NDSU Dept #2880 – PO Box 6050
Fargo, ND 58108-6050
Tel 701-231-8058 – Fax 701-231-6265
www.ugpti.org – www.atacenter.org

Interstate Operations Study: Fargo-Moorhead Metropolitan Area

2025 Simulation Results

Technical Memorandum IV

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Prepared for:
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(Metro COG)

Prepared by:
Advanced Traffic Analysis Center
Upper Great Plains Transportation Institute
North Dakota State University
Fargo, North Dakota

EXECUTIVE SUMMARY

This document provides the simulation results for the 2025 planning horizon of the Fargo-Moorhead Interstate Operations Study. Previous material focused on the simulation development process (Technical Memorandum I), the calibration process and the simulation results of the 2008 base cases (Technical Memorandum II), and the results of the 2015 simulation scenarios (Technical Memorandum III). Major sections of this document include the network modifications, traffic demand, and simulation results for the 2025 peak-hour scenarios. Based on the simulation output, the proposed near-term (by 2015) and long-term improvements (by 2025) reduced congestion at several areas within the study area during the peak periods.

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 traffic simulation program.

The freeway mainline densities that experienced congestion were generally along I-94 between I-29 and 20th St. (Moorhead, MN). The highest density values for the 2025 AM scenario were along the westbound sections of I-94 from 20th St. (Moorhead, MN) to I-29, which exhibited densities between 29 pc/mi/ln to 35 pc/mi/ln (LOS D-E). For the 2025 PM scenario, the highest density values were along the eastbound sections of I-94 from 25th St. (Fargo, ND) to 20th St. (Moorhead, MN) with densities ranging from 31 pc/mi/ln to 34 pc/mi/ln (LOS D).

The I-29 & I-94 Interchange experienced a significant number of vehicles during the peak periods; however, significant congestion did not developed at any of the ramps. Modifying the tri-level ramp and merge area (2025 network) alleviated the congestion that developed during the PM peak period. During both the 2008 PM and the 2015 PM scenarios, the merge area experienced significant congestion, producing maximum queue lengths of 2,027 ft and 5,506 ft, respectively. Incorporating a two lane tri-level ramp and auxiliary lane between I-29 and 25th St. (Fargo, ND) significantly improved traffic flow through the merge area.

The geometric improvements that are proposed by 2025 at several freeway interchanges significantly reduced congestion that was evident in previous scenarios. For both the 2025 AM and 2025 PM scenarios, the addition of the I-94 and 9th St. Interchange (2015 network) reduced congestion at the I-94 and Sheyenne St. Interchange and I-94 and 45th St. Interchange. The most influential improvement to this scenario (2025 network) related to the modified design of the I-94 & 8th St. (TH 75) Interchange, which significantly reduced congestion at the north ramp during the 2025 AM scenario and the south ramp during the 2025 PM scenario.

A few off-ramp and on-ramp locations showed signs of periodic congestion during the peak periods. Although no quantitative data were collected at these locations, the westbound traffic accessing the northeast loop of the I-29 and I-94 Interchange (AM peak), the eastbound on-ramp at 25th St. (PM peak), and the southbound on-ramp at Main Ave. (PM peak) experienced some congestion when observing the simulation animation.

To illustrate the affects of not incorporating the proposed 2025 network improvements, two additional scenarios were analyzed using the 2025 traffic on the 2015 network (2025/2015) During the AM and PM periods, significant congestion existed at the I-94 and 8th St. (TH 75) interchange. In addition, the PM peak period experienced significant congestion at the tri-level merge area. During the AM peak, the 2025/2015 scenario produced 47% more delay time compared to the 2025 network, while the PM peak using the 2025/2015 scenario produced 404% more delay compared to the 2025 PM scenario.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

OVERVIEW

This document provides the simulation results for the 2025 planning horizon of the Fargo-Moorhead Interstate Operations Study (F-M IOS). Previous material focused on the simulation development process (Technical Memorandum I), the calibration process and the simulation results of the 2008 base cases (Technical Memorandum II), and the results of the 2015 simulation scenarios (Technical Memorandum III). Major sections of this document include the network modifications, traffic demand, and simulation output for the 2025 peak-hour scenarios.

2025 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 provide numerical data and animation that will provide guidance on locations suffering from capacity deficiencies resulting from continued growth within the metropolitan area.

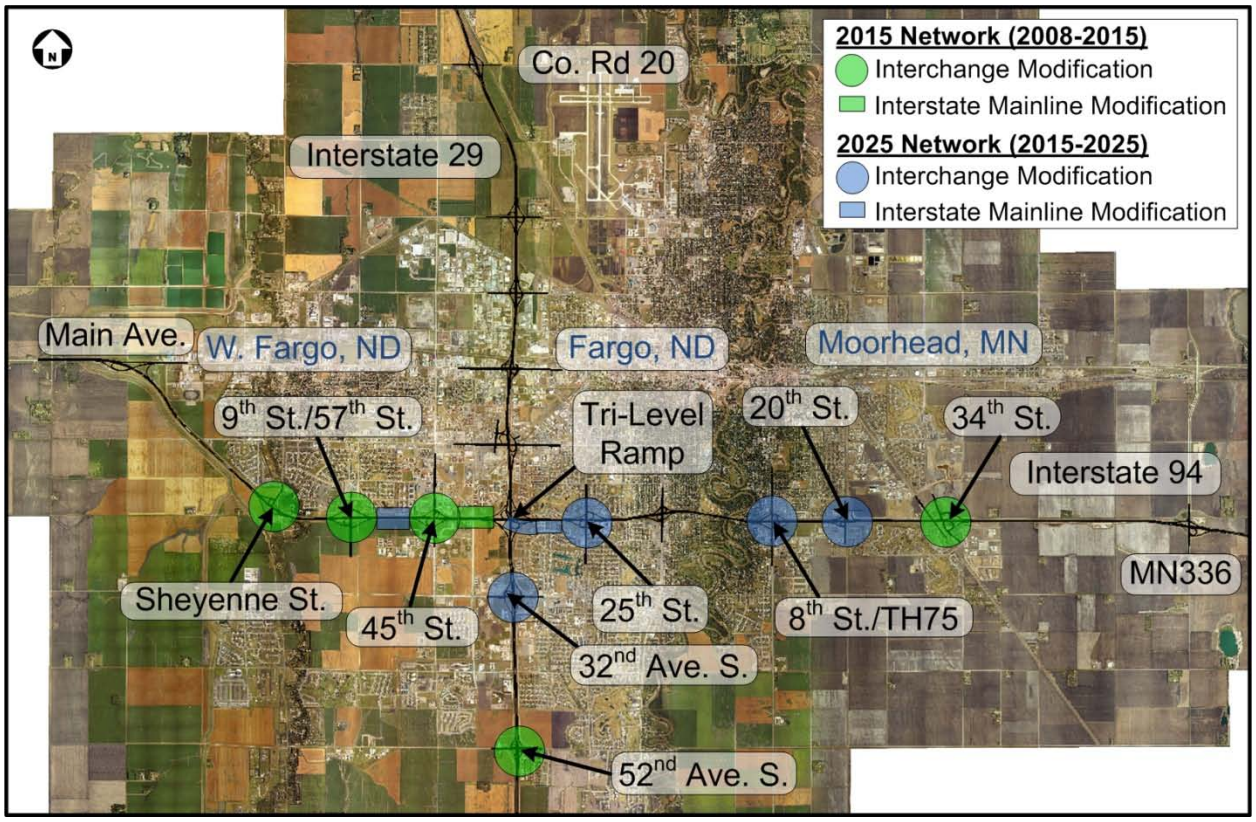


Figure 1. 2025 F-M IOS VISSIM network (changes from 2008 and 2015 networks are noted)

2025 NETWORK IMPROVEMENTS

Several interchanges and mainline sections were modified to reflect the proposed 2025 freeway conditions. These modifications were based on discussions among the Steering Committee and represent plausible network improvements. The 2008 and 2015 conditions are documented in Technical Memorandum II and Technical Memorandum III, respectively. Since the I-29 corridor within the metro area was reconstructed from 2001-2007, most of the geometric and traffic control modifications for the 2025 network occur along I-94.

Since this study focuses on 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 modifications from the 2015 network are provided in the following sections.

I-94 between 9th St. and 45th St.

- Updated Geometry: Auxiliary lanes for eastbound (#1) and westbound (#2) directions

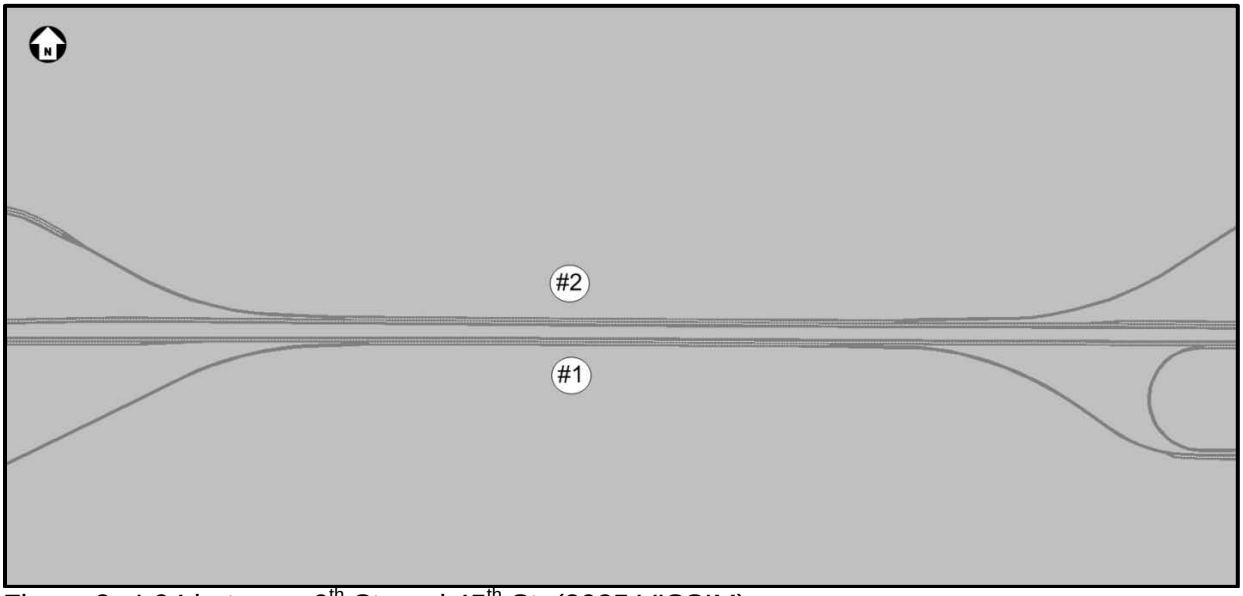


Figure 2. I-94 between 9th St. and 45th St. (2025 VISSIM)

Tri-Level Ramp Merge Area

- Updated Geometry: Two lane tri-level ramp (#1) and eastbound auxiliary lane between I-29 and 25th St. (#2)

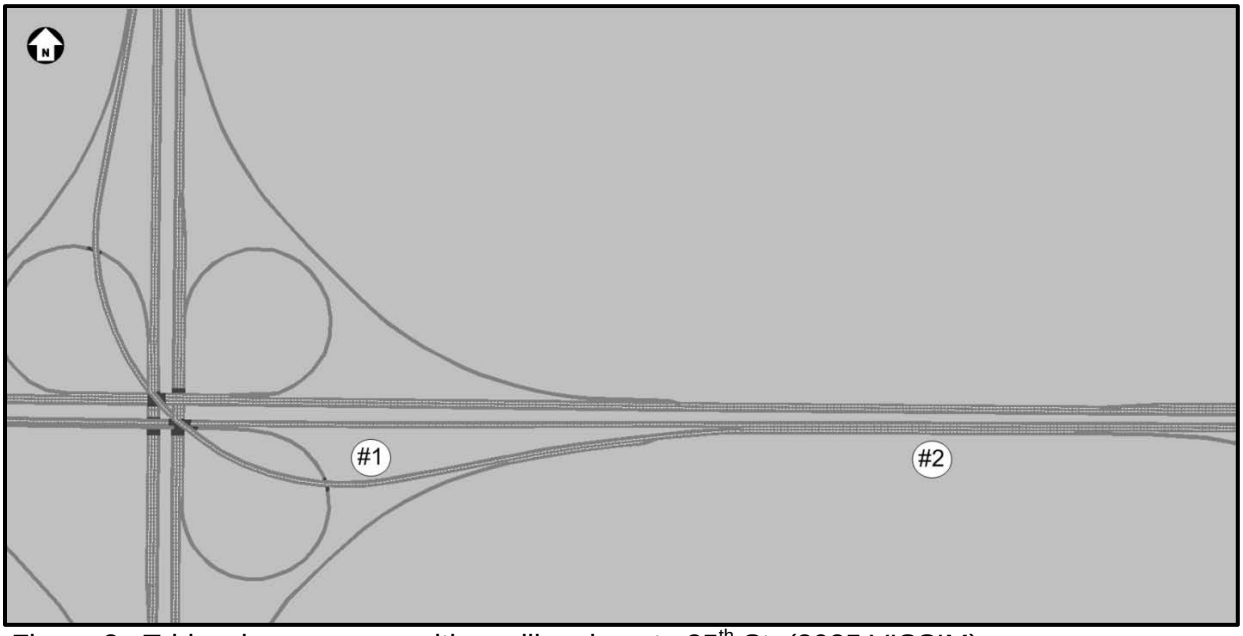


Figure 3. Tri-level merge area with auxiliary lane to 25th St. (2025 VISSIM)

I-94 & 25th St. Interchange (South Ramp)

- Updated/new Geometry: Eastbound on-ramp (#1), westbound/eastbound approaches (#2)
- Updated Traffic Control: Signal phasing/timing (removed northbound left-turn phase)

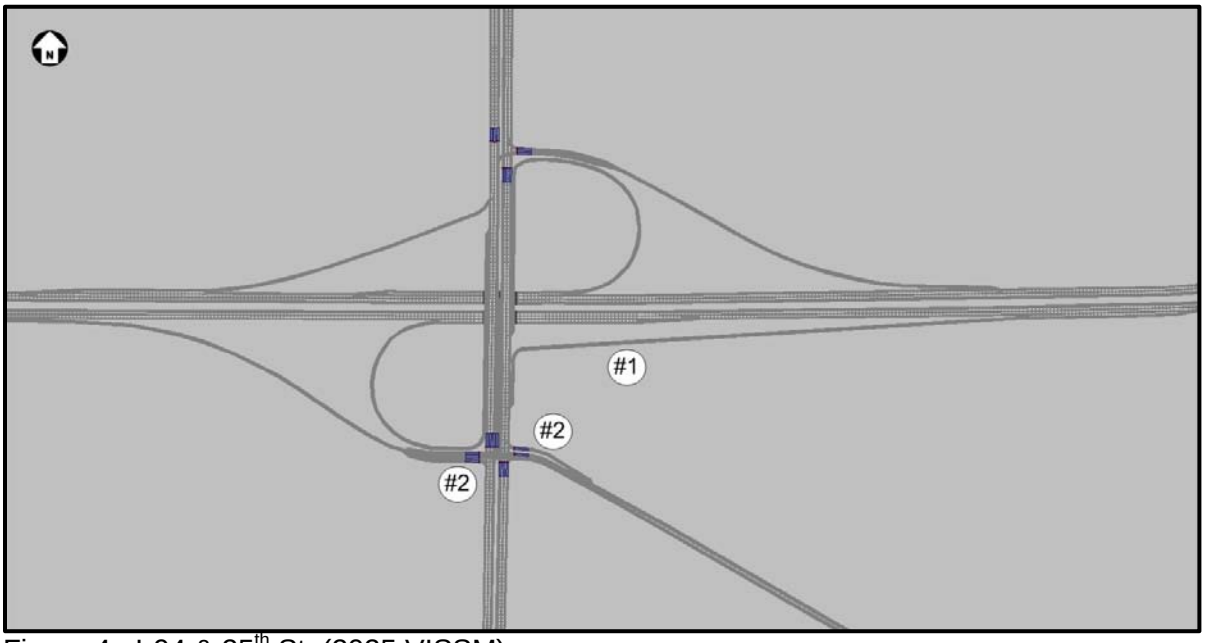


Figure 4. I-94 & 25th St. (2025 VISSM)

I-94 & 8th St. (TH 75) Interchange

- Updated/new Geometry: Eastbound off-ramp (#1), southeast loop ramp (#2), northeast loop ramp (#3), 8th St. northbound between loop ramps (#4)
- Updated/new Traffic Control: Signal phasing/timing (removed north ramp's northbound left-turn phase)

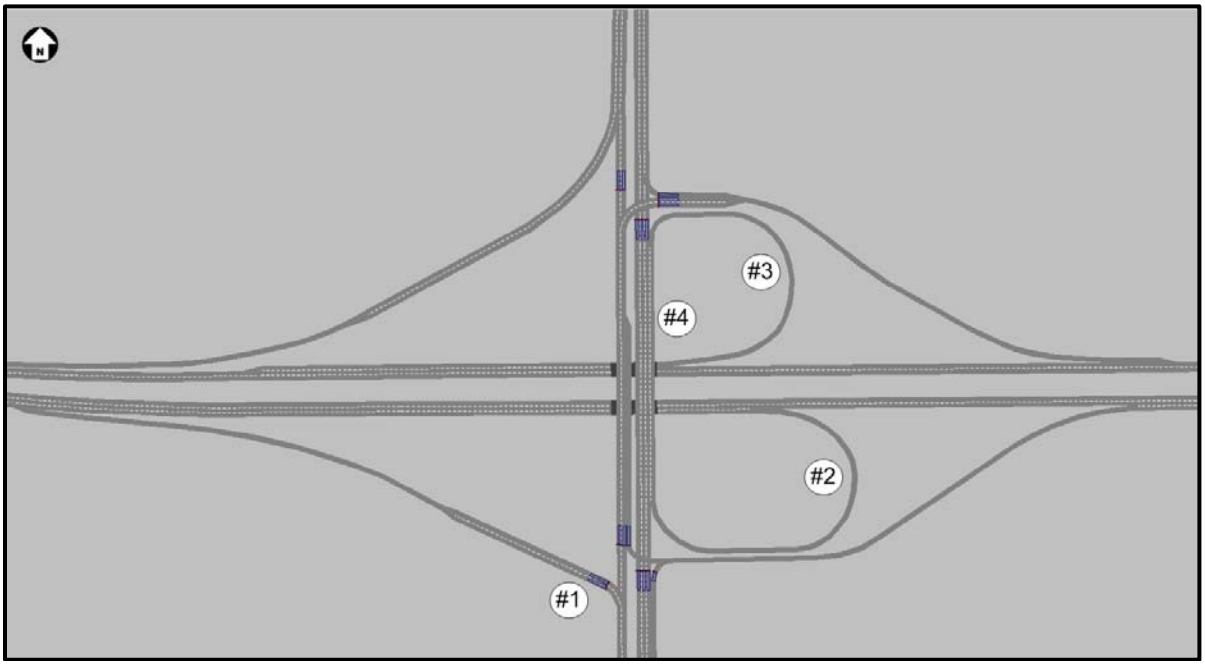


Figure 5. I-94 & 8th St. Interchange (2025 VISSIM)

I-94 and 20th St. Interchange
Updated/New Geometry: southwest loop ramp (#1), westbound off-ramp (#2)

Figure 6. I-94 and 20th St. Interchange (2025 VISSIM)

I-29 and 32nd Ave. S. Interchange

- Updated/New Geometry: Northwest loop ramp (#1), 32nd Ave. S. westbound (#2)
- Updated Traffic Control: Signal phasing/timing (removed west ramp's westbound left-turn phase)

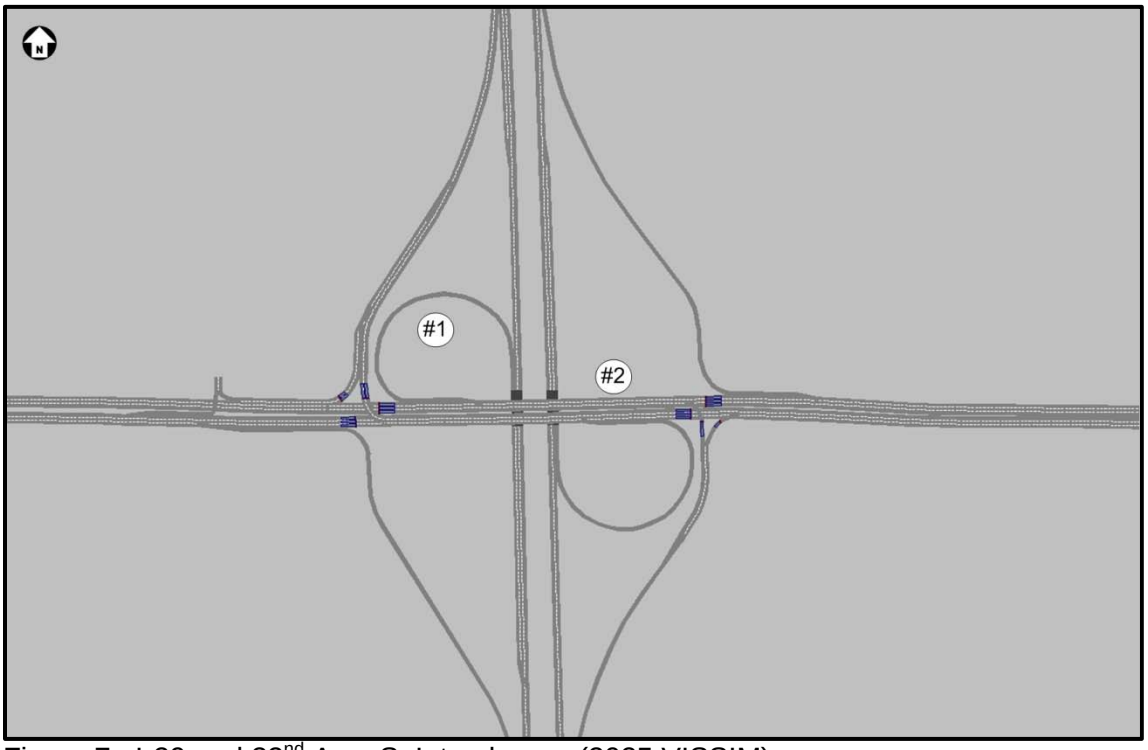


Figure 7. I-29 and 32nd Ave. S. Interchange (2025 VISSIM)

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 as a basis for the 2025 AM and 2025 PM simulation scenarios. A total of 30 traffic signals were modeled for the 2025 scenarios. Signal timing modifications were made when phases were removed and when ramp congestion developed.

TRAFFIC VOLUME INFORMATION

To account for conservative traffic growth, an average growth rate of 1.75% (simple interest) was used for the 2025 planning horizon (which was also used for the 2015 analyses), providing a 30% increase to the 2008 field counts. The 2025 target volumes were entered into the travel demand model's sub-area networks (Citilabs' Cube software) and Cube's Matrix Estimator (ME) was used to provide new origin-destination (O-D) matrices.

Since several network changes have been introduced since the 2008 network, target values were primarily used at the boundaries of the analysis network and areas that did not have major geometric changes. The targets were incorporated on the mainline sections, as well as the on- and off-ramps. The locations that did not have target values include the following:

- I-94 and Main Ave. Interchange (ramps and mainline sections west of interchange)
- I-94 and Sheyenne St. Interchange (ramps and mainline sections east of interchange)
- I-94 and 9th St. Interchange (ramps and mainline sections east and west of interchange)
- I-94 and 45th St. Interchange (ramps and mainline sections west of interchange)
- I-94 and 20th St. Interchange (ramps)
- I-94 and 34th St. Interchange (ramps)
- I-94 and MN 336 Interchange (ramps and mainline sections east of interchange)
- I-29 and 52nd Ave. S. Interchange (ramps and mainline sections north and south of interchange)
- I-29/I-94 Interchange (northeast, northwest, and southeast loop ramps)

Vehicle Composition

Similar to the 2008 and 2015 simulation scenarios, the 2025 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 periods, the peak-hour O-D matrices were factored at 5-minute intervals. The 2015 simulation scenarios used the same O-D demand factors as their respective 2008 simulation scenario, which were obtained by averaging interval data from 9 freeway mainline locations. The average peak-hour factors (PHFs) for the 2008 AM and 2008 PM peaks were .78 and .87, respectively.

As traffic volume increases, especially as capacity is reached, so does the PHF. A higher PHF more evenly distributes traffic over the peak-hour period. Since the 2025 peak-hour volumes are significantly higher than the 2008 volumes, a PHF of .92 (which is often used for planning purposes) was used for both AM and PM peak periods. The traffic distributions for the 2008, 2015, and 2025 scenarios are shown in Figure 8.

Although the traffic volumes of the 2025 scenarios are higher than those of the 2015 scenarios, it may not be reflected in some of the simulation output. Using a 1.75% annual growth from

2008, the 2025 traffic is approximately 16% higher than the 2015 traffic. However, the 2025 PHFs for the AM and PM peak periods are lower than those of 2008 by 18% and 6%, respectively. Therefore, the effects of increased traffic volume in the 2025 scenarios, primarily in the AM peak, may be diminished because of the higher PHF.

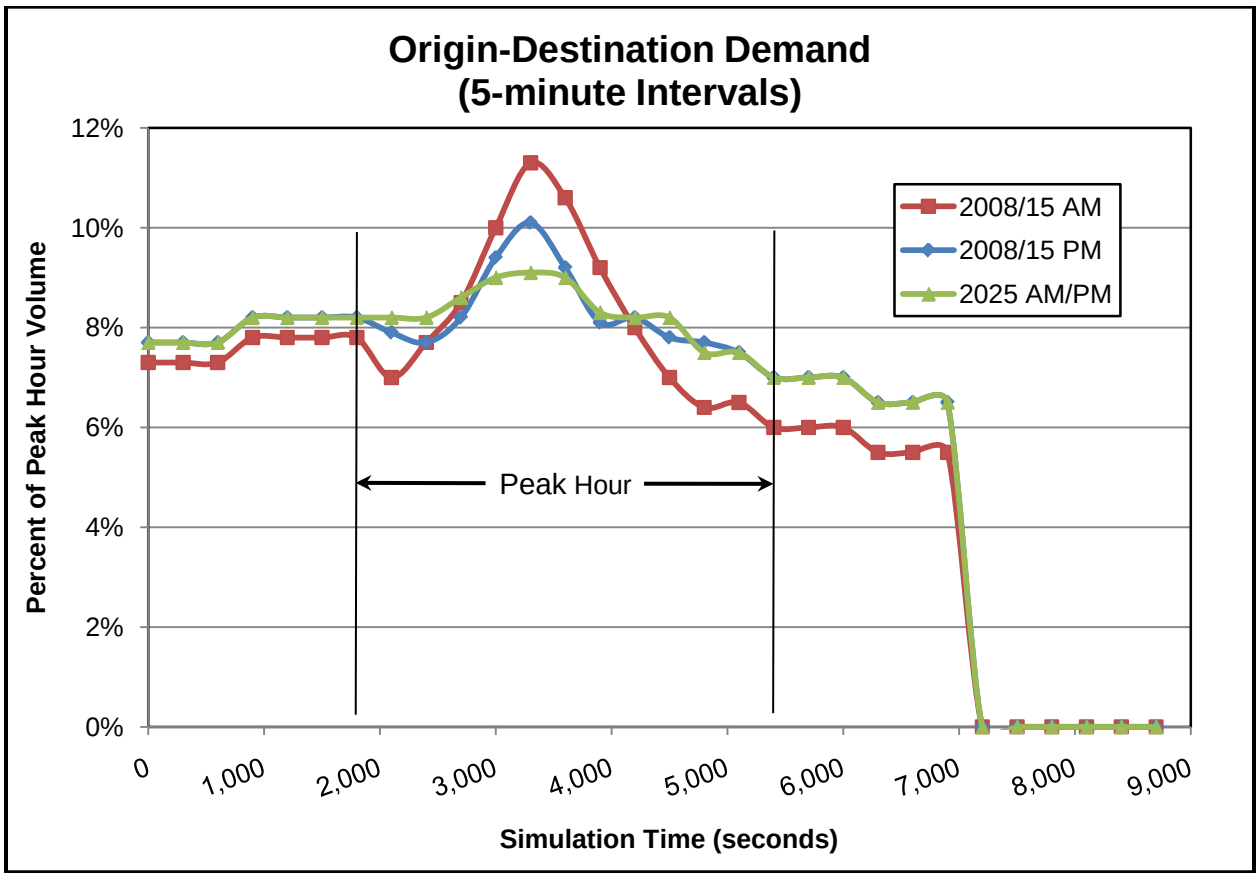


Figure 8. Origin-destination demand for the simulation duration (2008, 2015, and 2025)

SIMULATION DURATION

The simulation duration followed the same timeline as the 2008 and 2015 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 2025 scenario focused on the modifications that were made to the 2015 networks. Similar to the previous 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. Both the 2015 and 2025 simulation scenarios incorporated the calibration parameters of the 2008 scenarios.

Due to significant congestion at the I-94 & 8th St. South Ramp during the 2015 PM scenario, two modifications were incorporated into the model. First, the traffic signal plan was adjusted to provide off-ramp traffic with 80 seconds of green time, which doubled the original green time. Second, 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. Due to the geometric improvements in the 2025 network, which significantly improved traffic operations, these two modifications were changed back to their original values.

Due to operational issues at the I-94 and 45th St. Interchange during the 2025 PM scenario, the signal timing plan of the north ramp was modified. The westbound off-ramp at the I-94 & 45th St. Interchange during the 2025 PM scenario observed significant queue lengths. This was caused by the significant increase in the westbound left-turn volume for the 2025 PM scenario (976 vehicles), which was more than double the 2008 PM volume (472 vehicles). The large increase in traffic volume was produced since target values were not used in the travel demand model for this interchange. Although the volume exceeded capacity at the off-ramp in the travel demand model, it was favored rather than traveling to 9th St. (note: the travel demand model minimizes route travel time). However, if significant congestion were to occur at the westbound 45th St. off-ramp in the field, motorists would divert to the 9th St. interchange. To combat the high off-ramp volume in the simulation model, the green time of the westbound off-ramp was changed from 40 seconds to 60 seconds.

2025 VISSSIM RESULTS

Similar to the 2008 and 2015 scenarios, several measures of effectiveness (MOE) were extracted from the 2025 simulation scenarios. The 2025 AM output is provided in Appendices A through C while the 2025 PM output is provided in Appendices D through 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 and link target values were significantly different among the 2008, 2015, and 2025 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 both the 2015 and 2025 networks will affect the travel time output for the pass-through trips (note Technical Memorandum III). However, comparisons related to freeway queue lengths and mainline data collection (especially those with target values) will be performed in this report.

2025 AM Results

Freeway queue length was measured at the tri-level merge area and the westbound I-94 section between 45th St. and I-29 because these two freeway locations experienced congestion during the 2008 PM scenario. Similar to the 2008 AM and 2015 AM scenarios, the 2025 AM scenario does not experience congestion at these locations (Table 1). Modifying the tri-level ramp to two lanes for the 2025 network essentially eliminated queues from occurring during the AM peak period. To improve traffic operations for I-94 westbound traffic between I-29 and 45th St., an auxiliary lane will be constructed in 2010. Benefits were realized for both the 2015 AM and 2025 AM scenarios.

Table 1. Freeway Queue Measurement Locations for AM Peak Hour (2008, 2015, and 2025)

Simulation Scenario	Tri-Level Merge			I-94 WB (45th St)		
	Avg. (ft)	Max. (ft)	Stops	Avg. (ft)	Max. (ft)	Stops
2008 AM	0	98	1	0	31	1
2015 AM	1	174	3	0	0	0
2025 AM	0	15	0	0	0	0

The freeway mainline densities of the 2025 AM scenario were comparable to those of the 2015 AM scenario (Table 2). Density values for I-94 and I-29 ranged from 3 pc/mi/ln to 35 pc/mi/ln and 5 pc/mi/ln to 26 pc/mi/ln, respectively. The highest density values were along the westbound sections of I-94 from 20th St. to I-29, which exhibited densities between 29 pc/mi/ln to 35 pc/mi/ln (LOS D-E).

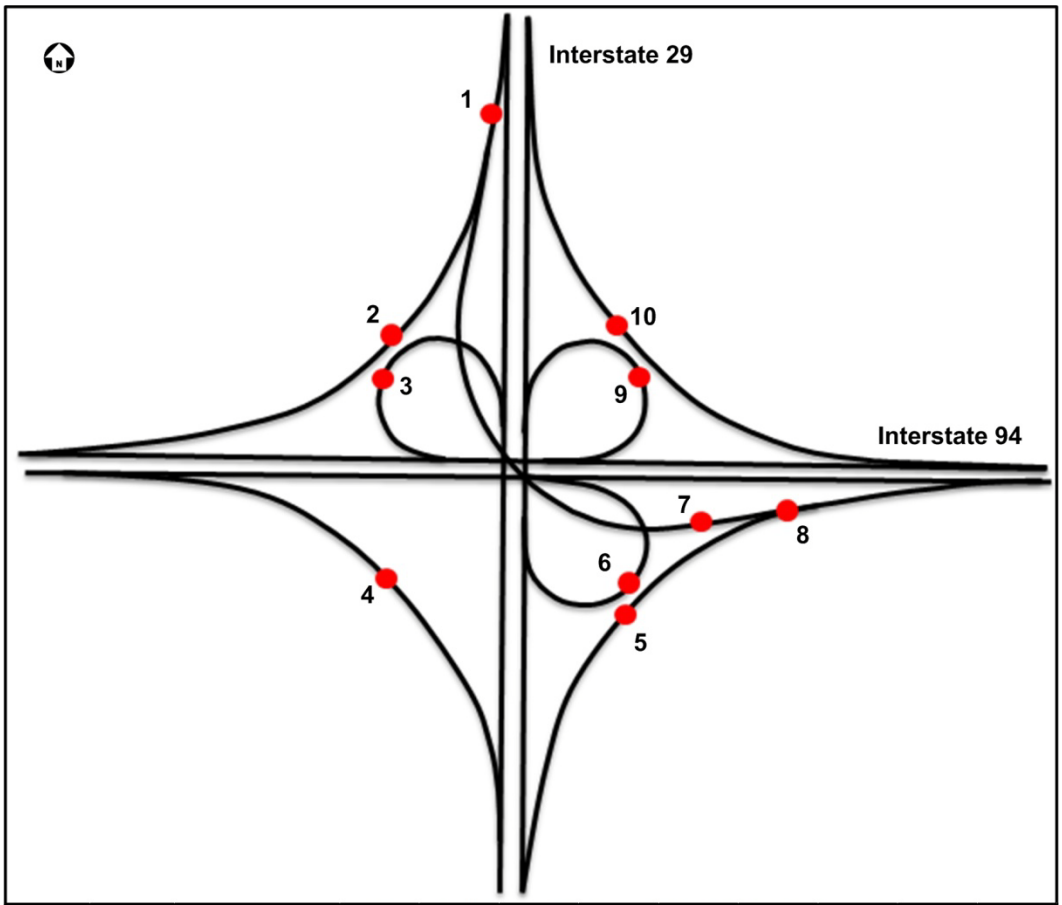
It should be noted that the westbound section of I-94 between 25th St. and I-29 developed congestion during the AM peak period. Since approximately 1,800 vehicles used the I-29/I-94 northeast ramp (westbound to northbound), westbound traffic from the northwest on-ramp and northeast loop ramp of the I-94 and 25th St. Interchange occasionally had difficulty merging onto I-94. While the simulation animation shows periods of congestion, it was not significant enough to lower the average speed of the section, which would produce a higher density value.

Table 2. Freeway Mainline Density for AM Peak Hour (2008, 2015, and 2025)

I-29 Freeway Mainline	Northbound (pc/mi/ln)			Southbound (pc/mi/ln)		
	2008	2015	2025	2008	2015	2025
CR 20 - 19th Ave. N	4	5	5	8	9	9
19th Ave. N - 12th Ave. N	9	10	10	10	11	11
12th Ave. N - Main Ave.	18	20	20	11	12	12
Main Ave. - 13th Ave. S	24	27	26	13	14	13
13th Ave. S - I-94	23	26	25	10	11	10
I-94 - 32nd Ave. S	19	22	21	9	10	9
32nd Ave. S - 52nd Ave. S	17	21	19	5	12	12
I-94 Freeway Mainline	**Eastbound (pc/mi/ln)**			**Westbound (pc/mi/ln)**		
	2008	**2015**	**2025**	**2008**	**2015**	**2025**
Main Ave. - Sheyenne St.	3	4	3	6	7	7
Sheyenne St. - 9th St/57th St.	12	11	9	9	10	8
9th St/57th St. - 45th St.		19	12		12	8
45th St. - I-29	27	20	20	24	17	16
I-29 - 25th St.	19	21	15	27	31	29
25th St. - University Dr.	20	23	22	28	31	31
University Dr. - TH 75	17	19	19	29	33	32
TH 75 - 20th St.	16	18	18	32	36	35
20th St. - 34th St.	11	13	13	25	29	28
34th St. - MN 336	4	6	5	15	17	16

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

Density values at the I-29 & I-94 Interchange were comparable between the 2015 AM and 2025 AM scenarios. The northeast ramp had a high density value (38 pc/mi/ln) since it served the most vehicles (1,801) during the AM peak period (Figure 9). The southeast loop ramp reported a high density (46 pc/mi/ln) since it served 999 vehicles and had a low speed due to the geometric design of the loop ramp. When viewing the simulation's animation, significant congestion was not observed on the ramps. However, congestion would develop occasionally on the westbound weaving segment accessing the northeast ramp.



Simulation Scenario	Data Collection Points of the I-29/I-94 Interchange									
	1	2	3	4	5	6	7	8	9	10
2008 AM (pc/mi/ln)[1]	10	7	28	4	12	42	14	26	10	35
2015 AM (pc/mi/ln)[1]	11	8	32	5	14	49	16	29	15	39
2025 AM (pc/mi/ln)[2]	11	8	31	5	14	46	8	14	12	38

[1] Original density was increased by 25%. [2] Original density was increased by 10%.

Figure 9. I-29 & I-94 Interchange Density Values (2008 AM, 2015 AM, and 2025 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. The 2015 network implemented several geometric and traffic control modifications to improve traffic operations. These modifications reduced congestion, which developed during the 2008 AM scenario, at the following ramp terminals:

- 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.

The 2025 AM output shows that the 2015 network modifications to the I-94 and Sheyenne St. Interchange provide improved traffic flow compared to the 2008 AM scenario. The congestion is reduced due to the modified traffic control (incorporating traffic signals) at the I-94 and Sheyenne St. Interchange and the construction of the I-94 and 9th St. Interchange.

Due to traffic congestion that occurred at the I-94 & 8th St. (TH 75) Interchange during the 2008 and 2015 scenarios, the 2025 network included a modified interchange. During the AM peak period, a significant amount of traffic travels westbound from the north ramp and significant queues develop for the northbound left-turn movement and the southbound right-turn movements. The modified north ramp eliminated the queues for southbound right-turn and northbound right-turn (which was previously a northbound left-turn) movements (Figure 10). During portions of the 2025 AM simulation, some congestion developed at the merge area from the northeast loop ramp since both the mainline and ramp volumes are significant.

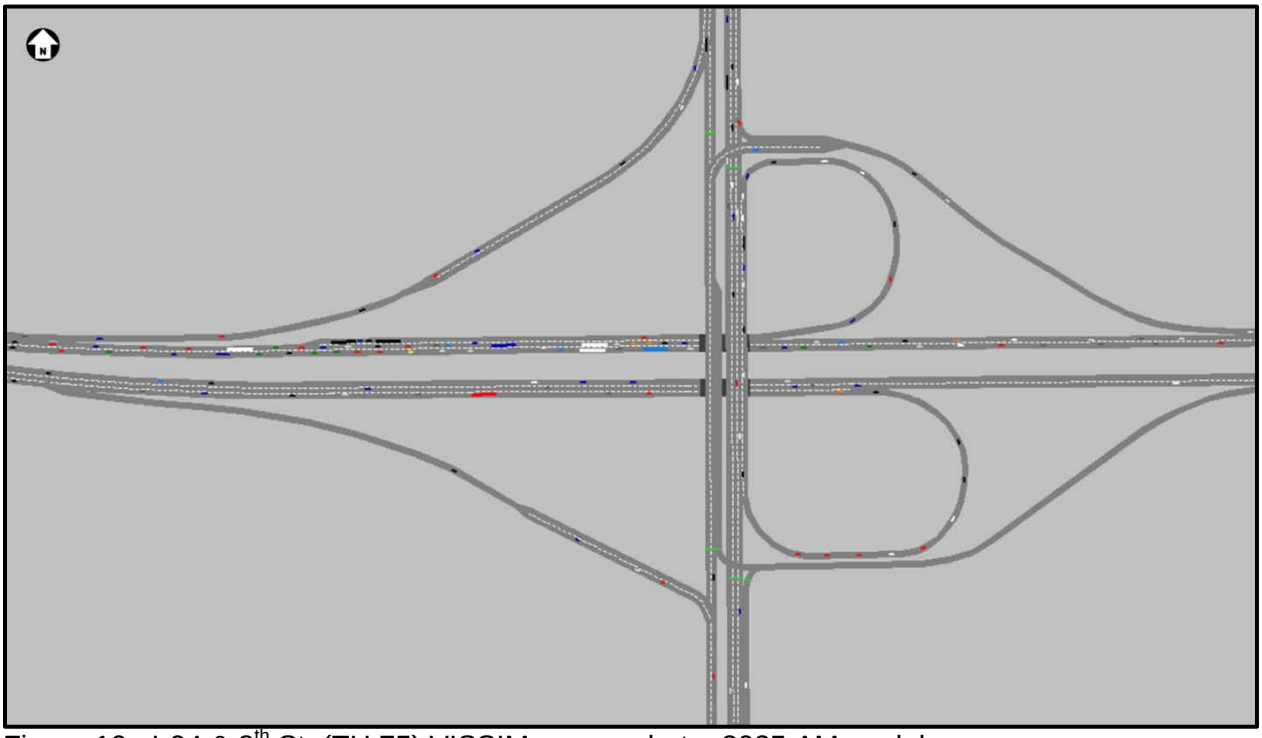


Figure 10. I-94 & 8th St. (TH 75) VISSIM screen shot – 2025 AM peak hour

2025 PM Results

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. During both the 2008 PM and the 2015 PM scenarios, the tri-level merge area experienced significant congestion that produced maximum queue lengths of 2,027 ft and 5,506 ft, respectively (Table 3). To reduce congestion at the merge area, the 2025 network incorporated a two-lane tri-level ramp and auxiliary lane between I-29 and 25th St. These geometric modifications produced a maximum queue length of 361 ft at the merge area. In addition, the westbound auxiliary lane of I-94 between I-29 and 45th St. eliminated queues from developing for both the 2015 PM and 2025 PM scenarios.

Table 3. Freeway Queue Measurement Locations for PM Peak Hour (2008, 2015, and 2025)

Simulation Scenario	Tri-Level Merge			I-94 WB (45th St)		
	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
2025 PM	2	361	10	0	0	0

Further analysis was performed into the queue length that developed at the tri-level ramp merge area during the 2025 PM peak period. It was assumed that the geometric modifications in this area would eliminate queues from developing. Upon reviewing the simulation's animation, congestion occasionally develops due to lane changes or weaving after the tri-level ramp/southeast ramp merge area and shortly after the merge with eastbound I-94. Due to the large amount of traffic in this area, a sudden lane change can cause a shockwave to develop upstream. Although the shockwave clears in a rather short period of time and may only occur a few times during the peak hour, the congestion will be reported in VISSIM as a queue. It should also be pointed out that the average speed at the merge area during the peak hour of the 2025 PM scenario was 54 mph compared to 37 mph for the 2015 PM scenario.

An example of this occurrence is shown in Figure 11. A decelerating truck (Veh_1) merging from the southeast ramp onto the tri-level ramp immediately changes lanes into the left lane (it was not exiting at 25th St.), causing a trailing car (Veh_2) to brake. Several other cars in the left lane also had to brake, which created a shockwave of several hundred feet. The shockwave was cleared in less than 25 seconds.

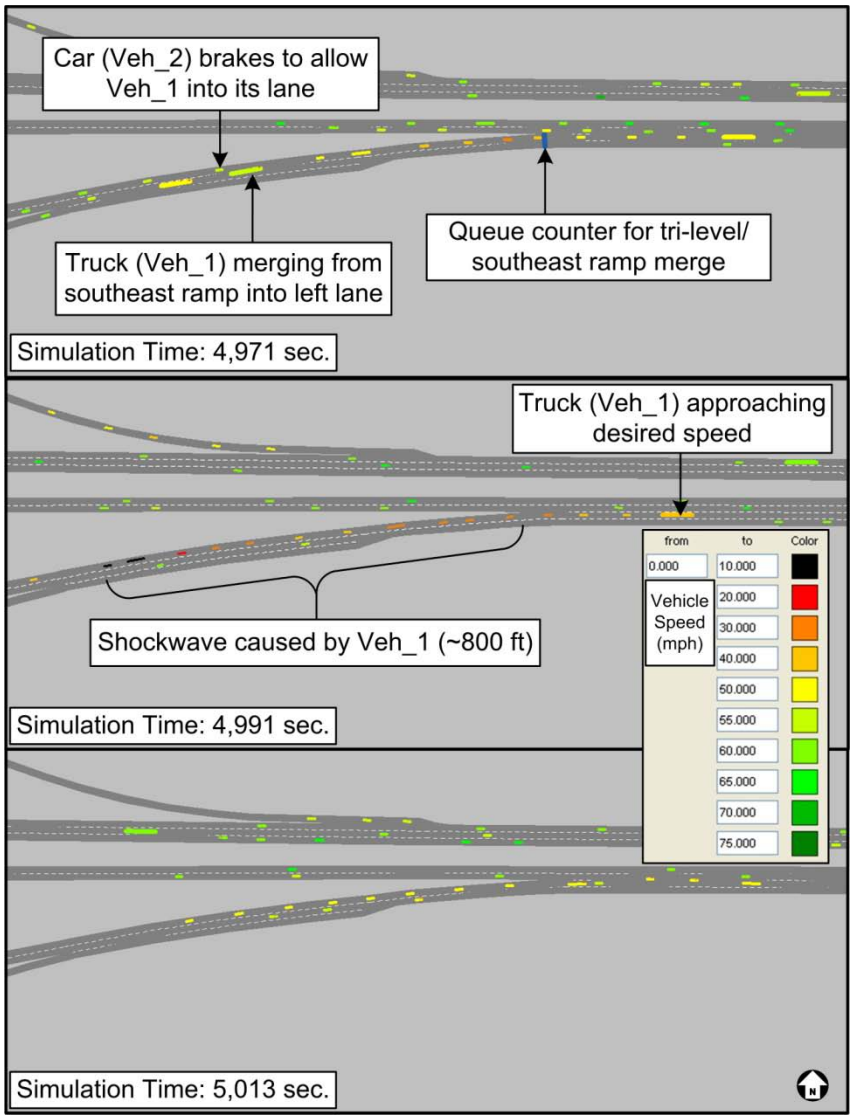


Figure 11. Tri-level ramp merge area VISSIM screen shots - 2025 PM peak hour

The freeway mainline densities of the 2025 PM scenario were comparable to those of the 2015 PM scenario (Table 4). Density values for I-94 and I-29 ranged from 3 pc/mi/ln to 34 pc/mi/ln and 7 pc/mi/ln to 30 pc/mi/ln, respectively. The highest density values were along the eastbound sections of I-94 from 25th St. (Fargo) to 20th St. (Moorhead), having densities ranging from 31 to 34 pc/mi/ln (LOS D).

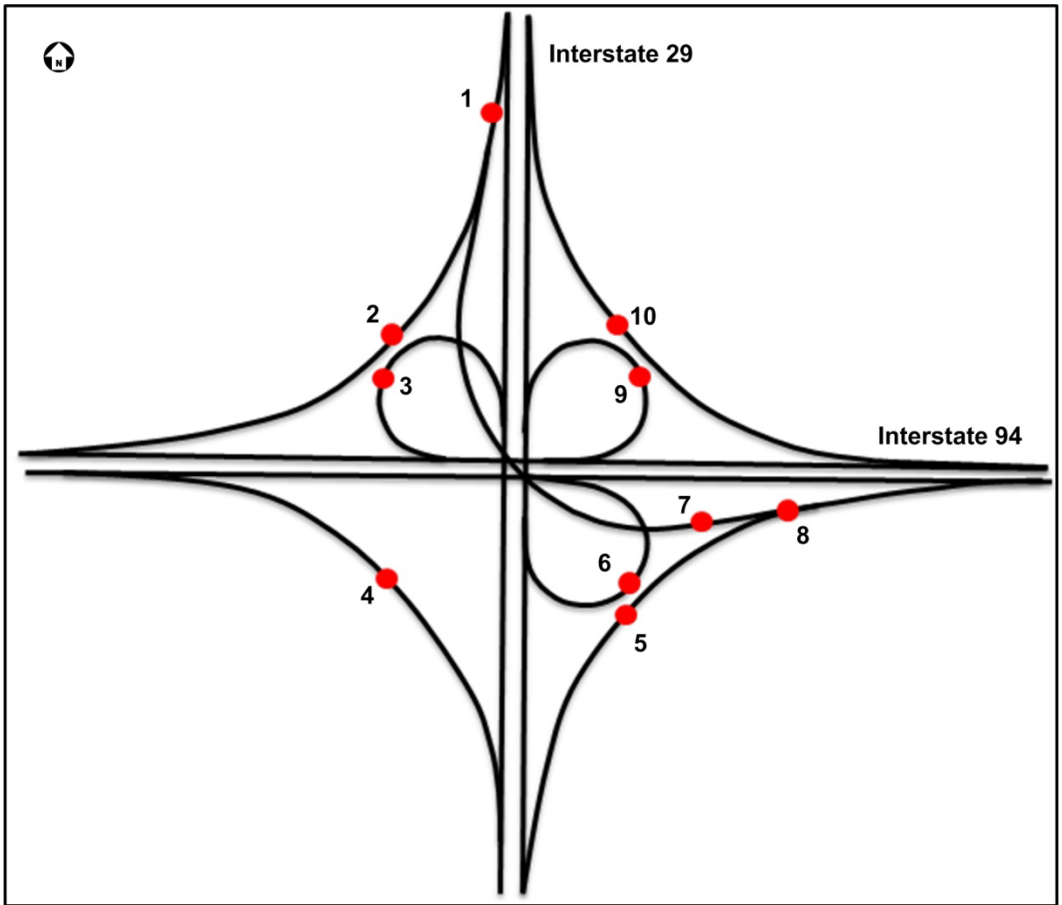
Table 4. Freeway Mainline Density for PM Peak Hour (2008, 2015, and 2025)

I-29 Freeway Mainline	**Northbound (pc/mi/ln)**			**Southbound (pc/mi/ln)**		
	2008	**2015**	**2025**	**2008**	**2015**	**2025**
CR 20 - 19th Ave. N	9	10	12	6	7	7
19th Ave. N - 12th Ave. N	11	9	14	9	8	11
12th Ave. N - Main Ave.	14	13	17	17	16	21
Main Ave. - 13th Ave. S	15	15	18	27	22	30
13th Ave. S - I-94	14	16	17	19	22	23
I-94 - 32nd Ave. S	13	15	16	10	11	13
32nd Ave. S - 52nd Ave. S	9	13	16	10	17	18
I-94 Freeway Mainline	**Eastbound (pc/mi/ln)**			**Westbound (pc/mi/ln)**		
	2008	**2015**	**2025**	**2008**	**2015**	**2025**
Main Ave. - Sheyenne St.	5	5	5	2	3	3
Sheyenne St. - 9th St/57th St.	8	9	9	10	7	7
9th St/57th St. - 45th St.		12	9		13	9
45th St. - I-29	25	17	19	26	17	19
I-29 - 25th St.	26	29	24	22	23	26
25th St. - University Dr.	24	29	32	21	22	26
University Dr. - TH 75	26	32	34	20	23	25
TH 75 - 20th St.	24	27	31	19	22	24
20th St. - 34th St.	19	16	24	15	12	18
34th St. - MN 336	10	11	12	7	7	8

Note: The yellow highlighted sections represent a LOS D.

A few on-ramp merge locations showed signs of periodic congestion during the 2025 PM scenario. Although no quantitative data were collected at these locations, the eastbound on-ramp at 25th St. and the southbound on-ramp at Main Ave. showed some congestion when observing the simulation animation. For both areas, the basic freeway sections between the on-ramp and the next downstream off-ramp are approximately 1,000 ft.

Density values at the I-29 & I-94 Interchange were comparable between the 2015 PM and 2025 PM scenarios except for the tri-level ramp and merge area. The 2025 network improvements to the tri-level ramp (two lanes) and adding an auxiliary lane to 25th St. significantly reduced the density and congestion at the tri-level ramp merge area (Figure 12).



Simulation Scenario	Data Collection Points of the I-29/I-94 Interchange									
	1	2	3	4	5	6	7	8	9	10
2008 PM (pc/mi/ln)[1]	23	13	19	4	10	17	36	51	7	25
2015 PM (pc/mi/ln)[1]	31	15	21	5	12	18	55	71	14	30
2025 PM (pc/mi/ln)[2]	29	17	23	5	13	20	21	28	11	31

[1] Original density was increased by 15%. [2] Original density was increased by 10%.

Figure 12. I-29 & I-94 Interchange Density Values (2008 PM, 2015 PM, and 2025 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. The 2015 network implemented several geometric and traffic control modifications to improve traffic operations. These modifications reduced congestion, which developed during the 2008 PM scenario, at the following ramp terminals:

- 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

Similar to the AM peak hour, the 2025 PM output shows that the 2015 network modifications to the I-94 and Sheyenne St. Interchange improved traffic flow compared to the 2008 PM scenario.

The congestion is reduced due to the modified traffic control at the I-94 and Sheyenne St. Interchange and the construction of the I-94 and 9th St. Interchange.

Since the westbound off-ramp of the I-94 and 45th St. North Ramp during the 2025 PM scenario did not have a target value, the Cube ME assigned significantly more traffic for this off-ramp. The 2015 modifications to this interchange, which included the construction of the I-94 and 9th St. Interchange and the 2025 PM signal timing modification, allowed the ramp to operate adequately.

Similar to the 2025 AM scenario, the modified I-94 and 8th St. (TH 75) Interchange provided operational benefits for the 2025 PM scenario. During the PM peak period, a significant amount of traffic travels from Fargo, ND (from the west) and exists at the 8th St. South Ramp. Both the 2008 PM and 2015 PM scenarios experienced significant congestion. During the 2015 PM scenario, queues from the ramp signal often extended back onto the freeway. The modified south ramp eliminated the queues for the eastbound approach, which include the eastbound off-ramp and the southeast loop ramp (Figure 13).

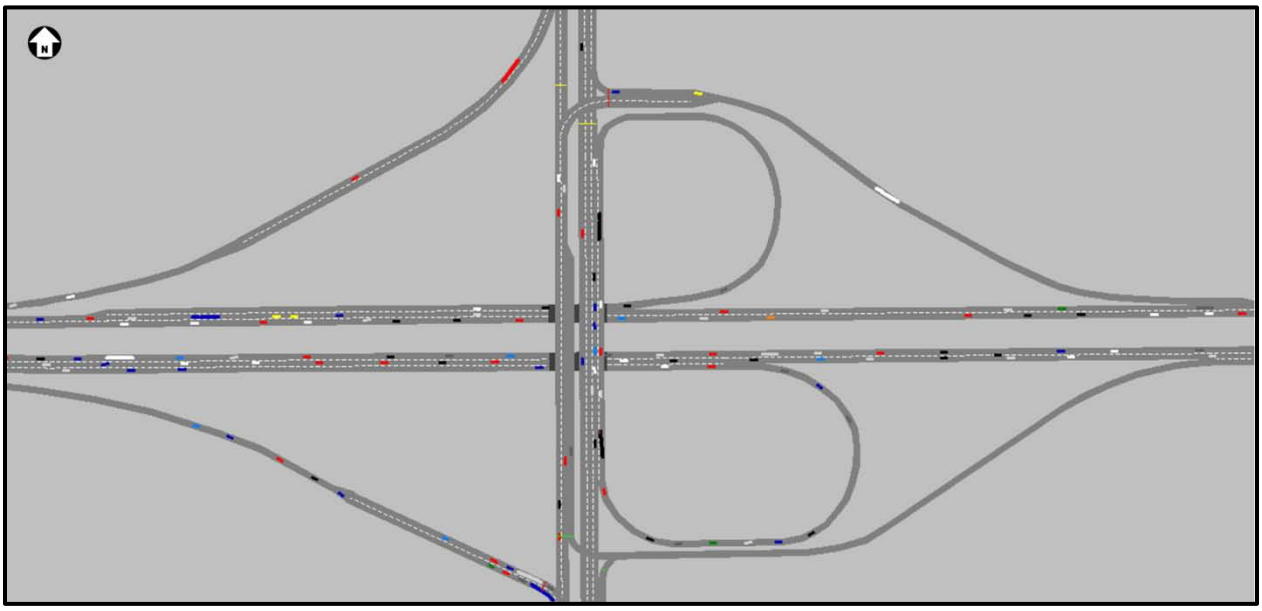


Figure 13. I-94 & 8th St. (TH 75) VISSIM screen shot – 2025 PM peak hour

2025 TRAFFIC WITH 2015 NETWORK (GEOMETRY)

The 2025 AM and PM simulation output illustrated that the proposed network improvements (geometric and traffic control) do a reasonable job of accommodating the estimated 2025 AM and PM peak-hour traffic. Several project stakeholders were interested in illustrating the affects of not continuing with the F-M freeway improvements, which would model the 2025 traffic in the 2015 simulation network (2025/2015). The major geometric improvements for the 2025 network included providing a two lane tri-level ramp with auxiliary lane to 25th St, and reconstructing the I-94 and 8th St. (TH 75) Interchange, which added two loop ramps. Removing these improvements will adversely affect freeway operations; however, this exercise will quantify the congestion. It should be pointed out that severe traffic congestion would alter motorist's route choice to reduce trip travel time.

Although the estimated 2025 traffic will be incorporated, the exact O-D matrices from the 2025 simulation could not be used for these scenarios. This was due to the fact that the I-94 and 20th

St. Interchange of the 2025 network included new geometry (southeast off-ramp and northeast on-ramp), which allows traffic movements not realized in the 2015 network. Most of the trips coming from and going to the east of the interchange were equally split between the I-94 and 8th St. Interchange and the I-94 and 34th St. Interchange. Detailed output of the overall network and freeway mainline results are provided in Appendices G through J. Discussions of simulation results are provided in the following sections.

2025 Traffic/2015 Network AM Output

The freeway mainline densities of the 2025/2015 AM scenario were comparable to those of the 2025 AM scenario. The highest density values were along the westbound sections of I-94 from 20th St. to I-29, which exhibited densities between 30 pc/mi/ln and 36 pc/mi/ln (LOS D-E). Significant congestion occurred at the I-94 and 8th St. Interchange (TH 75), which primarily related to the north ramp's southbound right-turn and northbound left-turn movements (Figure 14).

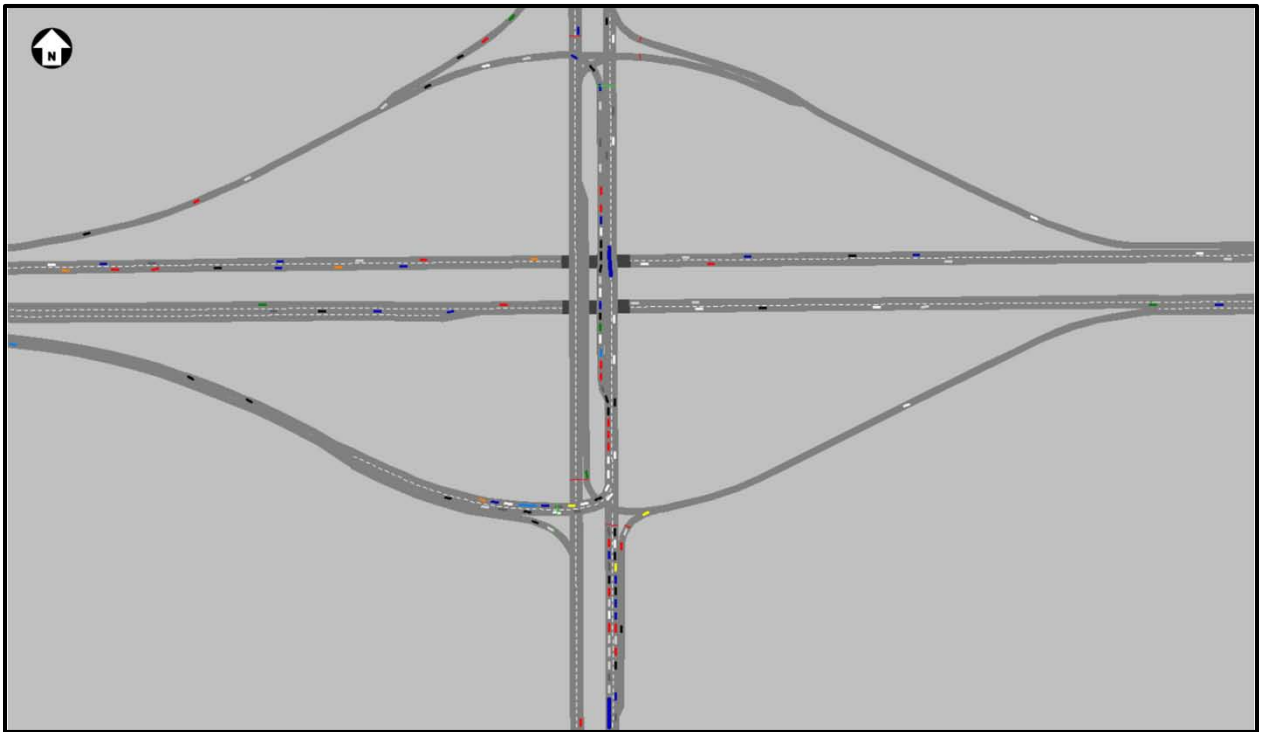


Figure 14. I-94 & 8th St. (TH 75) VISSIM screen shot – 2025/2015 AM peak hour

Comparisons were performed between the 2025 AM and 2025/2015 AM scenarios' delay time. The 2025/2015 AM scenario produced 47% more total delay time and 61% more total stopped delay than the 2025 AM scenario (Table 5). Most of the additional delay can be attributed to the congestion at the I-94 and 8th St. (TH 75) Interchange.

Table 5. Delay Time Comparisons (AM Peak)

Simulation Scenario	Total Delay Time (hr)	Total Stopped Delay (hr)
2025 AM	436	142
2025/2015 AM	641	228
% Difference	**47%**	**61%**

To illustrate the difference between the 2025 AM and 2025/2015 AM scenarios, the average link speed for the peak hour was calculated using VISSIM's Link Evaluation feature, which was set up to produce output at 300 ft segments. Figure 15 illustrates the speed comparison between the two scenarios near the I-94 and 8th St. (TH 75) Interchange.

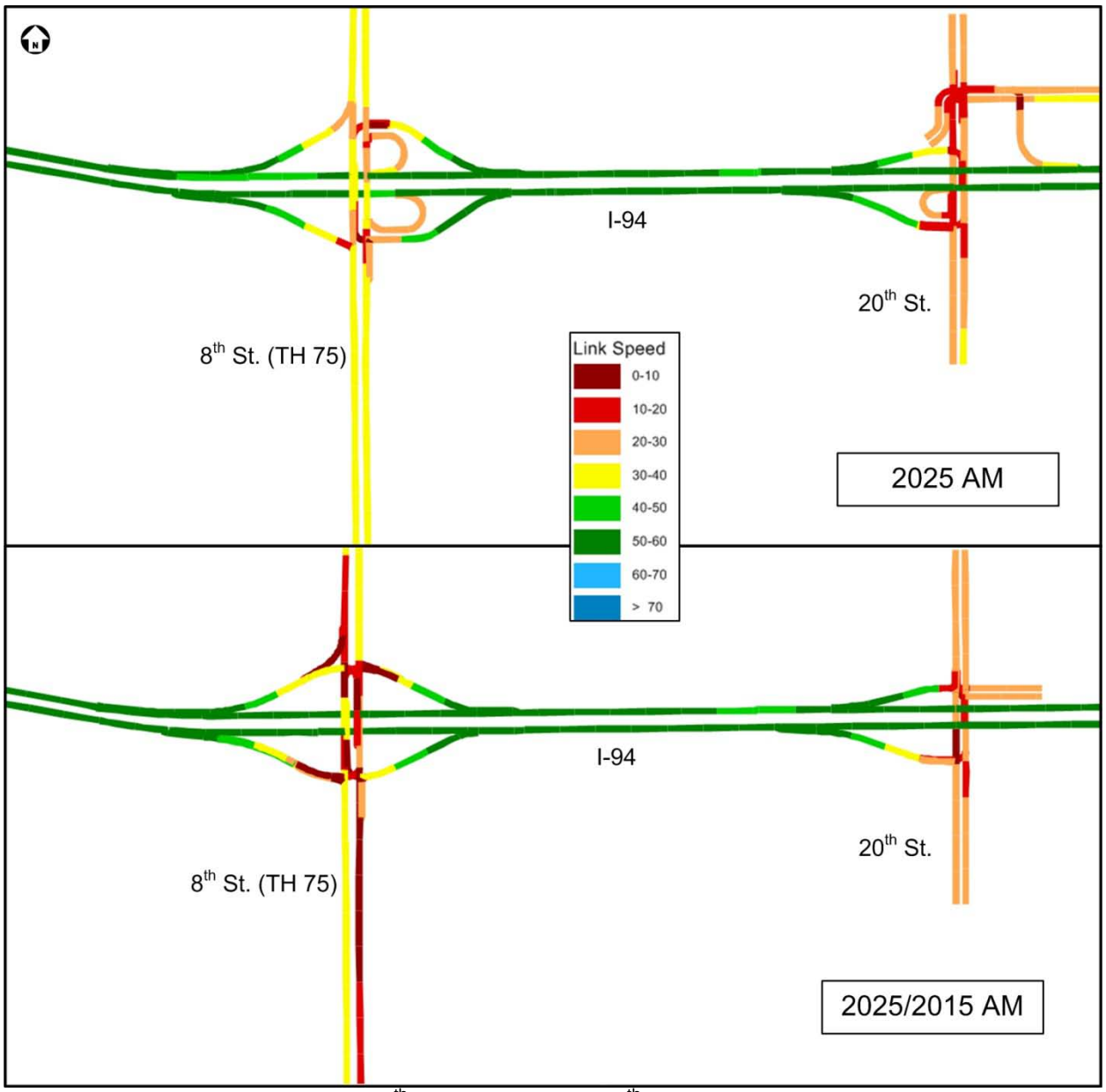


Figure 15. Average link speed – 8th St. (TH 75) and 20th St. (2025 AM and 2025/2015 AM)

2025 Traffic/2015 Network PM Output

The freeway mainline densities of the 2025/2015 PM scenario were higher those of the 2025 PM scenario at several sections. The highest density values were along the southbound sections I-29 between Main Ave. and I-94, which reported densities of 48 pc/mi/ln and 34 pc/mi/ln, respectively (LOS F and D) and along eastbound sections of I-94 from I-29 to 8th St. (TH 75), which exhibited densities between 30 pc/mi/ln to and 42 pc/mi/ln (LOS D-E).

The higher mainline density values for the 2025/2015 PM were a result severe congestion at the tri-level ramp and southeast ramp merge area, as well as at the eastbound off-ramp of the I-94 and 8th St. (TH 75). Since the tri-level ramp has one lane in the 2015 network, the demand for the facility is significantly higher than the capacity (Figure 16). The 2025 PM target volume for the merge area was over 2,600 vehicles; however, only 2,119 vehicles were able to travel through the area using the 2015 network. Therefore, the southbound queue extended to Main Ave.

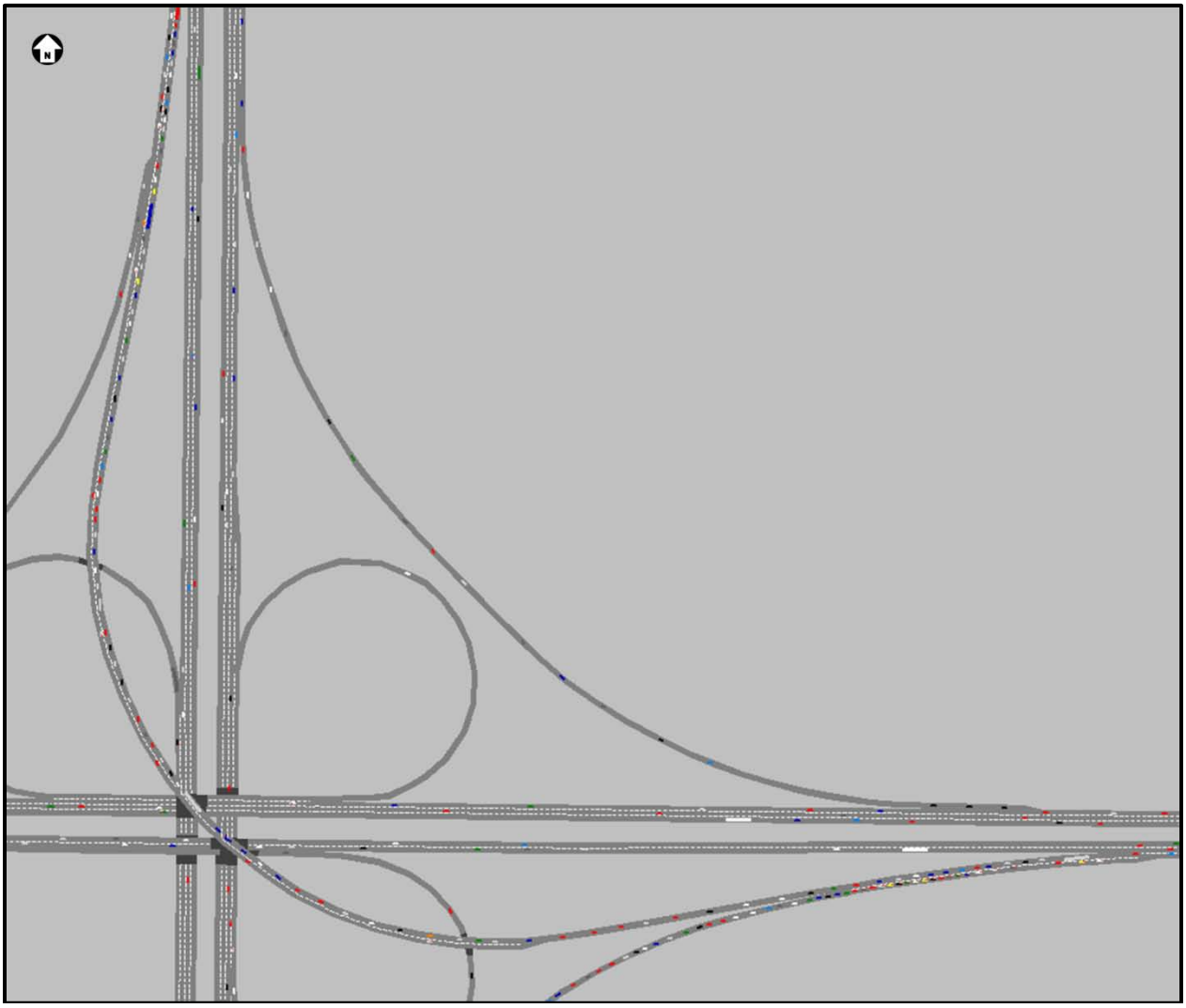


Figure 16. Tri-level ramp merge area VISSIM screen shot – 2025/2015 PM peak hour

Significant congestion also occurred at the I-94 and 8th St. Interchange (TH 75) during the 2025/2015 PM scenario (Figure 17). The eastbound approach of the south ramp queues back onto the eastbound mainline several thousand feet. The proposed 2025 interchange improves traffic operation by separating the eastbound left-turn traffic from the right-turn traffic (southeast loop ramp) and providing two lanes for the eastbound right-turn traffic.

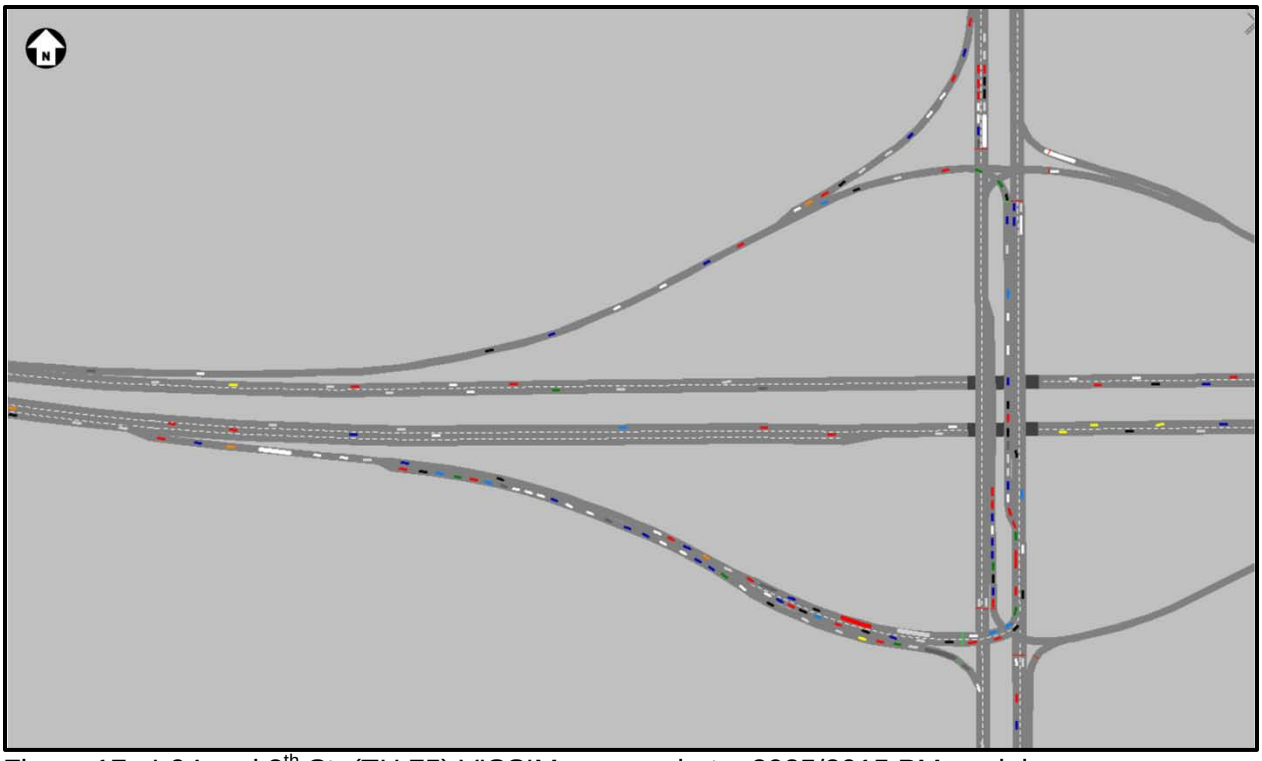


Figure 17. I-94 and 8th St. (TH 75) VISSIM screen shot – 2025/2015 PM peak hour

Comparisons were performed between the 2025 PM and 2025/2015 PM scenarios' delay time. The 2025/2015 PM scenario produced 404% more total delay time and 563% more total stopped delay than the 2025 PM scenario (Table 6). Most of the additional delay was attributed to the congestion at the tri-level ramp and southeast ramp merge are and to a lesser extent the I-94 and 8th St. (TH 75) Interchange.

Table 6. Delay Time Comparisons (PM Peak)

Simulation Scenario	Total Delay Time (hr)	Total Stopped Delay (hr)
2025 PM	473	147
2025/2015 PM	2,384	975
% Difference	**404%**	**563%**

To illustrate the difference between the 2025 PM and 2025/2015 PM scenarios, the average link speed for the peak hour was calculated using VISSIM's Link Evaluation feature. Figures 18 and 19 illustrate the speed comparison between the two scenarios near the tri-level ramp and southeast ramp merge area and the I-94 and 8th St. (TH 75) Interchange.

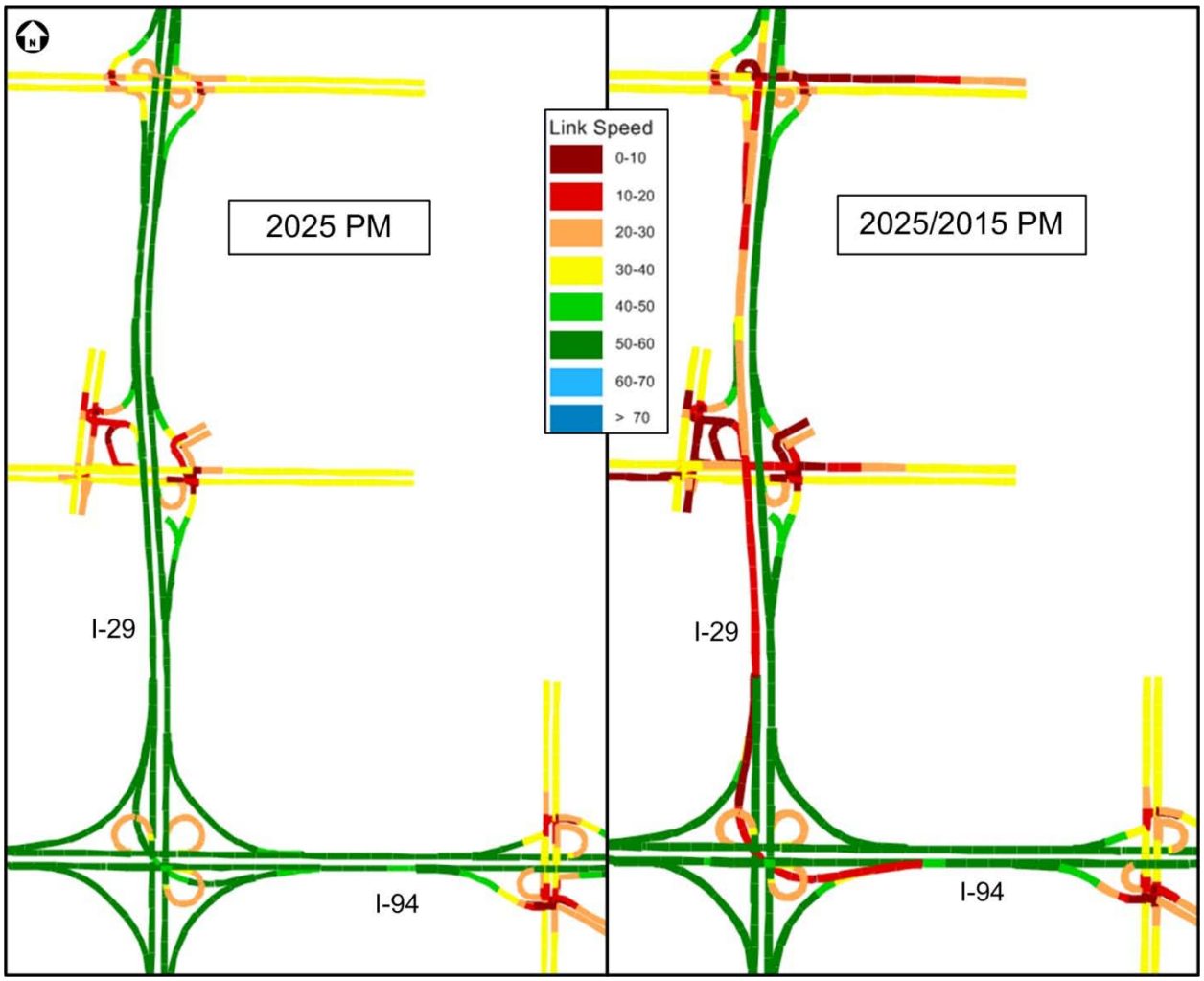


Figure 18. Average link speed – tri-level ramp merge area (2025 PM and 2025/2015 PM)

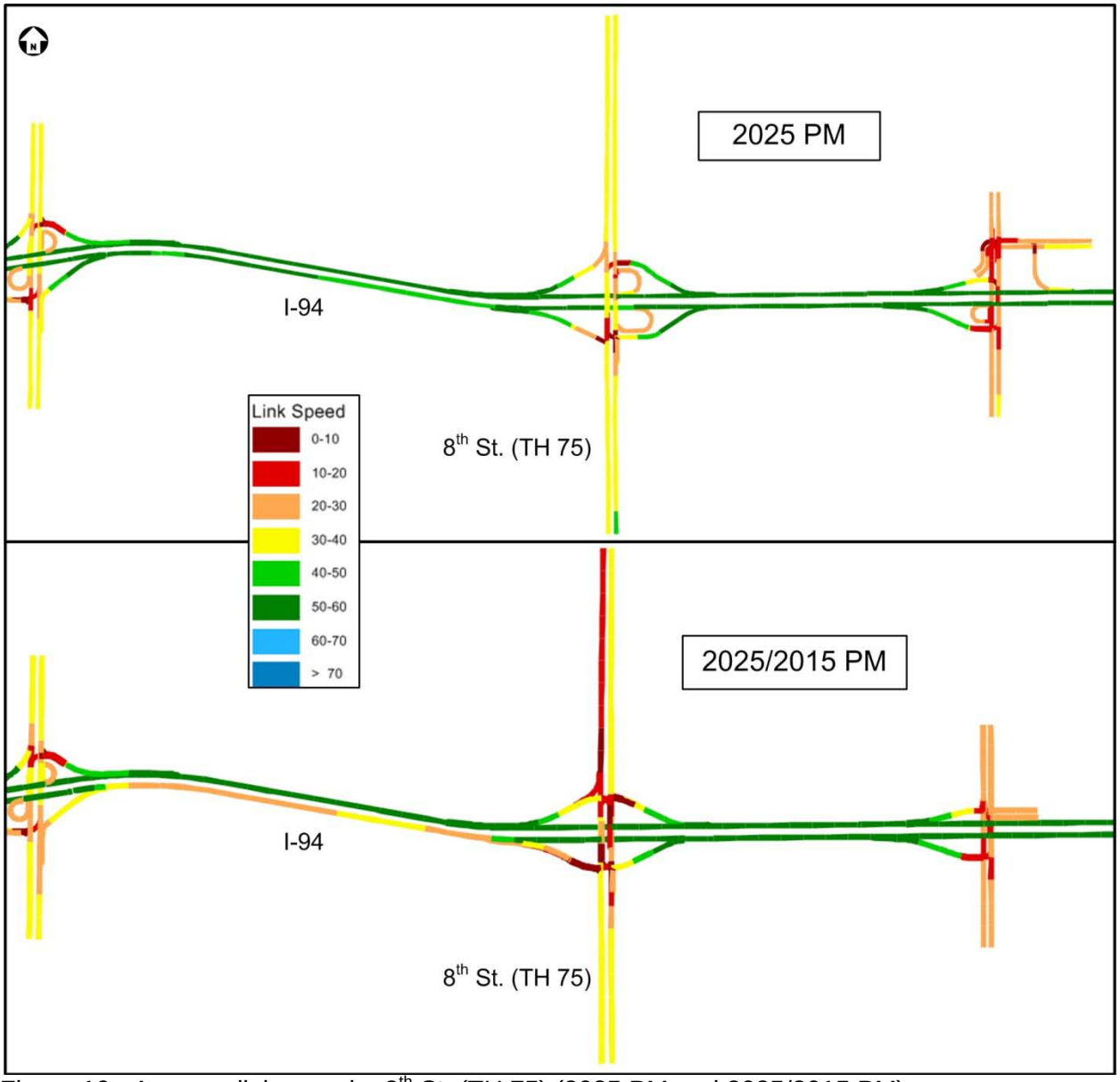


Figure 19. Average link speed – 8th St. (TH 75) (2025 PM and 2025/2015 PM)

SUMMARY

This document provided the simulation results of the 2025 AM and PM scenarios for the Fargo-Moorhead Interstate Operations Study. These scenarios provide insight into the traffic operations issues that may occur in the 2025 planning horizon. Based on the simulation output, the proposed near-term (by 2015) and long-term improvements (by 2025) reduced congestion at several areas within the study area during the peak-hour periods.

The freeway mainline densities of the 2025 AM scenario were comparable to those of the 2015 AM scenario. The highest density values were along the westbound sections of I-94 from 20th St. (Moorhead, MN) to I-29, which exhibited densities between 29 pc/mi/ln to 35 pc/mi/ln (LOS D-E). When viewing the simulation animation, the westbound section of I-94 between 25th St. and I-29 developed some congestion during the AM peak period due to the significant amount of traffic using the northeast ramp of the I-29 & I-94 Interchange.

Mainline density values at the I-29 & I-94 Interchange were comparable to those of the 2015 AM scenario. The northeast ramp had a high density value (38 pc/mi/ln) since it served the most vehicles (1,801) during the AM peak period. The southeast loop ramp reported a high density (46 pc/mi/ln) since it served 999 vehicles and had a low speed due to the geometric design of the loop ramp. When viewing the simulation's animation, significant congestion was not observed on the ramps. However, congestion would develop occasionally on the westbound weaving segment accessing the northeast ramp.

The ramp terminals for the 2025 AM scenario did not experience any significant traffic delay. The addition of the I-94 and 9th St. Interchange reduced congestion at the I-94 and Sheyenne St. Interchange and I-94 and 45th St. Interchange. The most influential improvement to this scenario related to the modified design of the I-94 & 8th St. (TH 75) Interchange, which significantly reduced congestion at the north ramp during the AM peak hour. However, it should be pointed out that some congestion developed at the merge area from the northeast loop ramp since both the westbound mainline and loop ramp volumes are significant.

Modifying the tri-level ramp and merge area (2025 network) alleviated the congestion that developed during the PM peak period. During both the 2008 PM and the 2015 PM scenarios, the merge area significant congestion occurred, producing maximum queue lengths of 2,027 ft and 5,506 ft, respectively. Incorporating a two lane tri-level ramp and auxiliary lane between I-29 and 25th St., eliminated the queues and congestion.

For the 2025 PM scenario, mainline density values for I-94 and I-29 ranged from 3 pc/mi/ln to 34 pc/mi/ln and 7 pc/mi/ln to 30 pc/mi/ln, respectively. The highest density values were along the eastbound sections of I-94 from 25th St. (Fargo) to 20th St. (Moorhead), having densities of ranging from 31 pc/mi/ln and 34 pc/mi/ln (LOS D).

A few on-ramp merge locations showed signs of periodic congestion during the 2025 PM scenario. Although no quantitative data were collected at these locations, the eastbound on-ramp at 25th St. and the southbound on-ramp at Main Ave. showed some congestion when observing the simulation animation.

The ramp terminals for the 2025 PM scenario did not experience any significant traffic delay. The addition of the I-94 and 9th St. Interchange reduced congestion at the I-94 and Sheyenne St. Interchange and I-94 and 45th St. Interchange. The modified design of the I-94 & 8th St. (TH 75) Interchange significantly reduced congestion at the south ramp during the PM peak hour.

The scenarios with the 2015 network with 2025 traffic illustrated the affects of not enhancing the freeway system. During the AM Peak period, significant congestion existed at the I-94 and 8th St. (TH 75) interchange. In addition, maintaining the 2015 network generated an additional 203 hours of delay time, which is an increase of 47% from the 2025 AM scenario. Similar to the AM peak period, the PM peak period produced significant congestion at the I-94 and 8th St. (TH 75). However, the tri-level merge area recorded the most congestion. The 2015 network with 2025 traffic generated an additional 1,911 hours of delay time, which is an increase of 404% from the 2025 PM scenario. Although motorists will select alternative routes to reduce their travel time as freeway congestion developments, the 2025 AM and PM analyses illustrate the importance of the long-term improvements.

Appendix A: 2025 AM Simulation Output (Network Performance, Travel Time, Freeway Queues)

Network Performance

Total Delay Time (hr)	436
Total Travel Time (hr)	4,459
Number of Active Vehicles	0
Number of Arrived Vehicles	55,124
Total Stopped Delay (hr)	142
Total Distance Traveled (mi)	218,820

Queue Measurement

Time	Tri-Level Merge			I-94 WB (45th St)		
	Avg.	Max.	Stop	Avg.	Max.	Stop
PM Peak	0	15	0	0	0	0

Travel Time (Network)

Origin		Destination					
		I-29 SB		I-94 EB		I-29 NB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-94 EB	1630-1645	12.2	4	15.2	4	15.7	3
	1645-1700	12.3	4	15.2	4	15.9	4
	1700-1715	12.2	4	15.2	4	15.9	4
	1715-1730	12.3	4	15.1	4	15.9	4
		I-29 SB		I-94 WB		I-29 NB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-94 WB	1630-1645	15.6	4	15.1	7	17.4	6
	1645-1700	15.6	4	15.2	7	17.5	6
	1700-1715	15.8	4	15.3	8	17.6	6
	1715-1730	15.7	5	15.3	8	17.6	7
		I-94 WB		I-29 NB		I-94 EB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-29 NB	1630-1645	13.2	5	14.7	7	14.8	5
	1645-1700	13.3	5	14.7	7	14.9	5
	1700-1715	13.2	5	14.8	8	14.9	5
	1715-1730	13.3	5	14.7	7	14.9	5
		I-94 WB		I-29 SB		I-94 EB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-29 SB	1630-1645	14.8	4	14.5	9	17.5	5
	1645-1700	14.8	4	14.6	9	17.5	5
	1700-1715	14.7	4	14.6	9	17.6	6
	1715-1730	14.7	4	14.6	9	17.5	5

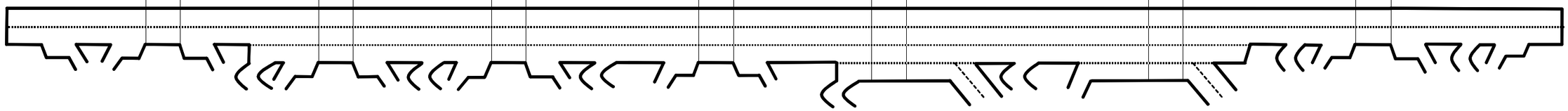
Appendix B: 2025 AM Simulation Output (Data Collection Points)

I-29 Data Collection: 2025 AM Peak Hour

Southbound

	CR20				19th Ave. N					12th Ave. N					Main Ave.						13th Ave. S						I-94								32nd Ave. S					52nd Ave. 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	880		3840			1300	640	1150	2895			815	1050	1270	625	7200	620	670	960	510	1900
2008 Vol. (vph)					899					1315					1459						1580				1674						1505							447					
2025 Sim. Vol. (vph)					1194					1733					1920						2075				2173						1958							1556					
Volume % Difference					33%					32%					32%						31%				30%						30%							248%					
Speed (mph)					74.2					59					58.9						58.5				58.8						59.2							73.4					
# of Lanes					2					3					3						3				4						4							2					
Density (pc/mi/ln)					9					11					12						13				10						9							12					
Level of Service					A					B					B						B				B						A							B					

South



North

Northbound

	CR 20				19th Ave. N					12th Ave. N					Main Ave.						13th Ave. S						I-94								32nd Ave. S					52nd Ave. S					
Distance (ft.)	8050	650	650	1885	7140	1165	1045	1015	665	1855	830	920	765	580	2190	525	745	570	655	760	1930	685	755	665	1310	2100			910	505	485	1260	990	1240	255	1145	305	860	720	7100	760	775	595	800	1675
2008 Vol. (vph)					488					1166					2269						3050					3943								2508						1485					
2025 Sim. Vol. (vph)					653					1539					2992						4008					5137								3252						2519					
Volume % Difference					34%					32%					32%						31%					30%								30%						70%					
Speed (mph)					74.8					57.8					56.6						56.1					57.1								57.8						72.1					
# of Lanes					2					3					3						3					4								3						2					
Density (pc/mi/ln)					5					10					20						26					25								21						19					
Level of Service					A					A					B						C					C								C						B					

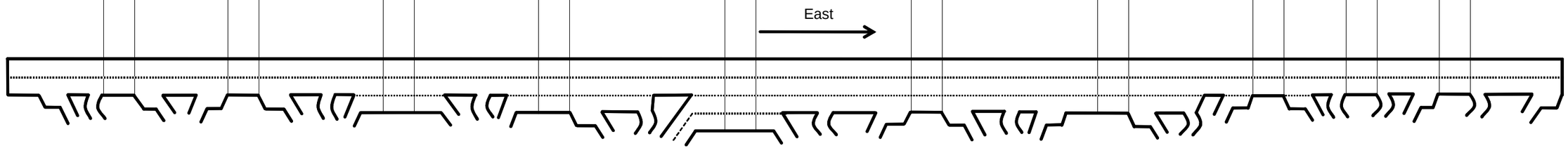
Note: Density values were adjusted using the following data:
Peak-hour factor = .92
Heavy vehicle percent = 5
This data increased the original density by 10%.

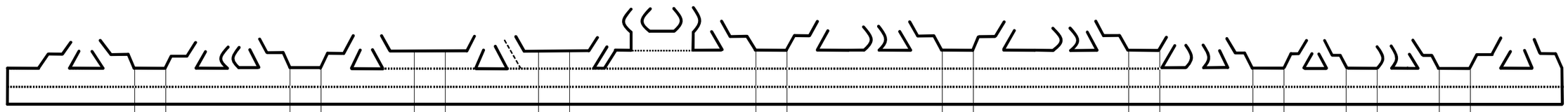
= Target Growth Percentage of 30%

I-94 Data Collection: 2025 AM Peak Hour

Eastbound

	Main Ave.			Sheyenne St.				9th St.					45th St.				I-29					25th St.					University Dr.					TH 75				20th St.				34th St.				MN 336		
Distance (ft.)	2660	575	1590	11770	755	2050	1040	7520	765	1650	1800	635	1475	705	930	1450	2185		760	465	1345	1365	1805		910	730	1465	515	870	960	740	1050	1125	4225		520	1445	790	2315		1665	5910	2110	575	14825	710	1365	1080
2008 Vol. (vph)				325				-					1298					2335						2471					2645						2250					1406			1015			504			
2025 Sim. Vol. (vph)				465				909					1849					3087						3268					3449						2939					1860			1326			678			
Volume % Difference				43%				-					42%					32%						32%					30%						31%					32%			31%			34%			
Speed (mph)				75.1				59.2					59.2					58.2						59.2					57.1						58.4					57.7			58.6			70			
# of Lanes				2				2					3					3						4					3						3					2			2			2			
Density (pc/mi/ln)				3				9					12					20						15					22						19					18			13			5			
Level of Service				A				A					B					B						B					C						B					B			B			A			



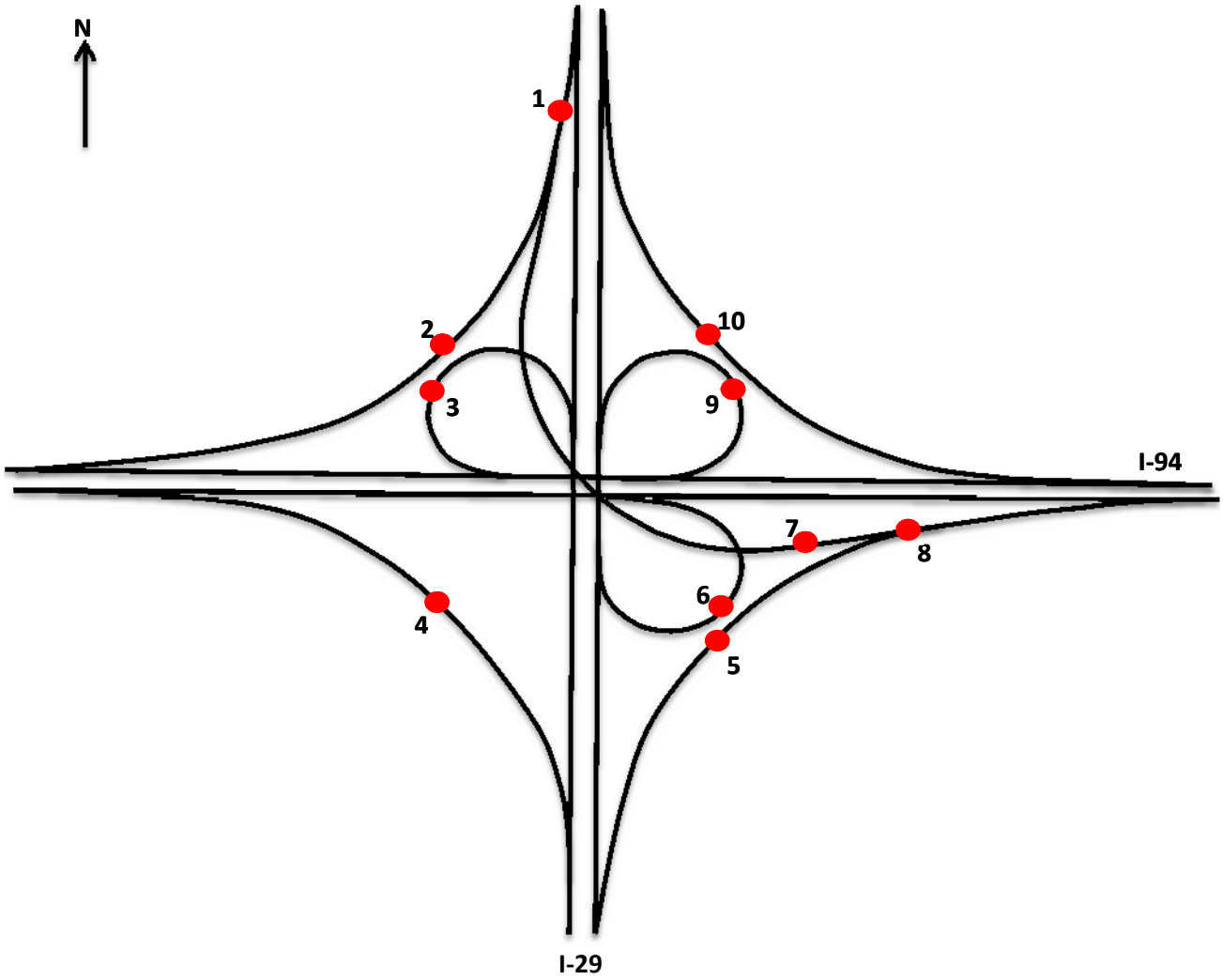


Westbound

	Main Ave.				Sheyenne St.					9th St.				45th St.				I-29																															
Distance (ft.)	2815	1215	2850	390	9790	1035	835	1130	785	8105	730	3045	845	1395	825	1900	2375			1490	975		945	650	1555	770	350	915	930	675	1930	700	470	490	505	1170	4750	980	810	550	1880	2425		5400	1365	585	12850	965	2195	465
2008 Vol. (vph)					661					-				939				1960							3362						3559						3736				2652			2198			1562			
2025 Sim. Vol. (vph)					880					869				1254				2587							4414						4660						4879				3479			2865			2037			
Volume % Difference					33%					-				34%				32%							31%						31%						31%				31%			30%			30%			
Speed (mph)					73.4					58.9				59				59.3							57						56.3						56.7				54.9			57.4			69.8			
# of Lanes					2					2				3				3							3						3						3				2			2			2			
Density (pc/mi/ln)					7					8				8				16							29						31						32				35			28			16			
Level of Service					A					A				A				B							D						D						D				E			C			B			

Note: Density values were adjusted using the following data:
Peak-hour factor = .92
Heavy vehicle percent = 5
This data increased the original density by 10%.

= Target Growth Percentage of 30%



2025 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
2025 Sim. Vol. (vph)	1142	395	691	235	655	999	749	1404	266	1801
Volume % Difference	34%	38%	35%	34%	31%	32%	32%	32%	45%	32%
Speed (mph)	58	54	24	55	54	24	55	56	25	53
# of Lanes	2	1	1	1	1	1	2	2	1	1
Density (pc/mi/ln)	11	8	31	5	14	46	8	14	12	38

This data increased the original density by 10%.

= Target Growth Percentage of 30%

Appendix C: 2025 AM Simulation Output (Node Evaluations)

2025 AM Peak - Ramp Terminal Data

Node Location: I-94 & Sheyenne St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume			84			204	254	395			739	42
Delay Time/Veh. (s)			7.6			4.0	9.5	0.6			4.0	2.7
Max Queue (ft)			154			249	231	61			368	2
Avg. Queue (ft)			9			6	12	0			18	0
								Intersection Delay (sec/veh)				2.6

Node Location: I-94 & Sheyenne St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	9		88					639	159	379	443	
Delay Time/Veh. (s)	30.0		7.2					18.7	11.4	20.5	1.7	
Max Queue (ft)	130		130					766	352	363	196	
Avg. Queue (ft)	5		5					121	7	59	3	
								Intersection Delay (sec/veh)				13.1

Node Location: I-94 & 9th St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				308		204	63	478			709	61
Delay Time/Veh. (s)				37.1		6.0	40.8	3.8			7.8	2.9
Max Queue (ft)				217		215	174	174			242	3
Avg. Queue (ft)				49		36	19	19			22	0
								Intersection Delay (sec/veh)				9.4

Node Location: I-94 & 9th St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	25		90					517	903		868	149
Delay Time/Veh. (s)	36.1		5.2					2.9	7.3		3.2	0.8
Max Queue (ft)	120		125					155	0		252	261
Avg. Queue (ft)	6		6					4	0		12	14
								Intersection Delay (sec/veh)				3.8

Node Location: I-94 & 45th St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				885		618		692	47		546	114
Delay Time/Veh. (s)				10.0		26.5		7.6	0.5		9.9	1.4
Max Queue (ft)				56		359		192	215		267	0
Avg. Queue (ft)				0		67		16	7		24	0
								Intersection Delay (sec/veh)				10.6

Node Location: I-94 & 45th St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	111		36					628	1084		868	295
Delay Time/Veh. (s)	39.5		7.3					2.7	1.6		9.1	1.3
Max Queue (ft)	192		135					218	5		291	228
Avg. Queue (ft)	28		2					9	0		26	25
								Intersection Delay (sec/veh)				2.9

2025 AM Peak - Ramp Terminal Data

Node Location: I-94 & 25th St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				241		627		592	430		515	190
Delay Time/Veh. (s)				36.3		18.9		10.1	1.6		8.9	9.5
Max Queue (ft)				341		616		233	315		306	306
Avg. Queue (ft)				60		104		19	15		31	31
								Intersection Delay (sec/veh)				11.2

Node Location: I-94 & 25th St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	125	160	99	8		256		904	1	62	400	297
Delay Time/Veh. (s)	39.0	41.1	4.6	54.6		9.7		6.6	2.7	5.9	1.7	2.9
Max Queue (ft)	218	238	130	67		203		255	0	92	110	311
Avg. Queue (ft)	32	41	3	2		16		22	0	1	3	6
								Intersection Delay (sec/veh)				9.6

Node Location: I-94 & University Dr (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				451		491		1153	295		406	417
Delay Time/Veh. (s)				39.0		15.7		11.8	1.6		6.3	0.8
Max Queue (ft)				332		420		517	305		295	0
Avg. Queue (ft)				71		80		54	1		13	0
								Intersection Delay (sec/veh)				12.3

Node Location: I-94 & University Dr (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	764		319					691	366		647	202
Delay Time/Veh. (s)	39.4		8.4					8.5	0.6		5.6	0.6
Max Queue (ft)	456		207					258	0		278	205
Avg. Queue (ft)	119		24					24	0		14	18
								Intersection Delay (sec/veh)				13.6

Node Location: I-94 & 8th St/TH75 (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				92		263		1948	782		284	965
Delay Time/Veh. (s)				22.1		9.3		6.4	12.8		4.4	1.0
Max Queue (ft)				138		182		729	268		141	62
Avg. Queue (ft)				11		14		118	5		5	0
								Intersection Delay (sec/veh)				6.4

Node Location: I-94 & 8th St/TH75 (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume			393			1021		1708	230	99	276	
Delay Time/Veh. (s)			5.7			3.0		9.1	5.8	10.6	3.9	
Max Queue (ft)			150			373		649	168	132	134	
Avg. Queue (ft)			13			8		73	6	3	4	
								Intersection Delay (sec/veh)				6.6

2025 AM Peak - Ramp Terminal Data

Node Location: I-94 & 20th St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume							415	234			711	375
Delay Time/Veh. (s)							13.1	8.4			0.2	12.3
Max Queue (ft)							367	367			244	535
Avg. Queue (ft)							92	92			27	51
							Intersection Delay (sec/veh)					6.9

Node Location: I-94 & 20th St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	473		151					613			146	89
Delay Time/Veh. (s)	11.1		4.0					8.4			6.5	0.8
Max Queue (ft)	210		139					276			158	371
Avg. Queue (ft)	24		4					31			6	11
							Intersection Delay (sec/veh)					8.2

Node Location: I-94 & 34th St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				31		71		938	319	603	198	
Delay Time/Veh. (s)				31.2		7.5		18.6	13.9	24.7	4.9	
Max Queue (ft)				130		138		408	408	376	358	
Avg. Queue (ft)				7		10		81	81	77	63	
							Intersection Delay (sec/veh)					17.7

Node Location: I-94 & 34th St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				200		492		764	35	7	223	
Delay Time/Veh. (s)				57.8		14.8		7.4	1.9	77.0	5.6	
Max Queue (ft)				319		319		313	102	143	143	
Avg. Queue (ft)				89		89		23	1	8	8	
							Intersection Delay (sec/veh)					14.6

Node Location: I-94 & MN 336 (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				34		80	51	299			114	767
Delay Time/Veh. (s)				7.9		7.3	0.7	0.1			1.9	2.9
Max Queue (ft)				130		130	0	0			0	0
Avg. Queue (ft)				4		4	0	0			0	0
							Intersection Delay (sec/veh)					2.3

Node Location: I-94 & MN 336 (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				32		219		166	10	65	84	
Delay Time/Veh. (s)				8.1		0.9		0.1	0.8	0.8	0.2	
Max Queue (ft)				0		0		0	0	12	12	
Avg. Queue (ft)				0		0		0	0	0	0	
							Intersection Delay (sec/veh)					0.9

2025 AM Peak - Ramp Terminal Data

Node Location: I-29 & CR 20 (W. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		188	87	140	203					106		276
Delay Time/Veh. (s)		0.8	1.9	1.2	1.1					12.8		12.1
Max Queue (ft)		0	0	24	24					250		250
Avg. Queue (ft)		0	0	0	0					12		12
							Intersection Delay (sec/veh)					5.4

Node Location: I-29 & CR 20 (E. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	91	203			285	60	57		159			
Delay Time/Veh. (s)	1.2	1.0			0.5	1.4	11.5		9.3			
Max Queue (ft)	73	73			0	0	171		171			
Avg. Queue (ft)	0	0			0	0	3		3			
							Intersection Delay (sec/veh)					3.1

Node Location: I-29 & 19 Ave N (W. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	35	508			445	657				154		2
Delay Time/Veh. (s)	2.9	4.8			5.1	3.7				12.5		0.6
Max Queue (ft)	0	174			205	311				166		8
Avg. Queue (ft)	0	10			9	1				13		0
							Intersection Delay (sec/veh)					5.1

Node Location: I-29 & 19 Ave N (E. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		636	25		1014	36	86		863			
Delay Time/Veh. (s)		9.4	0.3		10.4	1.3	22.1		10.7			
Max Queue (ft)		228	206		474	2	213		260			
Avg. Queue (ft)		22	7		59	0	13		51			
							Intersection Delay (sec/veh)					10.4

Node Location: I-29 & 12th Ave N (W. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		132	137		859	326				152		125
Delay Time/Veh. (s)		3.0	0.6		4.2	1.1				33.3		3.2
Max Queue (ft)		105	0		275	121				213		202
Avg. Queue (ft)		2	0		16	0				35		8
							Intersection Delay (sec/veh)					5.7

Node Location: I-29 & 12th Ave N (E. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		242	42		632	65	552		1008			
Delay Time/Veh. (s)		3.2	0.2		9.8	0.6	25.6		10.9			
Max Queue (ft)		107	175		260	0	287		306			
Avg. Queue (ft)		3	0		26	0	62		74			
							Intersection Delay (sec/veh)					12.6

2025 AM Peak - Ramp Terminal Data

Node Location: I-29 & Main Ave (W. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		844	243		1020	208				121		181
Delay Time/Veh. (s)		3.3	4.2		1.6	0.8				41.4		6.8
Max Queue (ft)		204	204		129	324				171		150
Avg. Queue (ft)		11	11		5	1				25		8
								Intersection Delay (sec/veh)				4.5

Node Location: I-29 & Main Ave (E. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		782	177		711	64	520		751			
Delay Time/Veh. (s)		6	0		7	8	38		9			
Max Queue (ft)		273	270		201	201	306		299			
Avg. Queue (ft)		17	2		16	16	78		67			
								Intersection Delay (sec/veh)				12.3

Node Location: I-29 & 38th St

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				363		27		89	170	122	27	
Delay Time/Veh. (s)				15.5		4.4		4.5	1.6	5.4	4.7	
Max Queue (ft)				183		114		114	116	139	139	
Avg. Queue (ft)				25		2		2	0	4	4	
								Intersection Delay (sec/veh)				8.9

Node Location: I-29 & 13th 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	67	806	197		1048	286	390	358	473			
Delay Time/Veh. (s)	46.9	10.1	0.2		17.5	7.0	28.7	42.9	10.8			
Max Queue (ft)	161	263	148		361	0	441	441	445			
Avg. Queue (ft)	18	27	0		62	0	92	95	95			
								Intersection Delay (sec/veh)				17.5

Node Location: I-29 & 32nd Ave S (W. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		694	146		1138	288				308		533
Delay Time/Veh. (s)		6.7	0.9		5.5	2.1				30.4		16.1
Max Queue (ft)		217	0		257	160				234		420
Avg. Queue (ft)		15	0		18	1				38		81
								Intersection Delay (sec/veh)				9.5

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		686	2552		1095	997	331		254			
Delay Time/Veh. (s)		10.9	4.8		9.1	2.8	34.5		11.5			
Max Queue (ft)		258	275		324	28	396		393			
Avg. Queue (ft)		23	7		31	0	84		56			
								Intersection Delay (sec/veh)				7.9

2025 AM Peak - Ramp Terminal Data

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

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		1572	100		1903	100				373		766
Delay Time/Veh. (s)		0.0	3.0		8.3	0.8				25.7		14.7
Max Queue (ft)		442	442		399	268				221		284
Avg. Queue (ft)		61	61		47	2				40		55
							Intersection Delay (sec/veh)					7.7

Node Location: I-29 & 52nd 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		1380	564		1939	942	61		166			
Delay Time/Veh. (s)		2.1	3.1		4.3	3.8	35.5		6.5			
Max Queue (ft)		187	237		353	353	150		4			
Avg. Queue (ft)		7	22		31	31	18		0			
							Intersection Delay (sec/veh)					3.9

Appendix D: 2025 PM Simulation Output (Network Performance, Travel Time, Freeway Queues)

Network Performance

Total Delay Time (hr)	473
Total Travel Time (hr)	4,858
Number of Active Vehicles	0
Number of Arrived Vehicles	57,213
Total Stopped Delay (hr)	147
Total Distance Traveled (mi)	238,414

Queue Measurement

Time	Tri-Level Merge			I-94 WB (45th St)		
	Avg.	Max.	Stop	Avg.	Max.	Stop
PM Peak	2	361	10	0	7	0

Travel Time (Network)

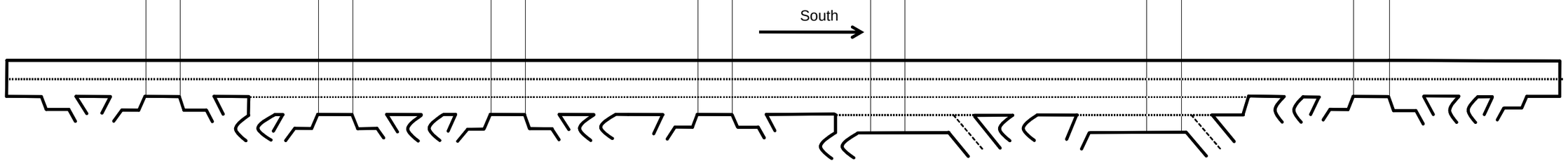
Origin		Destination					
		I-29 SB		I-94 EB		I-29 NB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-94 EB	1630-1645	12.3	4	15.3	11	15.9	4
	1645-1700	12.3	4	15.4	10	15.8	4
	1700-1715	12.3	4	15.6	11	16.0	4
	1715-1730	12.4	4	15.5	11	15.9	4
		I-29 SB		I-94 WB		I-29 NB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-94 WB	1630-1645	15.5	4	15.0	7	17.2	7
	1645-1700	15.6	4	14.9	7	17.2	6
	1700-1715	15.5	4	15.0	8	17.3	7
	1715-1730	15.6	4	15.0	8	17.2	7
		I-94 WB		I-29 NB		I-94 EB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-29 NB	1630-1645	13.2	4	14.6	13	14.9	4
	1645-1700	13.1	4	14.7	14	15.0	4
	1700-1715	13.2	4	14.7	15	15.2	4
	1715-1730	13.1	4	14.6	14	15.1	5
		I-94 WB		I-29 SB		I-94 EB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-29 SB	1630-1645	14.9	4	14.6	6	17.8	5
	1645-1700	14.9	4	14.7	6	17.9	5
	1700-1715	14.9	4	14.7	6	18.0	5
	1715-1730	15.0	4	14.7	6	18.0	6

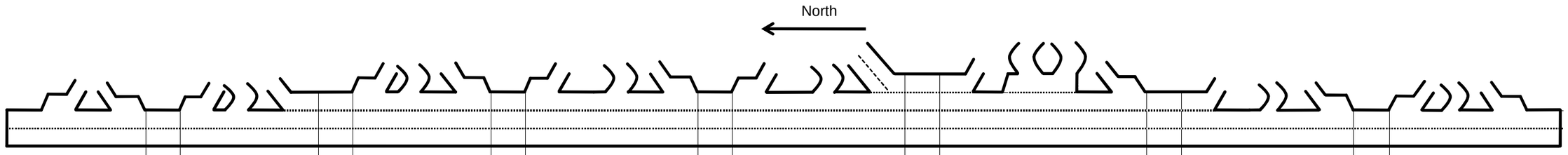
Appendix E: 2025 PM Simulation Output (Data Collection Points)

I-29 Data Collection: 2025 PM Peak Hour

Southbound

	CR20				19th Ave. N					12th Ave. N					Main Ave.						13th Ave. S				I-94								32nd Ave. S						52nd Ave. 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	880		3840			1300	640	1150	2895			815	1050	1270	625	7200	620	670	960	510	1900
2008 Vol. (vph)					748					1317					2489						3411				3603						2037						1021					
2025 Sim. Vol. (vph)					1004					1746					3271						4470				4702						2647						2327					
Volume % Difference					34%					33%					31%						31%				30%						30%						128%					
Speed (mph)					74.5					59.2					57.5						55.2				57						58.4						72.3					
# of Lanes					2					3					3						3				4						4						2					
Density (pc/mi/ln)					7					11					21						30				23						13						18					
Level of Service					A					B					C						D				C						B						B					





Northbound

	CR 20				19th Ave. N					12th Ave. N					Main Ave.						13th Ave. S					I-94								32nd Ave. S						52nd Ave. S					
Distance (ft.)	8050	650	650	1885	7140	1165	1045	1015	665	1855	830	920	765	580	2190	525	745	570	655	760	1930	685	755	665	1310	2100			910	505	485	1260	990	1240	255	1145	305	860	720	7100	760	775	595	800	1675
2008 Vol. (vph)					1155					1644					2025						2129					2763								1952						924					
2025 Sim. Vol. (vph)					1528					2161					2661						2798					3597								2517						2036					
Volume % Difference					32%					31%					31%						31%					30%								29%						120%					
Speed (mph)					73.7					58.1					57.9						57.9					58.5								58.3						72.8					
# of Lanes					2					3					3						3					4								3						2					
Density (pc/mi/ln)					12					14					17						18					17								16						16					
Level of Service					B					B					B						B					B								B						B					

Note: Density values were adjusted using the following data:
Peak-hour factor = .92
Heavy vehicle percent = 5
This data increased the original density by 10%.

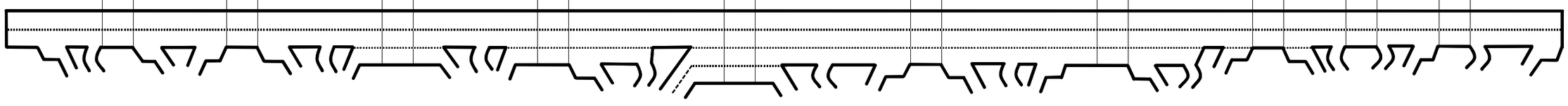
= Target Growth Percentage of 30%

I-94 Data Collection: 2025 PM Peak Hour

Eastbound

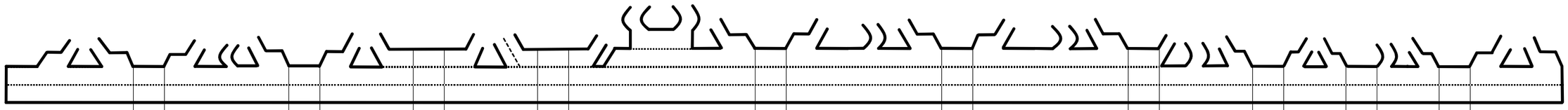
	Main Ave.			Sheyenne St.					9th St.				45th St.				I-29							25th St.					University Dr.						TH 75			20th St.			34th St.			MN 336		
Distance (ft.)	2660	575	1590	11770	755	2050	1040	7520	765	1650	1800	635	1475	705	930	1450	2185	760	465	1345	1365	1805	910	730	1465	515	870	960	740	1050	1125	4225	520	1445	790	2315	1665	5910	2110	575	14825	710	1365	1080
2008 Vol. (vph)				530				-					937				2297					3794					3678					3828				2297		1851			1092			
2025 Sim. Vol. (vph)				739				932					1384				3048					5006					4837					5029				3058		2437			1480			
Volume % Difference				39%				-					48%				33%					32%					32%					31%				33%		32%			36%			
Speed (mph)				74.7				59					59.4				58.8					57.9					55.2					54.1				54.9		57.4			69.9			
# of Lanes				2				2					3				3					4					3					3				2		2			2			
Density (pc/mi/ln)				5				9					9				19					24					32					34				31		24			12			
Level of Service				A				A					A				B					C					D					D				D		C			B			

East



West

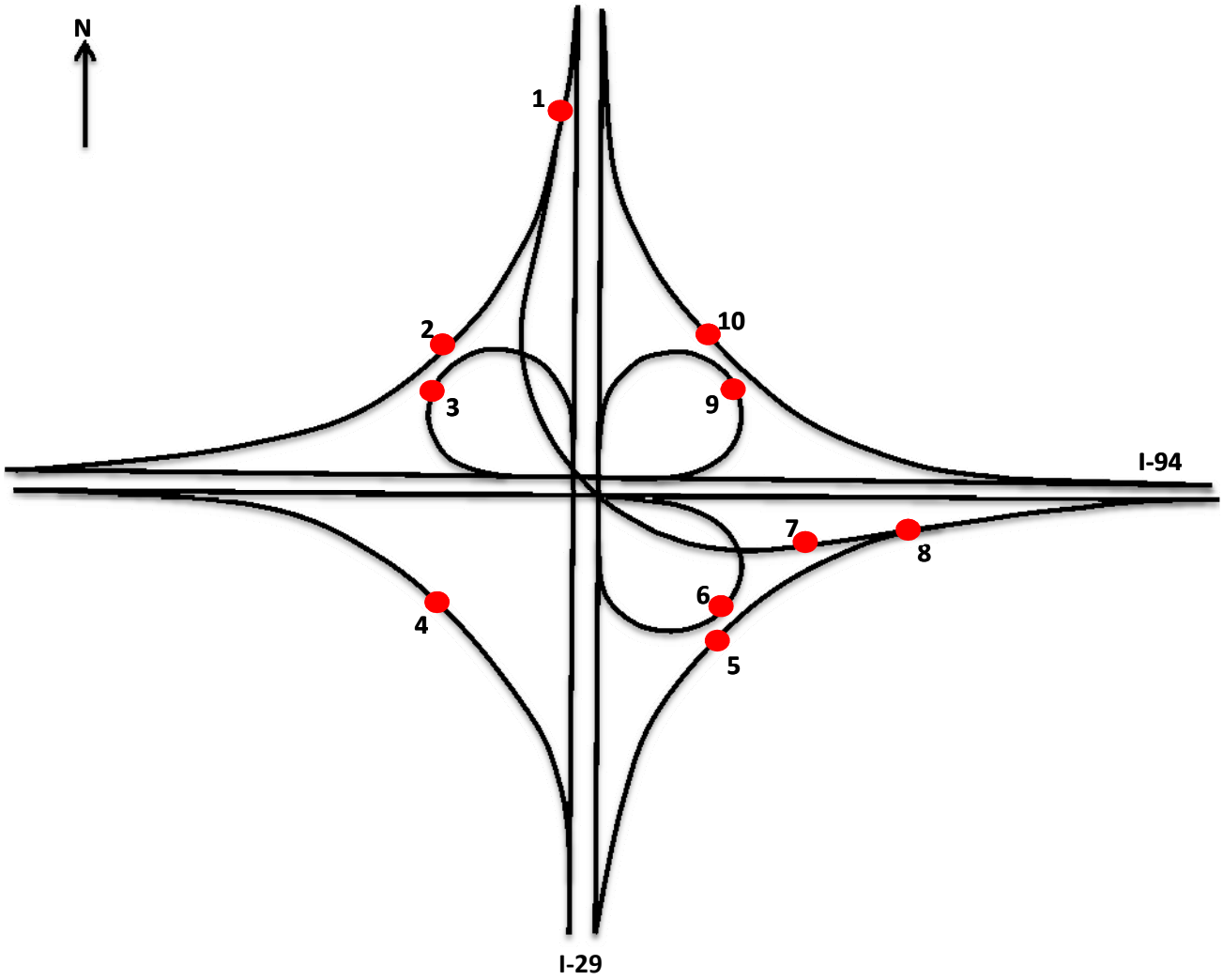
Westbound



	Main Ave.				Sheyenne St.					9th St.				45th St.				I-29									25th St.						University Dr.						TH 75				20th St.				34th St.				MN 336		
Distance (ft.)	2815	1215	2850	390	9790	1035	835	1130	785	8105	730	3045	845	1395	825	1900	2375	1490	975	945	650	1555	770	350	915	930	675	1930	700	470	490	505	1170	4750	980	810	550	1880	2425	5400	1365	585	12850	965	2195	465
2008 Vol. (vph)					256					-				1152			2292					3034						3023						2936				1825		1416			759			
2025 Sim. Vol. (vph)					392					766				1463			3045					3997						3973						3855				2437		1861			1024			
Volume % Difference					53%					-				27%			33%					32%						31%						31%				34%		31%			35%			
Speed (mph)					73.9					58.6				58.3			59.1					57.7						57.1						57.8				57.3		58.5			70.0			
# of Lanes					2					2				3			3					3						3						3				2		2			2			
Density (pc/mi/ln)					3					7				9			19					26						26						25				24		18			8			
Level of Service					A					A				A			B					C						C						C				C		B			A			

Note: Density values were adjusted using the following data:
Peak-hour factor = .92
Heavy vehicle percent = 5
This data increased the original density by 10%.

= Target Growth Percentage of 30%



2025 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
2025 Sim. Vol. (vph)	2844	810	515	265	622	443	2035	2658	242	1497
Volume % Difference	33%	34%	32%	31%	32%	25%	32%	32%	57%	32%
Speed (mph)	55	54	25	55	54	25	54	54	25	53
# of Lanes	2	1	1	1	1	1	2	2	1	1
Density (pc/mi/ln)	29	17	23	5	13	20	21	28	11	31

This data increased the original density by 10%.

= Target Growth Percentage of 30%

Appendix F: 2025 PM Simulation Output (Node Evaluations)

2025 PM Peak - Ramp Terminal Data

Node Location: I-94 & Sheyenne St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume			138			328	83	234			500	8
Delay Time/Veh. (s)			6.8			3.8	3.7	0.3			4.5	1.1
Max Queue (ft)			180			331	113	20			239	0
Avg. Queue (ft)			14			10	1	0			12	0
							Intersection Delay (sec/veh)					2.5

Node Location: I-94 & Sheyenne St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	24		171					292	97	289	348	
Delay Time/Veh. (s)	22.3		8.3					13.2	3.4	17.0	3.6	
Max Queue (ft)	176		176					297	2	286	198	
Avg. Queue (ft)	12		12					27	0	36	6	
							Intersection Delay (sec/veh)					9.6

Node Location: I-94 & 9th St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				342		434	57	335			561	22
Delay Time/Veh. (s)				34.6		9.5	40.3	4.1			8.7	2.8
Max Queue (ft)				248		246	149	149			220	0
Avg. Queue (ft)				61		55	16	16			19	0
							Intersection Delay (sec/veh)					11.3

Node Location: I-94 & 9th St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	31		93					361	352		682	222
Delay Time/Veh. (s)	35.6		4.8					2.2	2.2		4.1	0.9
Max Queue (ft)	121		128					134	0		248	264
Avg. Queue (ft)	7		6					3	0		12	15
							Intersection Delay (sec/veh)					2.1

Node Location: I-94 & 45th St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				976		808		273	29		1118	171
Delay Time/Veh. (s)				35.0		8.0		14.3	0.3		20.1	7.1
Max Queue (ft)				1070		220		155	194		1000	0
Avg. Queue (ft)				176		1		13	4		164	0
							Intersection Delay (sec/veh)					13.6

Node Location: I-94 & 45th St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	72		48					229	1055		1368	729
Delay Time/Veh. (s)	35.4		8.4					2.1	1.4		3.0	4.6
Max Queue (ft)	159		125					176	4		357	228
Avg. Queue (ft)	17		2					4	0		15	42
							Intersection Delay (sec/veh)					2.4

2025 PM Peak - Ramp Terminal Data

Node Location: I-94 & 25th St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				290		365		388	473		725	199
Delay Time/Veh. (s)				41.0		8.9		6.8	1.7		7.5	8.4
Max Queue (ft)				436		237		174	319		322	322
Avg. Queue (ft)				87		24		8	27		30	30
								Intersection Delay (sec/veh)				8.3

Node Location: I-94 & 25th St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	172	267	401	5		286		758	6	80	626	311
Delay Time/Veh. (s)	35.4	38.2	10.4	49.4		10.5		10.3	10.7	7.4	4.3	2.9
Max Queue (ft)	294	486	327	52		232		272	0	117	195	316
Avg. Queue (ft)	40	69	29	1		20		35	0	3	10	7
								Intersection Delay (sec/veh)				12.0

Node Location: I-94 & University Dr (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				314		389		658	310		802	499
Delay Time/Veh. (s)				42.6		10.0		1.8	0.9		5.2	1.8
Max Queue (ft)				245		266		218	200		430	0
Avg. Queue (ft)				55		46		4	0		24	0
								Intersection Delay (sec/veh)				6.6

Node Location: I-94 & University Dr (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	469		450					499	672		689	425
Delay Time/Veh. (s)	42.7		11.8					5.9	0.8		9.4	1.1
Max Queue (ft)	313		317					230	0		275	205
Avg. Queue (ft)	77		49					14	0		23	15
								Intersection Delay (sec/veh)				10.5

Node Location: I-94 & 8th St/TH75 (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				119		177		1507	552		831	1158
Delay Time/Veh. (s)				22.7		8.6		5.4	10.9		5.5	1.6
Max Queue (ft)				166		155		673	251		293	149
Avg. Queue (ft)				14		8		67	4		16	0
								Intersection Delay (sec/veh)				4.6

Node Location: I-94 & 8th St/TH75 (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume			1046			1248		811	97	222	729	
Delay Time/Veh. (s)			11.9			3.8		20.1	5.8	15.3	11.0	
Max Queue (ft)			279			1214		586	125	228	284	
Avg. Queue (ft)			56			74		95	3	19	32	
								Intersection Delay (sec/veh)				11.8

2025 PM Peak - Ramp Terminal Data

Node Location: I-94 & 20th St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume							456	312			438	305
Delay Time/Veh. (s)							13.9	9.0			0.1	14.0
Max Queue (ft)							391	391			241	445
Avg. Queue (ft)							114	114			17	44
							Intersection Delay (sec/veh)					8.9

Node Location: I-94 & 20th St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	335		381					408			221	91
Delay Time/Veh. (s)	9.5		6.1					9.4			8.4	0.8
Max Queue (ft)	171		221					243			196	403
Avg. Queue (ft)	15		18					24			11	17
							Intersection Delay (sec/veh)					8.8

Node Location: I-94 & 34th St (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				23		22		949	210	670	280	
Delay Time/Veh. (s)				32.3		6.4		17.4	13.1	21.7	4.3	
Max Queue (ft)				107		111		399	399	374	357	
Avg. Queue (ft)				5		6		75	75	77	63	
							Intersection Delay (sec/veh)					16.1

Node Location: I-94 & 34th St (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				297		742		416	61	16	288	
Delay Time/Veh. (s)				13.3		8.2		17.3	3.6	28.8	14.2	
Max Queue (ft)				271		271		218	122	190	190	
Avg. Queue (ft)				41		41		29	2	19	19	
							Intersection Delay (sec/veh)					9.8

Node Location: I-94 & MN 336 (N. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				39		77	41	567			174	360
Delay Time/Veh. (s)				8.4		7.6	0.6	0.2			0.8	1.7
Max Queue (ft)				134		134	0	0			0	0
Avg. Queue (ft)				4		4	0	0			0	0
							Intersection Delay (sec/veh)					1.3

Node Location: I-94 & MN 336 (S. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				33		489		156	11	99	113	
Delay Time/Veh. (s)				8.8		1.5		0.0	1.0	0.8	0.2	
Max Queue (ft)				10		10		0	0	24	24	
Avg. Queue (ft)				0		0		0	0	0	0	
							Intersection Delay (sec/veh)					1.2

2025 PM Peak - Ramp Terminal Data

Node Location: I-29 & CR 20 (W. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		388	69	182	190					92		133
Delay Time/Veh. (s)		1.0	2.0	1.9	1.7					11.7		7.8
Max Queue (ft)		0	0	61	61					156		156
Avg. Queue (ft)		0	0	0	0					2		2
							Intersection Delay (sec/veh)					3.2

Node Location: I-29 & CR 20 (E. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	242	237			271	96	101		229			
Delay Time/Veh. (s)	1.7	2.0			0.9	2.4	17.5		14.5			
Max Queue (ft)	65	65			0	0	265		265			
Avg. Queue (ft)	0	0			0	0	16		16			
							Intersection Delay (sec/veh)					5.5

Node Location: I-29 & 19 Ave N (W. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	42	418			544	796				98		2
Delay Time/Veh. (s)	2.4	3.7			4.2	4.4				11.0		0.7
Max Queue (ft)	0	161			260	310				143		0
Avg. Queue (ft)	0	6			9	1				7		0
							Intersection Delay (sec/veh)					4.5

Node Location: I-29 & 19 Ave N (E. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		436	79		1201	98	138		676			
Delay Time/Veh. (s)		7.1	0.4		9.3	1.8	20.8		8.4			
Max Queue (ft)		173	194		598	9	207		215			
Avg. Queue (ft)		12	4		67	0	19		34			
							Intersection Delay (sec/veh)					8.8

Node Location: I-29 & 12th Ave N (W. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		397	767		430	889				92		42
Delay Time/Veh. (s)		2.6	2.5		1.8	3.5				31.9		1.4
Max Queue (ft)		150	0		203	287				166		121
Avg. Queue (ft)		3	0		4	8				19		1
							Intersection Delay (sec/veh)					3.8

Node Location: I-29 & 12th Ave N (E. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		352	138		1040	191	278		556			
Delay Time/Veh. (s)		3.6	0.3		7.7	1.3	30.4		7.7			
Max Queue (ft)		142	143		401	0	211		223			
Avg. Queue (ft)		5	0		37	0	38		28			
							Intersection Delay (sec/veh)					8.8

2025 PM Peak - Ramp Terminal Data

Node Location: I-29 & Main Ave (W. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		769	533		795	1006				151		194
Delay Time/Veh. (s)		3.8	5.4		2.3	5.5				41.8		5.9
Max Queue (ft)		269	269		153	283				176		150
Avg. Queue (ft)		20	20		6	1				30		9
							Intersection Delay (sec/veh)					6.0

Node Location: I-29 & Main Ave (E. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		637	287		1589	167	214		379			
Delay Time/Veh. (s)		2.2	0.7		5.3	7.5	43.2		6.5			
Max Queue (ft)		265	298		427	427	196		182			
Avg. Queue (ft)		6	3		46	46	39		17			
							Intersection Delay (sec/veh)					7.0

Node Location: I-29 & 38th St

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				1267		55		69	667	357	72	
Delay Time/Veh. (s)				21.6		6.0		7.8	8.1	12.9	7.5	
Max Queue (ft)				621		468		122	283	259	259	
Avg. Queue (ft)				123		13		3	4	30	30	
							Intersection Delay (sec/veh)					15.4

Node Location: I-29 & 13th 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	56	1405	353		948	293	497	235	420			
Delay Time/Veh. (s)	51.3	9.3	0.6		16.5	6.1	38.8	47.3	11.8			
Max Queue (ft)	150	383	248		390	0	357	356	360			
Avg. Queue (ft)	17	43	1		61	0	93	89	87			
							Intersection Delay (sec/veh)					16.4

Node Location: I-29 & 32nd Ave S (W. Side)

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		1035	339		790	212				366		520
Delay Time/Veh. (s)		6.8	1.4		5.5	1.1				32.7		13.6
Max Queue (ft)		267	3		207	65				272		383
Avg. Queue (ft)		22	0		14	0				47		67
							Intersection Delay (sec/veh)					9.5

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		986	1739		794	675	209		403			
Delay Time/Veh. (s)		5.8	3.5		5.1	1.6	37.5		14.7			
Max Queue (ft)		258	266		190	0	404		406			
Avg. Queue (ft)		17	7		12	0	65		64			
							Intersection Delay (sec/veh)					6.4

2025 PM Peak - Ramp Terminal Data

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

	EB Approach			WB Approach			NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume		2087	127		1441	133				698		764
Delay Time/Veh. (s)		0.0	5.6		8.7	0.8				26.3		11.7
Max Queue (ft)		585	585		319	265				338		238
Avg. Queue (ft)		112	112		36	2				75		43
							Intersection Delay (sec/veh)					7.7

Node Location: I-29 & 52nd 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		2078	708		1463	722	111		154			
Delay Time/Veh. (s)		2.7	4.4		4.0	2.4	38.9		8.0			
Max Queue (ft)		303	239		252	252	191		4			
Avg. Queue (ft)		14	36		18	18	31		0			
							Intersection Delay (sec/veh)					4.2

Appendix G: 2025 AM Traffic with 2015 Network Simulation Output (Network Performance, Travel Time, Freeway Queues)

Network Performance

Total Delay Time (hr)	641
Total Travel Time (hr)	4,474
Number of Active Vehicles	21
Number of Arrived Vehicles	52,752
Total Stopped Delay (hr)	228
Total Distance Traveled (mi)	208,820

Queue Measurement

Time	Tri-Level Merge			I-94 WB (45th St)		
	Avg.	Max.	Stop	Avg.	Max.	Stop
AM Peak	1	174	4	0	0	0

Travel Time (Network)

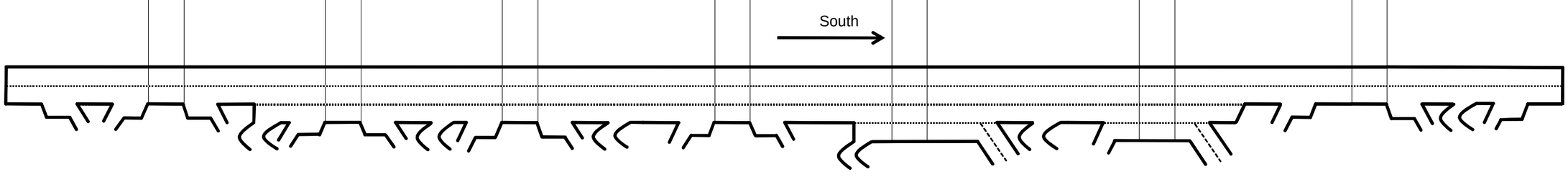
Origin		Destination					
		I-29 SB		I-94 EB		I-29 NB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-94 EB	1630-1645	12.3	4	15.1	4	15.9	4
	1645-1700	12.2	4	15.1	4	15.9	4
	1700-1715	12.3	4	15.3	4	15.9	4
	1715-1730	12.3	4	15.2	4	15.8	4
		I-29 SB		I-94 WB		I-29 NB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-94 WB	1630-1645	15.8	4	15.0	7	17.6	6
	1645-1700	15.8	4	15.2	7	17.9	6
	1700-1715	16.0	5	15.3	8	18.5	6
	1715-1730	16.3	4	15.5	8	19.0	7
		I-94 WB		I-29 NB		I-94 EB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-29 NB	1630-1645	13.3	5	14.7	7	14.9	5
	1645-1700	13.2	5	14.7	7	14.8	5
	1700-1715	13.3	5	14.8	7	14.9	6
	1715-1730	13.1	5	14.7	7	14.9	5
		I-94 WB		I-29 SB		I-94 EB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-29 SB	1630-1645	14.8	4	14.6	8	17.7	5
	1645-1700	14.7	4	14.6	9	17.4	5
	1700-1715	14.8	4	14.6	10	17.6	5
	1715-1730	14.7	4	14.6	9	17.5	5

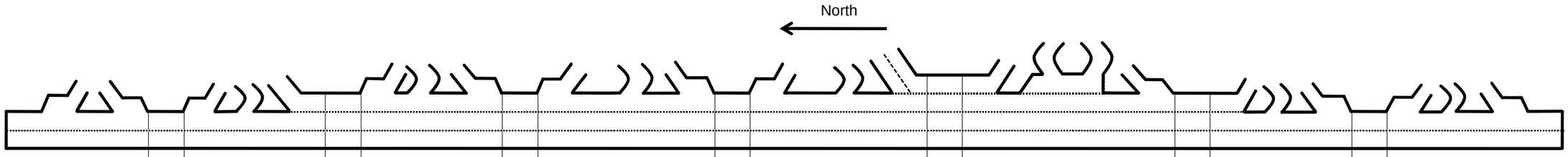
Appendix H: 2025 AM Traffic with 2015 Network Simulation Output (Data Collection Points)

I-29 Data Collection: 2025 Traffic - 2015 Network (AM Peak Hour)

Southbound

	CR20					19th Ave. N					12th Ave. N					Main Ave.						13th Ave. S					I-94								32nd Ave. S								52nd Ave. 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	840		3840			1300	640	1150	285	2325	285	950	1395	625	7200			620	670	960	510	1900
2008 Vol. (vph)					899					1315					1459						1580				1674							1505					447							
2025 Sim. Vol. (vph)					1191					1729					1917						2074				2170							1946					1551							
Volume % Difference					32%					32%					31%						31%				30%							29%					247%							
Speed (mph)					74.2					59					58.9						57.3				58.8							59.2					73.1							
# of Lanes					2					3					3						3				4							4					2							
Density (pc/mi/ln)					9					11					12						13				10							9					12							
Level of Service					A					B					B						B				B							A					B							





Northbound

	CR 20					19th Ave. N					12th Ave. N					Main Ave.						13th Ave. S					I-94								32nd Ave. S								52nd Ave. S					
Distance (ft.)	8050	650	1885	1150	7140	1165	1045	1015	2520		830	921	765	580	2190	525	745	570	655	760	1930	685	755	665	1310	2100			910	505	485	1260	990	1495			1450	860	720	7100	760	775	595	800	1675
2008 Vol. (vph)					488					1166					2269						3050					3943								2508					1485							
2025 Sim. Vol. (vph)					650					1529					2959						3970					5086								3265					2528							
Volume % Difference					33%					31%					30%						30%					29%								30%					70%							
Speed (mph)					74.8					57.8					56.4						56.2					57.3								57.8					72							
# of Lanes					2					3					3						3					4								3					2							
Density (pc/mi/ln)					5					10					19						26					25								21					20							
Level of Service					A					A					B						C					C								C					B							

Note: Density values were adjusted using the following data:
Peak-hour factor = .92
Heavy vehicle percent = 5
This data increased the original density by 10%.

= Target Growth Percentage of 30%

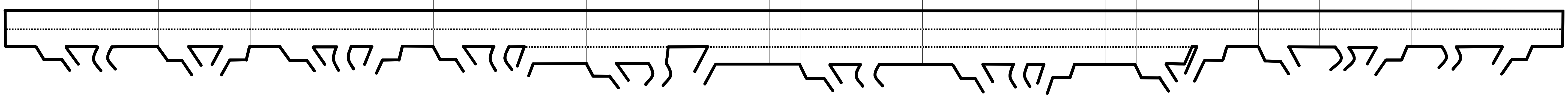
I-94 Data Collection: 2025 Traffic - 2015 Network (AM Peak Hour)

Eastbound

Main Ave. | Sheyenne St. | 9th St. | 45th St. | I-29 | 25th St. | University Dr. | TH 75 | 20th St. | 34th St. | MN 336

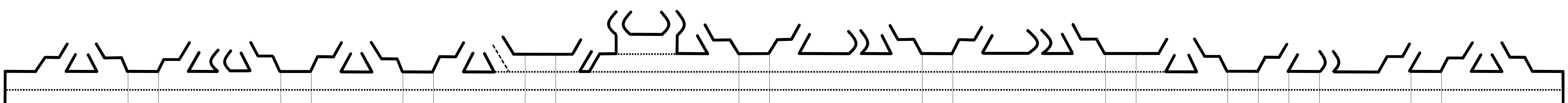
Distance (ft.)	2660	575	1005	1440	11770	755	2050	1040	7520	765	1650	1800	835	1475	705	930	1450	615	1570	760	465	1345	1365	1415		795	930	990	2610		960	740	1050	1125	4225		520	2005	840	1740	455	5645	410	955	585	12850	710	1365	1080	2170
2008 Vol. (vph)					325				-					1298					2335						2471				2645							2250				1406		1015				504				
2025 Sim. Vol. (vph)					465				909					1851					3083						3253				3429							2925				1813		1211				631				
Volume % Difference					43%				-					43%					32%						32%				30%							30%				29%		19%				25%				
Speed (mph)					75.2				59.2					58.3					58.2						58.8				58.1							58.1				57.7		58.6				70				
# of Lanes					2				2					2					3						3				3							3				2		2				2				
Density (pc/mi/ln)					3				9					18					20						20				22							19				17		11				5				
Level of Service					A				A					B					B						C				C							B				B		B				A				

East →



West ←

Westbound

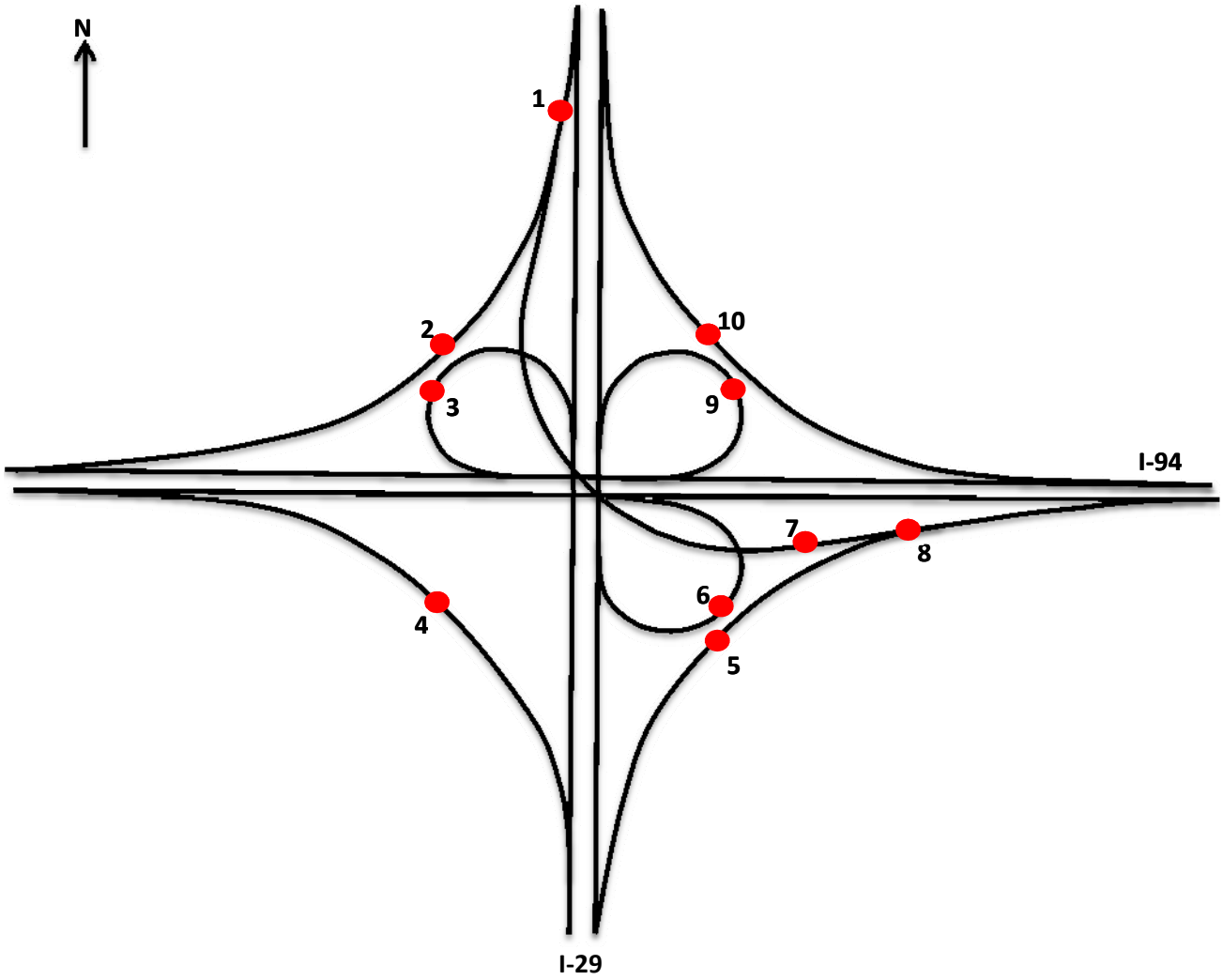


Main Ave. | Sheyenne St. | 9th St. | 45th St. | I-29 | 25th St. | University Ave. | TH 75 | 20th St. | 34th St. | MN 336

Distance (ft.)	2815	1215	2850	390	9790	1035	835	1130	785	8105	730	3045	845	1395	825	1900	740	800	835	1490	440	535	945	650	1555	770	350	915	930	675	1930	700	470	490	505	1170	4225	525	1935	550	1880	970	6855	605	860	585	12850	965	2195	465	3270
2008 Vol. (vph)					661					-				939				1960							3362						3559						3736				2652		2198				1562				
2025 Sim. Vol. (vph)					875					861				1241				2548							4306						4603						4812				3570		2790				2039				
Volume % Difference					32%					-				32%				30%							28%						29%						29%				35%		27%				31%				
Speed (mph)					73.5					59				58.6				59.3							48.7						56.3						57.1				54.6		57.5				69.9				
# of Lanes					2					2				2				3							3						3						3				2		2				2				
Density (pc/mi/ln)					7					8				12				16							33						30						31				36		27				16				
Level of Service					A					A				B				B							D						D						D				E		C				B				

Note: Density values were adjusted using the following data:
Peak-hour factor = .92
Heavy vehicle percent = 5
This data increased the original density by 10%.

(green) = Target Growth Percentage of 30%



2025/2015 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
2025 Sim. Vol. (vph)	1139	392	678	235	652	999	747	1400	267	1738
Volume % Difference	33%	37%	33%	34%	31%	33%	32%	31%	46%	28%
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	31	5	13	46	15	28	12	37

This data increased the original density by 10%.

= Target Growth Percentage of 30%

Appendix I: 2025 PM Traffic with 2015 Network Simulation Output (Network Performance, Travel Time, Freeway Queues)

Network Performance

Total Delay Time (hr)	2,384
Total Travel Time (hr)	6,730
Number of Active Vehicles	357
Number of Arrived Vehicles	56,790
Total Stopped Delay (hr)	975
Total Distance Traveled (mi)	236,585

Queue Measurement

Time	Tri-Level Merge			I-94 WB (45th St)		
	Avg.	Max.	Stop	Avg.	Max.	Stop
PM Peak	8,812	10,060	7,047	0	0	0

Travel Time (Network)

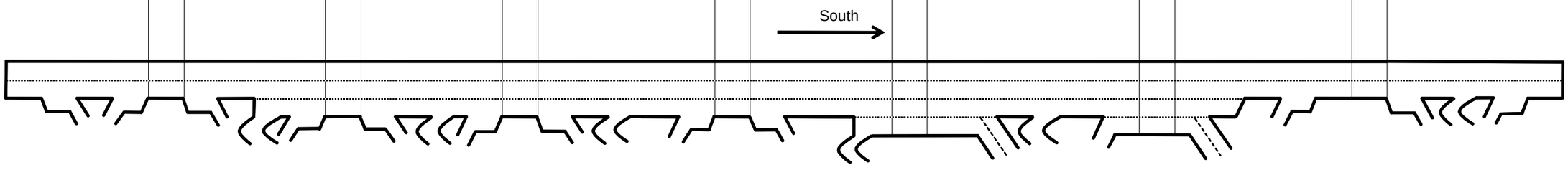
Origin		Destination					
		I-29 SB		I-94 EB		I-29 NB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-94 EB	1630-1645	12.3	4	15.4	11	16.0	4
	1645-1700	12.4	3	15.3	10	15.9	4
	1700-1715	12.4	4	15.3	10	15.9	4
	1715-1730	12.4	4	15.5	11	15.9	4
		I-29 SB		I-94 WB		I-29 NB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-94 WB	1630-1645	15.5	4	14.9	8	17.2	7
	1645-1700	15.5	4	14.9	7	17.3	6
	1700-1715	15.6	4	14.9	8	17.3	7
	1715-1730	15.6	4	14.4	8	16.7	7
		I-94 WB		I-29 NB		I-94 EB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-29 NB	1630-1645	13.1	4	14.6	13	15.7	4
	1645-1700	13.3	4	14.7	13	16.1	4
	1700-1715	13.3	4	14.7	15	16.2	4
	1715-1730	13.1	3	14.7	14	16.4	4
		I-94 WB		I-29 SB		I-94 EB	
	Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
I-29 SB	1630-1645	15.7	3	14.7	5	20.7	5
	1645-1700	17.5	3	14.9	6	22.0	3
	1700-1715	19.4	3	15.2	6	26.5	4
	1715-1730	20.8	4	15.4	6	28.0	5

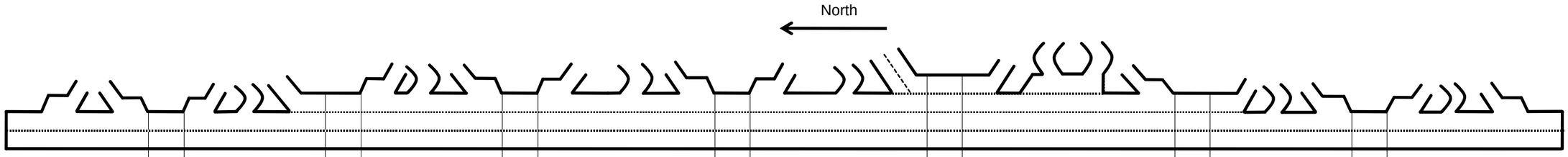
Appendix J: 2025 PM Traffic with 2015 Network Simulation Output (Data Collection Points)

I-29 Data Collection: 2025 Traffic - 2015 Network (PM Peak Hour)

Southbound

	CR20				19th Ave. N					12th Ave. N					Main Ave.						13th Ave. S						I-94								32nd Ave. S								52nd Ave. 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	840		3840			1300	640	1150	285	2325	285	950	1395	625	7200			620	670	960	510	1900
2008 Vol. (vph)					748					1317					2489						3411				3603								2037					1021							
2025 Sim. Vol. (vph)					1003					1744					3269						4131				3783								2364					2131							
Volume % Difference					34%					32%					31%						21%				5%								16%					109%							
Speed (mph)					74.5					59.2					57.6						33.9				32.7								58.7					72.3							
# of Lanes					2					3					3						3				4								4					2							
Density (pc/mi/ln)					8					12					22						48				34								12					17							
Level of Service					A					B					C						F				D								B					B							





Northbound

	CR 20				19th Ave. N					12th Ave. N					Main Ave.						13th Ave. S						I-94								32nd Ave. S								52nd Ave. S					
Distance (ft.)	8050	650	1885	1150	7140	1165	1045	1015	2520		830	921	765	580	2190	525	745	570	655	760	1930	685	755	665	1310	2100			910	505	485	1260	990	1495			1450	860	720	7100		760	775	595	800	1675
2008 Vol. (vph)					1155					1644					2025						2129					2763								1952					924							
2025 Sim. Vol. (vph)					1467					2056					2507						2641					3563								2523					2037							
Volume % Difference					27%					25%					24%						24%					29%								29%					120%							
Speed (mph)					73.8					58.2					58.0						58.0					58.6								58.3					72.9							
# of Lanes					2					3					3						3					4								3					2							
Density (pc/mi/ln)					12					14					17						18					18								17					16							
Level of Service					B					B					B						B					B								B					B							

Note: Density values were adjusted using the following data:
Peak-hour factor = .92
Heavy vehicle percent = 5
This data increased the original density by 10%.

= Target Growth Percentage of 30%

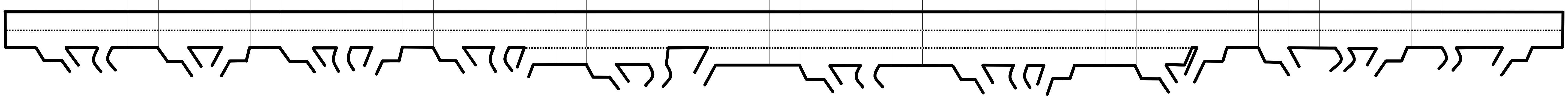
I-94 Data Collection: 2025 Traffic - 2015 Network (PM Peak Hour)

Eastbound

Main Ave. | Sheyenne St. | 9th St. | 45th St. | I-29 | 25th St. | University Dr. | TH 75 | 20th St. | 34th St. | MN 336

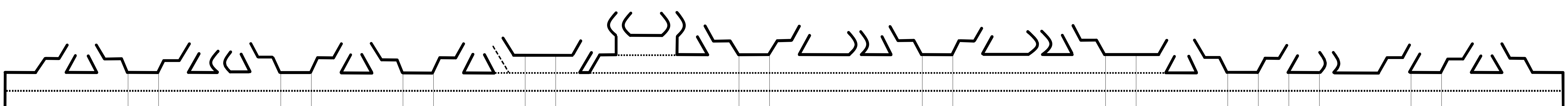
Distance (ft.)	2660	575	1005	1440	11770	755	2050	1040	7520	765	1650	1800	835	1475	705	930	1450	615	1570	760	465	1345	1365	1415		795	930	990	2610		960	740	1050	1125	4225		520	2005	840	1740	455	5645	410	955	585	12850	710	1365	1080	2170
2008 Vol. (vph)					530				-					937					2297						3794				3678							3828				2297		1851				1092				
2025 Sim. Vol. (vph)					742				940					1387					3034						4427				4268							4371				2640		2019				1267				
Volume % Difference					40%				-					48%					32%						17%				16%							14%				15%		9%				16%				
Speed (mph)					74.7				59.0					58.7					58.6						54.5				56.7							40.9				56.2		57.7				70.0				
# of Lanes					2				2					2					3						3				3							3				2		2				2				
Density (pc/mi/ln)					6				9					14					20						32				30							42				28		21				11				
Level of Service					A				A					B					C						D				D							E				C		C				B				

East →



West ←

Westbound

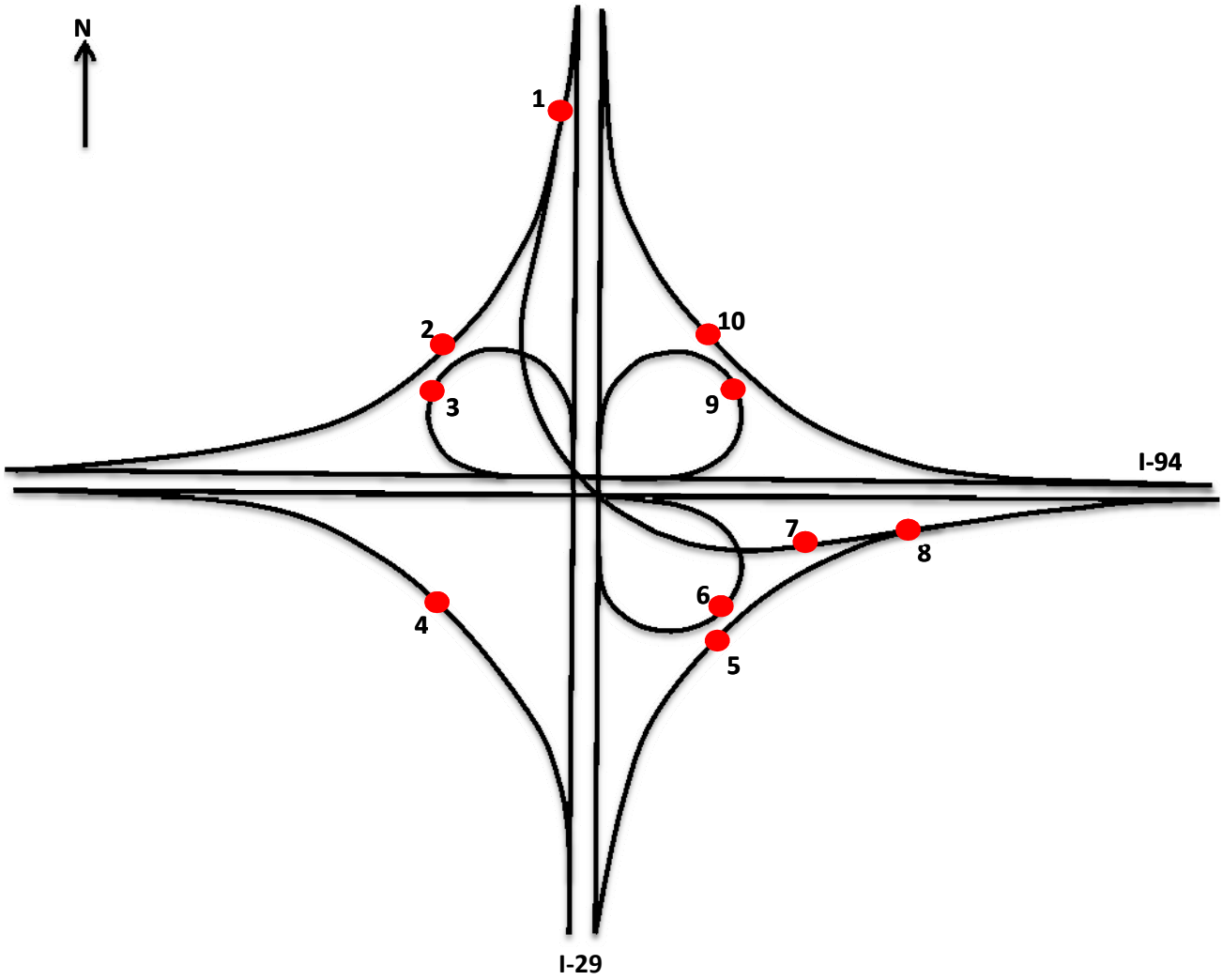


Main Ave. | Sheyenne St. | 9th St. | 45th St. | I-29 | 25th St. | University Dr. | TH 75 | 20th St. | 34th St. | MN 336

Distance (ft.)	2815	1215	2850	390	9790	1035	835	1130	785	8105	730	3045	845	1395	825	1900	740	800	835	1490	440	535	945	650	1555	770	350	915	930	675	1930	700	470	490	505	1170	4225	525	1935	550	1880	970	6855	605	860	585	12850	965	2195	465	3270
2008 Vol. (vph)					256					-				1152				2292							3034						3023						2936				1825		1416				759				
2025 Sim. Vol. (vph)					381					733				1385				2832							3890						3857						3741				2480		1776				1025				
Volume % Difference					49%					-				20%				24%							28%						28%						27%				36%		25%				35%				
Speed (mph)					74.0					58.7				58.1				59.2							56.5						57.8						58.0				56.0		58.6				70.0				
# of Lanes					2					2				2				3							3						3						3				2		2				2				
Density (pc/mi/ln)					3					7				14				19							27						26						25				26		18				9				
Level of Service					A					A				B				B							C						C						C				C		B				A				

Note: Density values were adjusted using the following data:
Peak-hour factor = .92
Heavy vehicle percent = 5
This data increased the original density by 10%.

[green box] = Target Growth Percentage of 30%



2025/2015 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
2025 Sim. Vol. (vph)	2170	654	505	266	613	441	1508	2119	240	1455
Volume % Difference	1%	8%	29%	31%	30%	25%	-2%	5%	56%	28%
Speed (mph)	18	54	25	55	51	24	21	28	25	53
# of Lanes	2	1	1	1	1	1	1	1	1	1
Density (pc/mi/ln)	72	14	24	6	14	21	83	89	11	32

This data increased the original density by 10%.

= Target Growth Percentage of 30%