5
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EB EBL 39 36.6 126 9 Node L EB EBL 87 30.7 163	ocation Approa EBT ocation Approa EBT ocation Approa EBT 0 0.0	EBR 95 4.3 132 6 EBR EBR EBR 5 7.5 63	I-94 & WBL 644 38.4 637 108	45th St 3 Appro WBT 0 0.0 0 0 45th St	(N. Side ach WBR 9.9 101 0 (S. Side ach	NBL Int	Approx NBT 215 2.2 108 2 ersection NBT 227 6.8 118 6 ersection NBT 227 6.8 118 6 ersection	ach NBR 206 1.4 0 0 on Delay ach NBR 26 0.2 201 4 on Delay ach NBR 647 3.9 245	SB SBL y (sec/v SB SBL	Approa SBT 374 3.7 180 5 eh) Approa SBT 1041 12.8 750 91 eh) Approa SBT 91 eh)	sch SBR 231 0.8 247 6 2.7 6 2.7 SBR 178 5.0 750 91 12.0 sch SBR 750 3.5 234
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EB EBL 39 36.6 126 9 Node L EB EBL EBL 87 30.7	ocation Approa EBT ocation Approa EBT ocation Approa OCATION Approa	95 4.3 132 6 :: ech EBR 5 7.5	I-94 & WBL 644 38.4 637 108	45th St 3 Appro WBT 0 0.0 0 0 45th St	(N. Side ach WBR 9.9 101 0 (S. Side ach	NBL Intel Intel Intel NBL	Approx NBT 215 2.2 108 2 ersection NBT 227 6.8 118 6 ersection NBT 165 2.3 245 14	ach NBR 206 1.4 0 0 on Delay ach NBR 26 0.2 201 4 on Delay ach NBR 647 3.9 245 14	SB SBL y (sec/v SB SBL	Approa SBT 180 5 eh) Approa SBT 1041 12.8 750 91 eh) Approa SBT 932 1.9 309 8	sech SBR 231 0.8 247 6 2.7 sech SBR 178 5.0 750 91 12.0 sech SBR 750 3.5

	Node L	.ocation	ı:	I-94 &	25th St	(N. Side	e)					
		Approa	ach		3 Appro	_		Approa			Approa	ich
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				150	0	199		436	266		1057	221
Delay Time/Veh. (s)				46.7	0.0	6.2		3.8	1.1		7.8	8.4
Max Queue (ft)				250	0	162		155	210		477	477
Avg. Queue (ft)				46	0	9		7	22		49	49
								ersectio	n Delay	y (sec/v	eh)	5.2
,	Node L	ocation.	ı:	I-94 &	25th St	(S. Side)					
	EB	Approa	ach		3 Appro	_		Approa		SB	Approa	ich
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	110	211	315	34	16	208	279	382	1	102	612	496
Delay Time/Veh. (s)	40.1	43.1	11.3	49.6	42.9	6.5	14.2	10.1	5.4	7.6	12.4	5.7
Max Queue (ft)	587	587	355	140	140	171	270	254	0	133	359	330
Avg. Queue (ft)	98	98	21	12	12	9	24	18	0	4	32	11
								ersectio	n Delay	y (sec/v	eh)	13.0
	Node L	ocation.) :	I-94 &	Univers	ity Dr (I						
		Approa			3 Appro			Approa			Approa	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				482		479		712	300		857	554
Delay Time/Veh. (s)				39.3		12.4		4.4	0.9		8.2	2.8
Max Queue (ft)				336		347		285	218		559	0
Avg. Queue (ft)				75		66		12	0		44	0
								ersectio	n Delay	y (sec/v	eh)	8.8
1		.ocation		_		ity Dr (S						
		Approa	ı		3 Appro	_		Approa			Approa	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	488		481					525	526		935	
Delay Time/Veh. (s)	39.2	1	13.0									404
Max Queue (ft)								6.8	0.7		10.6	1.2
			342					236	0		10.6 341	1.2 205
Avg. Queue (ft)								236 16	0		10.6 341 35	1.2 205 22
	75		342 56					236 16	0	y (sec/v	10.6 341 35	1.2 205
	75 Node L	ocation	342 56			-H75 (N	. Side)	236 16 ersectio	0 0 on Delay		10.6 341 35 eh)	1.2 205 22 10.4
	75 Node L EB	Approa	342 56 ::	WE	3 Appro	ach	. Side) NB	236 16 ersection	0 0 on Delay	SB	10.6 341 35 eh)	1.2 205 22 10.4
Avg. Queue (ft)	75 Node L		342 56	WBL	Appro WBT	ach WBR	. Side) NB NBL	236 16 ersection Approa	0 0 on Delay		10.6 341 35 eh) Approa	1.2 205 22 10.4 ach SBR
Avg. Queue (ft) Volume	75 Node L EB	Approa	342 56 ::	WBL 136	Appro WBT	wBR 237	. Side) NB NBL 472	236 16 ersection Approx NBT 1278	0 0 on Delay	SB	10.6 341 35 eh) Approa SBT 821	1.2 205 22 10.4 ach SBR 1040
Avg. Queue (ft) Volume Delay Time/Veh. (s)	75 Node L EB EBL	Approa	342 56 ::	WBL 136 30.8	Appro WBT 0	ach WBR 237 13.2	. Side) NB NBL 472 32.7	236 16 ersection Approx NBT 1278 9.4	0 0 on Delay	SB	10.6 341 35 eh) Approa SBT 821 46.9	1.2 205 22 10.4 ach SBR 1040 39.0
Volume Delay Time/Veh. (s) Max Queue (ft)	75 Node L EB EBL	Approa	342 56 ::	WBL 136 30.8 298	WBT 0 0.0	wBR 237 13.2 206	. Side) NB NBL 472 32.7 929	236 16 ersection Approx NBT 1278 9.4 794	0 0 on Delay	SB	10.6 341 35 eh) Approa SBT 821 46.9 2000	1.2 205 22 10.4 ech SBR 1040 39.0 2153
Avg. Queue (ft) Volume Delay Time/Veh. (s)	75 Node L EB EBL	Approa	342 56 ::	WBL 136 30.8	Appro WBT 0	ach WBR 237 13.2	. Side) NBL 472 32.7 929 182	236 16 ersection Approx NBT 1278 9.4 794 72	0 0 on Delay ach NBR	SB SBL	10.6 341 35 eh) Approa SBT 821 46.9 2000 467	1.2 205 22 10.4 sch SBR 1040 39.0 2153 609
Volume Delay Time/Veh. (s) Max Queue (ft)	75 Node L EB EBL	Approa EBT	342 56 :: ach EBR	WBL 136 30.8 298 43	WBT 0 0.0 0	wBR 237 13.2 206 12	. Side) NBL 472 32.7 929 182 Int	236 16 ersection Approx NBT 1278 9.4 794 72	0 0 on Delay ach NBR	SB	10.6 341 35 eh) Approa SBT 821 46.9 2000 467	1.2 205 22 10.4 ech SBR 1040 39.0 2153
Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL Node L	Approa EBT	342 56 :: ach EBR	WBL 136 30.8 298 43	3 Appro WBT 0 0.0 0	wBR 237 13.2 206 12 TH75 (S.	. Side) NBL 472 32.7 929 182 Int Side)	236 16 ersection Approx NBT 1278 9.4 794 72 ersection	0 0 on Delay ach NBR on Delay	SB SBL / (sec/v	10.6 341 35 eh) Approa SBT 821 46.9 2000 467 eh)	1.2 205 22 10.4 sch SBR 1040 39.0 2153 609 18.9
Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL Node L	Approa EBT ocation	342 56 :: ech EBR	WBL 136 30.8 298 43	3 Appro WBT 0 0.0 0 0 8th St/1	wBR 237 13.2 206 12 TH75 (S.	. Side) NBL 472 32.7 929 182 Int. Side) NB	Approa 9.4 794 72 ersection	0 0 on Delay ach NBR	SB SBL y (sec/v	10.6 341 35 eh) Approa 88T 821 46.9 2000 467 eh)	1.2 205 22 10.4 sch SBR 1040 39.0 2153 609 18.9
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL Node L EB EBL	Approa EBT	342 56 :: ach EBR	WBL 136 30.8 298 43	3 Appro WBT 0 0.0 0	wBR 237 13.2 206 12	. Side) NBL 472 32.7 929 182 Int Side)	236 16 ersection Approx NBT 1278 9.4 794 72 ersection Approx Approx NBT	0 0 on Delay ach NBR	SB SBL / (sec/v	10.6 341 35 eh) Approa 821 46.9 2000 467 eh)	1.2 205 22 10.4 sch SBR 1040 39.0 2153 609 18.9
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EB EBL Node L EB EBL 989	Approa EBT ocation	342 56 :: ech EBR 923	WBL 136 30.8 298 43	3 Appro WBT 0 0.0 0 0 8th St/1	wBR 237 13.2 206 12 TH75 (S.	. Side) NBL 472 32.7 929 182 Int. Side) NB	Approa NBT 1278 9.4 794 72 ersection NBT Approa	0 0 on Delay ach NBR on Delay	SB SBL y (sec/v	10.6 341 35 eh) Approa 821 46.9 2000 467 eh) Approa SBT 774	1.2 205 22 10.4 sch SBR 1040 39.0 2153 609 18.9
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EB EBL Node L EB EBL 989 31.1	Approa EBT ocation	342 56 :: ach EBR :: ach EBR 923 58.9	WBL 136 30.8 298 43	3 Appro WBT 0 0.0 0 0 8th St/1	wBR 237 13.2 206 12 TH75 (S.	. Side) NBL 472 32.7 929 182 Int. Side) NB	Approa NBT 1278 9.4 794 72 ersection Approa NBT 764 49.7	0 0 on Delay ach NBR 74 4.8	SB SBL / (sec/v	10.6 341 35 eh) Approa 881 46.9 2000 467 eh) Approa 8BT 774 23.7	1.2 205 22 10.4 sch SBR 1040 39.0 2153 609 18.9
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	75 Node L EB Node L EB EBL 989 31.1 1878	Approa EBT ocation	342 56 :: ech EBR 923 58.9 5647	WBL 136 30.8 298 43	3 Appro WBT 0 0.0 0 0 8th St/1	wBR 237 13.2 206 12 TH75 (S.	. Side) NBL 472 32.7 929 182 Int. Side) NB	236 16 ersection Approx NBT 1278 9.4 794 72 ersection Approx NBT 764 49.7 729	on Delay ach NBR Ach NBR 74 4.8 116	SB SBL SBL 185 48.1 370	10.6 341 35 eh) Approa 821 46.9 2000 467 eh) Approa SBT 774 23.7 520	1.2 205 22 10.4 SBR 1040 39.0 2153 609 18.9
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	75 Node L EB Node L EB EBL 989 31.1 1878	Approa EBT ocation	342 56 :: ach EBR :: ach EBR 923 58.9	WBL 136 30.8 298 43	3 Appro WBT 0 0.0 0 0 8th St/1	wBR 237 13.2 206 12 TH75 (S.	. Side) NBL 472 32.7 929 182 Int. Side) NBL	236 16 ersection Approa NBT 1278 9.4 794 72 ersection Approa NBT 764 49.7 729 217	on Delay on Delay on Delay ach NBR 74 4.8 116 2	SB SBL / (sec/v	10.6 341 35 eh) Approa SBT 821 46.9 2000 467 eh) Approa SBT 774 23.7 520 81	1.2 205 22 10.4 sch SBR 1040 39.0 2153 609 18.9

Avg. Queue (ft)

2015 PM Peak - Ramp 1	Cillinia	II Data										
	Node L	ocation	ı :	I-94 &	20th St	(N. Side	<u>e)</u>					
	EB	Approa	ach	WE	3 Appro	ach	NB	Appro	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				123	10	15	334	541	65	14	230	533
Delay Time/Veh. (s)				6.5	1.7	4.9	9.0	1.0	1.1	12.1	6.5	15.5
Max Queue (ft)				118	118	118	180	180	180	193	193	193
Avg. Queue (ft)				0	0	0	32	32	32	6	6	6 7.0
		ocation						ersectio	y (sec/v	(sec/veh)		
			st (S. Side)									
	EB Approach				3 Appro			Appro			Approa	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	472		502					466			241	
Delay Time/Veh. (s)			9.3					15.4			16.8	
Max Queue (ft)			369					501			303	
Avg. Queue (ft)	45		27				1.1	60		11	30	45.0
					241 61	/N. 6: 1		ersectio	on Delay	y (sec/v	en)	15.9
Node Location: I-94 & 34th St (N. Side)												
		Approa			Appro			Appro			Approa	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				33		42		336	140	237	171	
Delay Time/Veh. (s)				14.4		5.4		0.3	6.8	1.2	4.4	
Max Queue (ft) Avg. Queue (ft)				119 3		0		220 22	194 5	119 0	119 3	
Avg. Queue (It)	3		U			_		_	2.4			
Intersection Delay Node Location: I-94 & 34th St (S. Side)											71	
	Node I	ocation	1.	I-94 &	34th St	(S. Side		ersectio	ni Dela	y (sec/v	en)	2.1
						•)					
	EB	Approa	ach	WE	3 Appro	ach) NB	Appro	ach	SB	Approa	ach
Volume				WBL		ach WBR)	Approa NBT		SB SBL	Approa SBT	
	EB	Approa	ach	WE	3 Appro	ach) NB	Appro	ach NBR	SB	Approa	ach
Delay Time/Veh. (s)	EBL	Approa	ach	WBL 187	3 Appro	ach WBR 243) NB	Approx NBT 233	ach NBR 77	SB SBL 24	Approa SBT 180 6.3	ach
	EBL	Approa	ach	WBL 187 56.8	3 Appro	ach WBR 243 7.1) NB	Approx NBT 233 11.8	nch NBR 77 2.2	SB SBL 24 58.9	Approa SBT 180	ach
Delay Time/Veh. (s) Max Queue (ft)	EBL	Approa	ach	WBL 187 56.8 284	3 Appro	ach WBR 243 7.1 284) NBL	Approx NBT 233 11.8 168 10	nsch NBR 77 2.2 107 2	SB SBL 24 58.9 130	Approa SBT 180 6.3 130	ach
Delay Time/Veh. (s) Max Queue (ft)	EBL	Approa	EBR	WBL 187 56.8 284 58	Appro WBT	ach WBR 243 7.1 284	NBL	Approx NBT 233 11.8 168 10	nsch NBR 77 2.2 107 2	SB SBL 24 58.9 130	Approa SBT 180 6.3 130	ach SBR
Delay Time/Veh. (s) Max Queue (ft)	EB EBL Node L	Approa EBT	EBR	WBL 187 56.8 284 58	Appro WBT	ach WBR 243 7.1 284 58) NBL NBL Int	Approx NBT 233 11.8 168 10	nach NBR 77 2.2 107 2 on Delay	SB SBL 24 58.9 130 11 y (sec/v	Approa SBT 180 6.3 130	sch SBR 17.6
Delay Time/Veh. (s) Max Queue (ft)	EB EBL Node L	Approa EBT	EBR	WBL 187 56.8 284 58	Appro WBT	ach WBR 243 7.1 284 58) NBL NBL Int	NBT 233 11.8 168 10 ersection	nach NBR 77 2.2 107 2 on Delay	SB SBL 24 58.9 130 11 y (sec/v	Approa SBT 180 6.3 130 11 eh)	sch SBR 17.6
Delay Time/Veh. (s) Max Queue (ft)	EB EBL Node L	Approa EBT ocation Approa	EBR	WBL 187 56.8 284 58 I-94 &	MN 336	wBR 243 7.1 284 58 (N. Sidach) NBL Inte	Approx NBT 233 11.8 168 10 ersection	nach NBR 77 2.2 107 2 on Delay	SB SBL 24 58.9 130 11 y (sec/v	Approa SBT 180 6.3 130 11 eh)	ach SBR 17.6
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EB EBL Node L	Approa EBT ocation Approa	EBR	WBL 187 56.8 284 58 I-94 & WBL 23 7.9	MN 336 Appro	ach WBR 243 7.1 284 58 6 (N. Sidach WBR) NBL Int e) NBL	Approa NBT 233 11.8 168 10 ersection	nach NBR 77 2.2 107 2 on Delay	SB SBL 24 58.9 130 11 y (sec/v	Approa SBT 180 6.3 130 11 eh)	ach SBR 17.6
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EBL Node L EB EBL	Approa EBT ocation Approa	EBR	WBL 187 56.8 284 58 I-94 & WBL 23 7.9 119	MN 336 3 Appro WBT 0 0.0	ach WBR 243 7.1 284 58 6 (N. Sid ach WBR 59 7.2 119) NBL Int e) NBL 30 0.6 0	Approx NBT 233 11.8 168 10 ersection Approx NBT 446 0.2 0	nach NBR 77 2.2 107 2 on Delay	SB SBL 24 58.9 130 11 y (sec/v	Approa SBT 180 6.3 130 11 eh) Approa SBT 121 0.7 0	17.6 SBR 292 1.5 0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EBL Node L EB EBL	Approa EBT ocation Approa	EBR	WBL 187 56.8 284 58 I-94 & WBL 23 7.9	MN 336 3 Appro WBT 0 0.0	243 7.1 284 58 6 (N. Sid ach WBR 59 7.2) NBL Int e) NBL 30 0.6 0	Approx NBT 233 11.8 168 10 ersection NBT 446 0.2 0	non Delay	SB SBL 24 58.9 130 11 y (sec/v SB SBL	Approa SBT 121 0.7 0	17.6 SBR 292 1.5 0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node LEBL	ocation Approa EBT	ech EBR :: ach EBR	WBL 187 56.8 284 58 I-94 & WBL 23 7.9 119 3	MN 336 3 Appro WBT 0 0.0 0	ach WBR 243 7.1 284 58 6 (N. Sidach WBR 59 7.2 119 3)	Approx NBT 233 11.8 168 10 ersection NBT 446 0.2 0	non Delay	SB SBL 24 58.9 130 11 y (sec/v	Approa SBT 121 0.7 0	17.6 SBR 292 1.5 0
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	ocation Approa EBT	EBR EBR EBR	WE WBL 187 56.8 284 58 I-94 & WE WBL 23 7.9 119 3	MN 336 3 Appro WBT 0 0.0 0 0	ach WBR 243 7.1 284 58 6 (N. Sid ach WBR 59 7.2 119 3) NBL Int e) NBL 30 0.6 0 Int e)	Approx NBT 233 11.8 168 10 ersection NBT 446 0.2 0 0 ersection	ach NBR 77 2.2 107 2 on Delay ach NBR	SB SBL 24 58.9 130 11 (sec/v SB SBL SBL SBL SBL SBL SBL SBL SBL SBL	Approa SBT 121 0.7 0 0 eh)	17.6 SBR 292 1.5 0 1.2
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB Node L EB EBL	ocation Approa EBT ocation Approa	EBR EBR EBR Each	WE WBL 187 56.8 284 58 I-94 & WE WBL 23 7.9 119 3 I-94 & WE	MN 336 WBT MN 336 Appro 0 0 0 0 MN 336 Appro	ach WBR 243 7.1 284 58 6 (N. Sid ach WBR 59 7.2 119 3 6 (S. Sid ach) NBL Int e) NBL 30 0.6 0 Int e) NB	Approx NBT 233 11.8 168 10 ersection NBT 446 0.2 0 0 ersection	ach NBR 77 2.2 107 2 on Delay ach NBR	SB SBL 24 58.9 130 11 (sec/v SB SBL SBL SBL SBL SBL SBL SBL SBL SBL	Approa SBT 121 0.7 0 0 eh)	17.6 17.6 SBR 292 1.5 0 0 1.2
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL	ocation Approa EBT	EBR EBR EBR	WE WBL 187 56.8 284 58 I-94 & WBL 23 7.9 119 3 I-94 & WE WBL	MN 336 3 Appro WBT 0 0.0 0 0	ach WBR 243 7.1 284 58 6 (N. Sid ach WBR 59 7.2 119 3 6 (S. Sid ach WBR) NBL Int e) NBL 30 0.6 0 Int e)	Approx NBT 233 11.8 168 10 ersection NBT 446 0.2 0 0 ersection	ach NBR 77 2.2 107 2 on Delay ach NBR On Delay	SB SBL 24 58.9 130 11 y (sec/v SB SBL SBL SBL SBL SBL SBL SBL SBL SBL	Approa SBT 121 0.7 0 0 eh)	17.6 SBR 292 1.5 0 1.2
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EB Node L EB EBL	ocation Approa EBT ocation Approa	EBR EBR EBR Each	WE WBL 187 56.8 284 58 I-94 & WE WBL 23 7.9 119 3 I-94 & WE WBL 25	MN 336 WBT MN 336 Appro 0 0 0 0 MN 336 Appro	ach WBR 243 7.1 284 58 6 (N. Side ach WBR 59 7.2 119 3 6 (S. Side ach WBR 413) NBL Int e) NBL 30 0.6 0 Int e) NB	Approx 11.8 168 10 ersection Approx NBT 446 0.2 0 0 ersection Approx NBT 446 0.2 0 NBT 446 0.2 0 0 ersection	ach NBR 77 2.2 107 2 on Delay ach NBR NBR NBR 11	SB SBL 24 58.9 130 11 (sec/v SB SBL SBL SBL SBL SBL SBL SBL SBL SBL	Approa SBT 121 0.7 0 0 eh) Approa SBT 62	17.6 17.6 SBR 292 1.5 0 0 1.2
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB Node L EB EBL	ocation Approa EBT ocation Approa	EBR EBR EBR Each	WE WBL 187 56.8 284 58 I-94 & WBL 23 7.9 119 3 I-94 & WE WBL	MN 336 WBT MN 336 Appro 0 0 0 0 MN 336 Appro	ach WBR 243 7.1 284 58 6 (N. Sid ach WBR 59 7.2 119 3 6 (S. Sid ach WBR) NBL Int e) NBL 30 0.6 0 Int e) NB	Approx NBT 233 11.8 168 10 ersection NBT 446 0.2 0 0 ersection	ach NBR 77 2.2 107 2 on Delay ach NBR On Delay	SB SBL 24 58.9 130 11 y (sec/v SB SBL SBL SBL SBL SBL SBL SBL SBL SBL	Approa SBT 121 0.7 0 0 eh)	17.6 17.6 SBR 292 1.5 0 0 1.2

0

Intersection Delay (sec/veh)

	Node L	ocation	ı:	I-29 &	CR 20 (\	W. Side)						
	EB Approach			WE	3 Appro	ach	NB	Approa	ach	SB Approa		ach	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Volume		301	70	113	145					104		93	
Delay Time/Veh. (s)		0.8	1.7	1.4	1.1					10.3		6.8	
Max Queue (ft)		0	0	40	40					141		141	
Avg. Queue (ft)		0	0	0	0					1		1	
							Intersection Delay (sec/veh)					2.9	
	Node L	Location: I-29 & CR 20 (E. Side)											
	EB	Approa	ach	WE	3 Appro	ach	NB	NB Approach		SB Approa		ach	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Volume	182	222			174	122	84		156				
Delay Time/Veh. (s)	1.2	1.5			0.8	2.3	12.1		10.1				
Max Queue (ft)	44	44			0	0	199		199				
Avg. Queue (ft)	0	0			0	0	5		5				
					ı		Int	ersectio	n Delay	/ (sec/v	eh)	3.8	
	Node L	ocation	ı :	I-29 &	19 Ave	N (W. S	ide)				•		
	EB	Approa	ach	_	3 Appro			Approa	ach	SB	ach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Volume	47	334			477	509				182		3	
Delay Time/Veh. (s)	2.8	5.0			5.5	2.0				12.3		1.3	
Max Queue (ft)	0	150			196	253				186		0	
Avg. Queue (ft)	0	7			10	1				15		0	
3							Int	ersectio	n Delay	/ (sec/v	eh)	5.0	
	Node Location: I-29 & 19 Ave N (E. Side)								, , , ,				
	Node L	ocation	ı:	I-29 &	19 Ave	N (E. Sid	de)						
								Approa	ach	SB	Approa	ach	
		ocation Approa EBT			19 Ave 3 Appro WBT			Approa	ach NBR	SB SBL	Approa SBT	nch SBR	
Volume	EB	Approa EBT	ech EBR	WE	Appro WBT	ach WBR	NBL	1	NBR				
Volume Delay Time/Veh. (s)	EB	Approa EBT 513	ech EBR 3	WE	Appro WBT 935	ach WBR 330	NBL 51	1	NBR 314				
Delay Time/Veh. (s)	EBL	Approa EBT 513 5.6	EBR 3 0.2	WE	Appro WBT 935 6.1	ach WBR 330 1.6	NBL 51 19.3	1	NBR 314 6.8				
Delay Time/Veh. (s) Max Queue (ft)	EBL	Approa EBT 513 5.6 167	EBR 3 0.2 194	WE	935 6.1 279	ach WBR 330 1.6	NBL 51 19.3 127	1	NBR 314				
Delay Time/Veh. (s)	EBL	Approa EBT 513 5.6	EBR 3 0.2	WE	Appro WBT 935 6.1	ach WBR 330 1.6	NBL 51 19.3 127	NBT	NBR 314 6.8 148 14	SBL	SBT	SBR	
Delay Time/Veh. (s) Max Queue (ft)	EBL	Approa EBT 513 5.6 167 10	BR 3 0.2 194 8	WBL	935 6.1 279 26	wbr 330 1.6 0	NBL 51 19.3 127 6	NBT	NBR 314 6.8 148 14		SBT		
Delay Time/Veh. (s) Max Queue (ft)	EB EBL Node L	Approa EBT 513 5.6 167 10	ech EBR 3 0.2 194 8	WBL WBL	935 6.1 279 26	330 1.6 0	NBL 51 19.3 127 6 Int	NBT ersection	NBR 314 6.8 148 14 on Delay	SBL / (sec/v	SBT eh)	5.7	
Delay Time/Veh. (s) Max Queue (ft)	EBL EBL Node L	Approa EBT 513 5.6 167 10 ocation	BBR 3 0.2 194 8	WEL I-29 & WE	935 6.1 279 26 12th Av	wBR 330 1.6 0 0	NBL 51 19.3 127 6 Int Side)	NBT ersection	NBR 314 6.8 148 14 on Delay	SBL / (sec/v	SBT eh)	SBR 5.7	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	EB EBL Node L	Approa EBT 513 5.6 167 10 ocation Approa	8 194 8 3 0.2 194 8	WBL WBL	Appro WBT 935 6.1 279 26 12th Av Appro WBT	wBR 330 1.6 0 0 ee N (Waach	NBL 51 19.3 127 6 Int	NBT ersection	NBR 314 6.8 148 14 on Delay	SBL / (sec/v	SBT eh)	5.7 ach SBR	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	EBL EBL Node L	Approa EBT 513 5.6 167 10 ocation Approa EBT 286	8 3 0.2 194 8 :: ach EBR 559	WEL I-29 & WE	935 6.1 279 26 12th Av 3 Appro WBT 451	ach WBR 330 1.6 0 0 ee N (Waach WBR 667	NBL 51 19.3 127 6 Int Side)	NBT ersection	NBR 314 6.8 148 14 on Delay	SBL SBL SBL 112	SBT eh)	5.7 ach SBR 31	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EBL Node L EB EBL	Approa EBT 513 5.6 167 10 ocation Approa EBT 286 2.5	8 194 8 3 0.2 194 8 : ach EBR 559	WEL I-29 & WE	935 6.1 279 26 12th Av 3 Appro WBT 451 2.1	ach WBR 330 1.6 0 0 e N (W.ach WBR 667 2.1	NBL 51 19.3 127 6 Int Side)	NBT ersection	NBR 314 6.8 148 14 on Delay	SBL / (sec/v SB SBL 112 33.5	SBT eh)	5.7 sch SBR 31 1.5	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	EBL Node L EB EBL	Approa EBT 10 coation Approa EBT 286 2.5 135	8 3 0.2 194 8 :: ach EBR 559 1.8	WEL I-29 & WE	935 6.1 279 26 12th Av 3 Appro WBT 451 2.1 175	ach WBR 330 1.6 0 0 e N (Wach WBR 667 2.1 190	NBL 51 19.3 127 6 Int Side)	NBT ersection	NBR 314 6.8 148 14 on Delay	SBL / (sec/vi	SBT eh)	5.7 5.7 ach SBR 31 1.5	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	EBL Node L EB EBL	Approa EBT 513 5.6 167 10 ocation Approa EBT 286 2.5	8 194 8 3 0.2 194 8 : ach EBR 559	WEL I-29 & WE	935 6.1 279 26 12th Av 3 Appro WBT 451 2.1	ach WBR 330 1.6 0 0 e N (W.ach WBR 667 2.1	NBL 51 19.3 127 6 Int Side) NBL	ersection NBT	NBR 314 6.8 148 14 on Delay ach NBR	SBL / (sec/vi	eh) Approa	5.7 SBR 31 1.5 133	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	Approa EBT 513 5.6 167 10 cocation Approa EBT 286 2.5 135 3	EBR 3 0.2 194 8 :: ach EBR 559 1.8 0	I-29 & WBL	3 Appro WBT 935 6.1 279 26 12th Av 3 Appro WBT 451 2.1 175 4	ach WBR 330 1.6 0 0 ee N (Waach WBR 667 2.1 190 1	NBL 51 19.3 127 6 Int Side) NBL	ersection NBT	NBR 314 6.8 148 14 on Delay ach NBR	SBL / (sec/vi	eh) Approa	5.7 5.7 ach SBR 31 1.5	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	Approa EBT 513 5.6 167 10 ocation Approa EBT 286 2.5 135 3	8 3 0.2 194 8 : ach EBR 559 1.8 0	I-29 & WBL	3 Appro WBT 935 6.1 279 26 12th Av 3 Appro WBT 451 2.1 175 4	ach WBR 330 1.6 0 0 e N (W.ach WBR 667 2.1 190 1	NBL 51 19.3 127 6 Int Side) NBL	ersection NBT NBT	NBR 314 6.8 148 14 on Delay ach NBR on Delay	SBL / (sec/vi SB SBL 112 33.5 179 25 / (sec/vi	eh) Approa SBT	5.7 SBR 31 1.5 133 1 3.7	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EBL Node L EBL	Approa EBT 513 5.6 167 10 ocation Approa EBT 286 2.5 135 3	EBR 3 0.2 194 8 :: ach EBR 559 1.8 0 0	I-29 & WBL	3 Appro WBT 935 6.1 279 26 12th Av 3 Appro WBT 451 2.1 175 4	ach WBR 330 1.6 0 0 ee N (W. ach WBR 667 2.1 190 1	NBL 51 19.3 127 6 Int Side) Int Side) NBL	ersection NBT ersection Approx	NBR 314 6.8 148 14 on Delay ach NBR on Delay	SBL / (sec/v) SB SBL 112 33.5 179 25 / (sec/v) SB	eh) Approa	5.7 5.7 SBR 31 1.5 133 1 3.7	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL	Approa EBT 513 5.6 167 10 ocation Approa EBT 2.5 135 3 ocation Approa EBT	8 3 0.2 194 8 :: ach EBR 559 1.8 0 0 :: ach EBR	I-29 & WBL	3 Appro WBT 935 6.1 279 26 12th Av 3 Appro WBT 451 2.1 175 4 12th Av 3 Appro WBT	ach WBR 330 1.6 0 0 e N (W. ach WBR 667 2.1 190 1 e N (E. ach WBR	NBL 51 19.3 127 6 Int Side) NBL Int Side) NBL NBL	ersection NBT NBT	NBR 314 6.8 148 14 on Delay ach NBR On Delay	SBL / (sec/vi SB SBL 112 33.5 179 25 / (sec/vi	eh) Approa SBT	5.7 SBR 31 1.5 133 1 3.7	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EBL Node L EBL	Approa EBT 513 5.6 167 10 ocation Approa EBT 286 2.5 135 3 ocation Approa EBT 352	EBR 3 0.2 194 8 :: ach EBR 559 1.8 0 0 :: ach EBR 46	I-29 & WBL	3 Appro WBT 935 6.1 279 26 12th Av 3 Appro WBT 451 2.1 175 4 12th Av 3 Appro WBT 8 Appro	ach WBR 330 1.6 0 0 e N (Wach WBR 667 2.1 190 1 e N (E. ach WBR 158	NBL 51 19.3 127 6 Int Side) NBL Int Side) NBL 299	ersection NBT ersection Approx	NBR 314 6.8 148 14 on Delay ach NBR on Delay ach NBR 509	SBL / (sec/v) SB SBL 112 33.5 179 25 / (sec/v) SB	eh) Approa	5.7 5.7 SBR 31 1.5 133 1 3.7	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EBL Node L EBL	Approa EBT 513 5.6 167 10 ocation Approa EBT 286 2.5 135 3 ocation Approa EBT 352 3.2	EBR 3 0.2 194 8 :: ach EBR 559 1.8 0 0 :: ach EBR 46 0.2	I-29 & WBL	3 Appro WBT 935 6.1 279 26 12th Av 3 Appro WBT 451 2.1 175 4 12th Av 3 Appro WBT 8 Appro WBT 8 Appro	ach WBR 330 1.6 0 0 e N (Wach WBR 667 2.1 190 1 e N (E. Sach WBR 158 1.0	NBL 51 19.3 127 6 Int Side) NBL Side) NBL Side) NBL 299 30.5	ersection NBT ersection Approx	NBR 314 6.8 148 14 on Delay ach NBR NBR NBR NBR 509 7.5	SBL / (sec/v) SB SBL 112 33.5 179 25 / (sec/v)	eh) Approa	5.7 5.7 SBR 31 1.5 133 1 3.7	
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EBL Node L EBL	Approa EBT 513 5.6 167 10 ocation Approa EBT 286 2.5 135 3 ocation Approa EBT 352	EBR 3 0.2 194 8 :: ach EBR 559 1.8 0 0 :: ach EBR 46	I-29 & WBL	3 Appro WBT 935 6.1 279 26 12th Av 3 Appro WBT 451 2.1 175 4 12th Av 3 Appro WBT 8 Appro	ach WBR 330 1.6 0 0 e N (Wach WBR 667 2.1 190 1 e N (E. ach WBR 158	NBL 51 19.3 127 6 Int Side) NBL Int Side) NBL 299	ersection NBT ersection Approx	NBR 314 6.8 148 14 on Delay ach NBR on Delay ach NBR 509	SBL / (sec/v) SB SBL 112 33.5 179 25 / (sec/v)	eh) Approa	5.7 5.7 SBR 31 1.5 133 1 3.7	

Intersection Delay (sec/veh)

Max Queue (ft)

Avg. Queue (ft)

296

13

293

19

232

11

0

0

299

47

309

5.9

Node Location: I-29 & Main Ave (W. Side) **EB** Approach WB Approach **NB** Approach SB Approach **EBL EBR** WBL **WBT WBR** NBL **NBT NBR** SBL **SBT SBR EBT** Volume 586 493 851 611 149 0 186 Delay Time/Veh. (s) 3.4 2.4 42.0 0.0 4.9 2.1 6.1 Max Queue (ft) 245 245 156 239 175 0 157 Avg. Queue (ft) 14 30 0 9 14 6 0 Intersection Delay (sec/veh) 5.2 I-29 & Main Ave (E. Side) Node Location: WB Approach EB Approach **NB** Approach SB Approach **EBL EBT EBR WBL WBT WBR NBL NBT NBR** SBL **SBT SBR** Volume 634 107 1257 190 203 0 389 Delay Time/Veh. (s) 2.2 0.3 4.3 6.0 42.7 0.0 6.7 Max Queue (ft) 274 309 347 347 197 179 0 Avg. Queue (ft) 7 3 26 26 37 0 16 6.9 Intersection Delay (sec/veh) I-29 & 38th St Node Location: **EB** Approach WB Approach **NB** Approach SB Approach **EBL** WBL **WBR** NBL **SBL EBT EBR WBT NBT** NBR SBT SBR Volume 411 0 18 0 71 592 309 67 Delay Time/Veh. (s) 15.2 0.0 4.3 0.0 5.2 6.2 7.8 4.9 Max Queue (ft) 123 267 233 233 182 0 101 0 Avg. Queue (ft) 27 15 15 Intersection Delay (sec/veh) 8.7 I-29 & 13th Ave S (E. Side) Node Location: **EB** Approach WB Approach NB Approach SB Approach **EBL EBT EBR WBL** WBT **WBR NBL NBT NBR** SBL **SBT SBR** Volume 35 1048 304 960 279 419 238 453 Delay Time/Veh. (s) 50.4 7.8 0.4 14.2 5.6 39.0 49.2 11.8 Max Queue (ft) 126 298 393 353 352 356 165 0 Avg. Queue (ft) 10 26 53 88 86 86 Intersection Delay (sec/veh) 15.7 I-29 & 32nd Ave S (W. Side) Node Location: **EB** Approach WB Approach **NB** Approach SB Approach **SBR EBL EBT EBR WBL WBT WBR NBL** NBT **NBR** SBL **SBT** 244 Volume 771 313 665 397 386 Delay Time/Veh. (s) 14.8 8.7 3.4 40.2 5.2 40.2 Max Queue (ft) 347 277 0 367 243 281 Avg. Queue (ft) 48 69 13 40 65 Intersection Delay (sec/veh) 16.2 Node Location: I-29 & 32nd Ave S (E. Side) EB Approach WB Approach **NB** Approach SB Approach **EBL EBT EBR WBL WBT WBR** NBL **NBT NBR** SBL **SBT SBR** Volume 955 219 735 800 167 310 Delay Time/Veh. (s) 3.4 1.2 4.5 2.2 38.8 12.1

2015 PM Peak - Ramp Terminal Data

Node Location: I-29 & 52nd Ave S (W. Side)

		EB Approach		WE	WB Approach			NB Approach			SB Approach		
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
	Volume		1052	186		613	89				579		543
	Delay Time/Veh. (s)		9.4	1.7		7.9	0.7				26.7		1.7
	Max Queue (ft)		254	254		186	266				299		14
	Avg. Queue (ft)		29	29		14	2				64		0
									ersectio	n Delay	i lsectvi	eh)	10.3

Node Location: I-29 & 52nd Ave S (E. Side)

	EB Approach			WE	3 Appro	ach	NB	Approach		SB Approa		nch
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		1113	517		576	451	127		107			
Delay Time/Veh. (s)		2.7	4.0		3.4	1.3	37.3		2.2			
Max Queue (ft)		260	238		161	161	216		0			
Avg. Queue (ft)		7	28		7	7	32		0			
							Int	ersectio	n Delay	/ (sec/v	eh)	4.4