

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

# Simulation Development

## Technical Memorandum I

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

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

#### **EXECUTIVE SUMMARY**

This document serves as an update to the simulation modeling effort of the Fargo-Moorhead Interstate Operations Study. The major sections of this document include network development, traffic control devices, traffic volume data, and measures of effectiveness (MOE). The simulation analysis will produce numerical data and animation that will provide guidance on locations suffering from capacity deficiencies resulting from continued traffic growth within the metropolitan area.

The simulation analysis, which will be performed using PTV AG's VISSIM simulation program, will include 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. Nine interchanges exist with local roadways along the 15-mile portion of I-94 and 7 interchanges exist on I-29, spanning 9 miles.

Traffic simulation models are constructed using various types of data, which include network geometry, traffic control devices, and traffic volume information. The VISSIM networks were primarily constructed by using the F-M Metro COG's orthorectified 2005 MrSID file. Field visits were performed to verify lane geometry and obtain several types of data including, speed limit information, signal phasing, and turn restrictions.

Most of the ramp terminals located within the metro area are controlled by traffic signals. The signal timing data for the AM and PM peak periods were provided by Mn/DOT (5 traffic signals) and NDDOT (17 traffic signals). The signalized intersections were modeled as vehicle-actuated traffic signals and used VISSIM's NEMA Signal Controller.

Turning movement counts were performed during the AM and PM peak-hour periods (April 2008) by several parties (City of Fargo, Metro COG, ATAC, and Iteris, Inc.). A significant effort was required to prepare the traffic volume data for the simulation scenarios. Over 120 count files (PetraPro) were analyzed, combined, and balanced for the 2008 scenarios.

To provide more realistic traffic flow for the simulation, origin-destination (O-D) demands were required for the modeling effort. This was accomplished using Metro COG's regional travel demand model (which uses Citilabs' Cube software). Using a sub-area network of the travel demand model, Cube's Matrix Estimator (ME), and the freeway link target values; O-D matrices were produced for both the 2008 AM and PM scenarios (which had 45 origins and 45 destinations). To account for variations during the peak-hour periods, the O-D matrices were factored at 5-minute intervals based on data from nine mainline locations for each peak period.

Simulation models provide an abundance of numerical data to describe the operational performance of a simulation scenario. Several MOE are available for comparison purposes, such as delay time, travel time, speed, queue length, etc. VISSIM's numerical output must be defined by the user prior to running the simulation. Common data collection elements of VISSIM include travel time sections, node evaluations, data collection points, and queue counters. The project team identified several measures and locations, which include the overall network (vehicle trips, travel time, delay time, etc.), the interchange ramps (turning movement volume, delay time, queue length, etc.), and several routes/locations (vehicle trips, travel time, speed, etc.).

Once the simulation networks are error-checked by verifying the geometric, traffic control, and volume data, simulation calibration will be performed to more accurately predict the traffic performance of the analysis area. This is a critical step before providing the results of the 2008 AM and 2008 PM simulation scenarios.

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#### **OVERVIEW**

This document serves as an update to the simulation modeling effort of the Fargo-Moorhead Interstate Operations Study. The major sections of this document include the network development, traffic control devices, traffic volume data, and measures of effectiveness (MOE). Currently, ATAC is error-checking and calibrating the 2008 AM and PM scenarios while we await the forthcoming results of the external origin-destination (O-D) study. In the mean time, we would like to present some of the model development and measures of effectiveness (MOE) information to the stakeholders. If concerns exist from the stakeholders about the modeling effort, we would like to address them before further efforts are performed. It should be noted that the output for the 2008 PM peak scenario, which is provided in this document, serves only as a sample of the formatted simulation output.

#### 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. Nine interchanges exist with local roadways along the 15-mile portion of I-94 and 7 exist on I-29, which spans 9 miles. PTV AG's VISSIM 5.0 traffic simulation program was purchased by Metro COG and used for this study (Figure 1). The simulation analysis will provide numerical data and animation that will provide guidance on locations suffering from capacity deficiencies resulting from continued traffic growth within the metropolitan area.



Figure 1. VISSIM network for 2008 simulation scenarios

#### SIMULATION DEVELOPMENT

Traffic simulation models are constructed using various types of data. The data can typically be grouped into network geometry, traffic control devices, and traffic volume information. The following sections will discuss these components in detail.

#### **Network Geometry**

The VISSIM networks were primarily constructed by using the F-M Metro COG's orthorectified 2005 MrSID file. Updated information for the I-29 reconstruction was accounted for using MicroStation files obtained by the Department of Transportation Support Center (DOTSC), which is a program of the Upper Great Plains Transportation Institute (UGPTI). Field visits were performed to verify lane geometry and obtain several types of data including, speed limit information, signal phasing, and turn restrictions. In addition to the freeway mainline and ramps, the arterial approaches for the ramp terminals were coded into the model. Several network elements were incorporated into this project's VISSIM model, which include the following:

- Links/Connectors: Physical geometry of the network
- **Desired Speed Decisions**: Vehicles receive speed distribution information
- Reduced Speed Areas: Vehicles receive temporary speed/acceleration information
- **Conflict Areas**: Define yield/priority requirements for intersecting/merging vehicles
- Stop Signs: Traffic control (also used for right-turn-on-red movements)
- Signal Heads: Traffic control (illustrate phase indications)
- **Detectors**: Vehicle detection for appropriate phase
- Parking Lots: Define trip origins and destinations for dynamic traffic assignment
- **Nodes**: Define intersections/diverge network sections for determining paths for dynamic traffic assignment. In addition, they are used to collect output data (e.g., intersection MOE)
- **Data collection**: Data Collection Points, Travel Time Sections, and Queue Counters define points/sections for gathering various types of output data.

Although constructing a VISSIM simulation can be a time consuming process, user familiarity makes incorporating all these elements less of a challenge. In addition, these elements allow for greater flexibility and functionality to model more complicated simulation networks/scenarios. To assist in the simulation error-checking, screen shots were captured that illustrated the network elements at the ramp terminals. An example of the network elements for the Main Ave. S.E. & I-94 North Ramp is shown in Figures 2 and 3. Figure 2 provides the simulation network and the associated elements along with the desired speed distribution information. The speed distributions are linear distributions representing a range of speeds from 90 percent to 110 percent of the posted speed limits.



Figure 2. Simulation network and associated elements for Main Ave. S.E. & I-94 North Ramp.

A description of the network elements in Figure 2 is as follows:

- Desired Speed Decisions: Light blue lines with desired speed distribution number (#,#)
- Reduced Speed Areas: Green areas with desired speed distribution number (#,#)
- Conflict Areas: Yellow highlighted areas
- Stop Signs: Yellow lines at stop lines for the lane farthest right
- Signal Heads: Red lines representing stop line locations with corresponding phase #
- **Detectors**: Blue rectangles near stop line with corresponding phase #
- **Node**: Black line traced around all intersection approaches for obtaining MOE

Figure 3 shows the same intersection; however, it displays the network using the center line view and has the conflict areas active. This view shows the links (blue) and connectors (pink), as well as the conflict areas' yielding (red) and priority (green) movements for the intersecting and merging locations.



Figure 3. Link centerlines and conflict areas for Main Ave. S.E. & I-94 North Ramp.

A description of the network elements in Figure 3 is as follows:

- Desired Speed Decisions: Light blue lines with desired speed distribution number (#,#)
- Reduced Speed Areas: Green areas with desired speed distribution number (#,#)
- **Conflict Areas**: Yielding movement in dark red and the priority movement in dark green
- Stop Signs: Yellow lines at stop lines for the lane farthest right
- Signal Heads: Red lines representing stop line locations with corresponding phase #
- Detectors: Blue rectangles near stop line with corresponding phase #
- Node: Black line traced around all intersection approaches for obtaining MOE

Freeway sections within VISSIM networks contain fewer elements. Besides the links/connectors, other typical freeway elements include desired speed decisions, data collection points, and nodes. An example of the freeway elements for I-94 between I-29 and 25<sup>th</sup> St. is shown in Figure 4. A description of the network elements is as follows:

- **Desired Speed Decisions**: Light blue lines with desired speed distribution number (#,#)
- Data Collection Points: Dark blue lines between interchange ramps for obtaining MOE
- **Node**: Black rectangles at diverge locations for dynamic traffic assignment

Errors related to the network geometry are significantly reduced since VISSIM allows the user to trace over scaled background images. Therefore, the link attributes (length and number of lanes) can easily be verified. To ensure that the correct link types (e.g., urban, freeway, etc.) were used for this study, each link type was assigned a different color.



Figure 4. Network attributes for I-94 between I-29 and 25<sup>th</sup> St.

### **Traffic Control Devices**

Most of the ramp terminals located within the metro area are controlled by traffic signals (Table 1). The signal timing data for the AM and PM peak periods were provided by Mn/DOT (5 traffic signals) and NDDOT (17 traffic signals). In addition, field visits were conducted to determine/verify signal phasing information, such as protected/permitted left-turn operation, right-turn-on-red restrictions, phase overlaps, etc.

Interchange Ramp Terminal	Method of Control	Actuated	Coordinated	Cycle Length
I-94 & Sheyenne St. N. Ramp	Yield/Stop Signs	-	-	-
I-94 & Sheyenne St. S. Ramp	Stop Signs	-	-	-
I-94 & 45th St. N. Ramp	Traffic Signal	Yes	AM/PM	95 sec/110 sec
I-94 & 45th St. S. Ramp	Traffic Signal	Yes	AM/PM	95 sec/110 sec
I-94 & 25th St. N. Ramp	Traffic Signal	Yes	AM/PM	105 sec/105 sec
I-94 & 25th St. S. Ramp	Traffic Signal	Yes	AM/PM	105 sec/105 sec
I-94 & University Dr. N. Ramp	Traffic Signal	Yes	AM/PM	110 sec/110 sec
I-94 & University Dr. S. Ramp	Traffic Signal	Yes	AM/PM	110 sec/110 sec
I-94 & 8 <sup>th</sup> St. N. Ramp	Traffic Signal	Yes	No	-
I-94 & 8 <sup>th</sup> St. S. Ramp	Traffic Signal	Yes	No	-
I-94 & 20th St. N. Ramp	Stop Signs	-	-	-
I-94 & 20th St. S. Ramp	Traffic Signal	Yes	No	-
I-94 & Main Ave. S.E. N. Ramp	Traffic Signal	Yes	No	-
I-94 & Main Ave. S.E. S. Ramp	Traffic Signal	Yes	No	-
I-94 & MN 336 N. Ramp	Yield/Stop Signs	-	-	-
I-94 & MN 336 N. Ramp	Yield/Stop Signs	-	-	-
I-29 & Co. Rd 20 W. Ramp	Stop Signs	-	-	-
I-29 & Co. Rd 20 E. Ramp	Stop Signs	-	-	-
I-29 & 19th Ave. W. Ramp	Traffic Signal	Yes	No	-
I-29 & 19th Ave. E. Ramp	Traffic Signal	Yes	No	-
I-29 & 12th Ave. W. Ramp	Traffic Signal	Yes	AM	80 sec
I-29 & 12th Ave. E. Ramp	Traffic Signal	Yes	AM	80 sec
I-29 & Main Ave. W. Ramp	Traffic Signal	Yes	AM/PM	105 sec/105 sec
I-29 & Main Ave. E. Ramp	Traffic Signal	Yes	AM/PM	105 sec/105 sec
I-29 & 38th St. W. Ramp	Traffic Signal	Yes	AM	40 sec
I-29 & 36th St. E. Ramp	Traffic Signal	Yes	AM/PM	95 sec/110 sec
I-29 & 32nd Ave. S. W. Ramp	Traffic Signal	Yes	AM/PM	105 sec/105 sec
I-29 & 32nd Ave. S. E. Ramp	Traffic Signal	Yes	AM/PM	105 sec/105 sec
I-29 & 52nd Ave. S. W. Ramp	Traffic Signal	Yes	AM/PM	90 sec/90 sec
I-29 & 52nd Ave. S. E. Ramp	Traffic Signal	Yes	AM/PM	90 sec/90 sec

 Table 1. Interchange Ramp Terminal Control.

The signalized intersections were modeled using detectors, signal heads, stop signs (RTOR), and incorporated the NEMA Signal Controller. The NEMA Standard Editor was used to input the timing and phasing information for signalized intersections, creating a .NSE file. If a signalized intersection had different timing plans for the AM and PM peak periods, multiple .NSE files were created and used for the appropriate simulation scenario. Figure 5 illustrates the signal information for the S.E. Ave. & I-94 North Ramp. To assist in the signal data error-checking, screen shots from the NEMA Editor were pasted under the spreadsheet information provided by both DOTs for comparison purposes.



Figure 5. Signal timing/phasing information for Main Ave. S.E. & I-94 N. Ramp.

### Traffic Volume Information

The AM and PM peak-hour counts were performed by several parties (City of Fargo, Metro COG, ATAC, and Iteris, Inc.) and were primarily conducted in April 2008. A significant effort was required to prepare the traffic volume data for the simulation scenarios. Over 120 count files (PetraPro) were analyzed, combined, and balanced for the 2008 scenarios. Issues were realized with some of the files, including incorrect approach headings, counting boards that were rotated 90 degrees, different count intervals, missing classifications, etc. In addition, it was noticed that at least one counting board had malfunctioned during some of the counts, which primarily affected the vehicle classification.

#### Origin-Destination Demands

Once the traffic counts were processed, the peak-hour volumes were entered into a spreadsheet for balancing and error checking. Since the interstate mainline and ramp sections act as a closed system, volume continuity should exist. If an erroneous count is used, it could adversely affect the downstream traffic of the network. The balancing effort included the traffic volume data for the on-ramps, off-ramps, and mainline sections. Equations were incorporated to add/subtract ramp traffic for determining the theoretical traffic that would travel to the downstream interchange. The calculated mainline volumes were compared to the actual mainline counts, which were conducted about every two miles or every other mainline section. Adjustments were made to some of the mainline entry volumes and ramps to provide mainline

traffic volume that typically differed by less than five percent from the mainline count, especially for the critical areas of the network.

To provide more realistic traffic flow for the simulation, origin-destination (O-D) demands were required for the modeling effort. Metro COG's regional travel demand model (which uses Citilabs' Cube software) was used to accomplish this task. A sub-area network was extracted from the travel demand model which represents this project's study area. The sub-area was created in such a way that the pseudo links of the travel demand model would distribute traffic into the network links prior to the ramp terminals. The balanced mainline and ramp volumes were entered into the 2005 F-M Cube network to serve as target volumes for the vehicle distribution. ATAC staff coded the appropriate logic to incorporate Cube's Matrix Estimator (ME), creating an O-D matrix that satisfied the target values for both the 2008 AM and PM scenarios (which had 45 origins and 45 destinations).

The Cube sub-area network was then imported into VISUM (PTV AG's planning software package). This process was performed to prepare the information for VISSIM, which primarily consists of generating the appropriate nodes and parking lot elements that are used for VISSIM's dynamic assignment feature. This network was then exported to a .ANM file that was imported into VISSIM.

#### Vehicle Composition

Initially, it was intended to develop both passenger car and truck O-D matrices. However, due to the issues described above with some of the volume counts, only a limited number of truck counts were available to balance. Therefore, the truck percentages for the mainline counts were calculated and averaged. The AM peak period consisted of 95% passenger cars and 5% trucks (67% heavy vehicles and 33% single unit trucks). The PM peak period averaged 95% passenger cars and 5% trucks (75% heavy vehicles and 25% single unit trucks). The AM and PM peak vehicle compositions were applied to the O-D matrices.

#### Peak Hour Origin-Destination Demand

To account for the variation in traffic demand within the peak-hour periods, the O-D matrices were factored at 5-minute intervals. Nine mainline locations for each peak period were used to determine the average 5-minute flow as a percentage of the peak-hour demand (Table 2). The AM Peak hour had a more defined peak interval compared to the PM peak hour.

AM P	eak Hour	PM Peak Hour				
Interval Start Time	nterval Start Time Percent of Peak-Hour		Percent of Peak-Hour			
7:20	7.8%	4:40	8.2%			
7:25	7.0%	4:45	7.9%			
7:30	7.7%	4:50	7.7%			
7:35	8.5%	4:55	8.2%			
7:40	10.0%	5:00	9.4%			
7:45	11.3%	5:05	10.1%			
7:50	10.6%	5:10	9.2%			
7:55	9.2%	5:15	8.1%			
8:00	8.0%	5:20	8.2%			
8:05	7.0%	5:25	7.8%			
8:10	6.4%	5:30	7.7%			
8:15	6.5%	5:35	7.5%			

#### Table 2. Peak Traffic Flow Percentages

#### **Simulation Duration**

The simulation duration consists of two and a half hours having the following components:

- 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 (This interval may be useful for the 2015/2025 scenarios)

The off-peak traffic incorporated 15-minute steps from the start and end of the peak-hour interval. For example, the first peak-hour interval for the AM peak is 7.8% (Table 3). Therefore, from simulation time 0-900 seconds (15 minutes), the traffic demand was 7.3%. The next 15-minute step (900-1800 seconds) equals the first interval of the peak hour 7.8%. This was performed to ensure that the peak-hour traffic arrives at all of the freeway sections when the MOE data is collected for the peak hour (1800-5400 seconds). Since the peak-hour data collection ends at 5400 seconds, the traffic demand is stepped down twice from the last peak-hour interval.

Simulation	AM Pea	ık Hour	PM Peak Hour		
Time	O-D Start Time	Peak Hour %	O-D Start Time	Peak Hour %	
0	6:50	7.3%	16:10	7.7%	
300	6:55	7.3%	16:15	7.7%	
600	7:00	7.3%	16:20	7.7%	
900	7:05	7.8%	16:25	8.2%	
1200	7:10	7.8%	16:30	8.2%	
1500	7:15	7.8%	16:35	8.2%	
1800	7:20	7.8%	16:40	8.2%	
2100	7:25	7.0%	16:45	7.9%	
2400	7:30	7.7%	16:50	7.7%	
2700	7:35	8.5%	16:55	8.2%	
3000	7:40	10.0%	17:00	9.4%	
3300	7:45	11.3%	17:05	10.1%	
3600	7:50	10.6%	17:10	9.2%	
3900	7:55	9.2%	17:15	8.1%	
4200	8:00	8.0%	17:20	8.2%	
4500	8:05	7.0%	17:25	7.8%	
4800	8:10	6.4%	17:30	7.7%	
5100	8:15	6.5%	17:35	7.5%	
5400	8:20	6.0%	17:40	7.0%	
5700	825	6.0%	17:45	7.0%	
6000	8:30	6.0%	17:50	7.0%	
6300	8:35	5.5%	17:55	6.5%	
6600	8:40	5.5%	18:00	6.5%	
6900	8:45	5.5%	18:05	6.5%	
7200	8:50	0.0%	18:10	0.0%	
7500	8:55	0.0%	18:15	0.0%	
7800	9:00	0.0%	18:20	0.0%	
8100	9:05	0.0%	18:25	0.0%	
8400	9:10	0.0%	18:30	0.0%	
8700	9:15	0.0%	18:35	0.0%	

Table 3. Traffic Flow Percentages for Peak and Off-Peak Periods

#### **MEASURES OF EFFECTIVENESS (MOE)**

Simulation models provide an abundance of numerical data to describe the operational performance of a simulation scenario. Several MOE are available for comparison purposes, such as delay time, travel time, speed, queue length, etc. VISSIM's numerical output must be defined by the user prior to running the simulation. Common data collection elements of VISSIM include travel time sections, node evaluations, data collection points, and queue counters. The project team identified several measures and locations which are summarized as follows and shown in Figure 6:

- 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.



Figure 6. Data Collection Locations

#### **Network Performance**

Network output provides system performance which is beneficial for comparing different simulation scenarios (note Appendix A). Currently, the following performance measures have been specified for VISSIM to report:

- Total Delay Time (hr)
- Total Travel Time (hr)
- Number of Active Vehicles
- Number of Arrived Vehicles
- Total Stopped Delay (hr)
- Total Distance Traveled (mi)

### **Travel Time**

Travel time information provides corridor/system performance information that is beneficial for comparing different simulation scenarios (note Appendix A). Travel time segments were identified for trips traveling between the cordon areas of the study area, as well as between the I-29 and I-94 Interchange. As indentified in Figure 6, the travel time information will be summarized as shown in Tables 4 and 5.

		Destination								
		Station #1	Station #2	Station #3	Station #4					
Drigin	Station #1	-	Time/Volume	Time/Volume	Time/Volume					
	Station #2	Time/Volume	-	Time/Volume	Time/Volume					
	Station #3	Time/Volume	Time/Volume	-	Time/Volume					
Ŭ	Station #4	Time/Volume	Time/Volume	Time/Volume	-					

Table 4. External-External Travel Time

	Destination									
		Station #5	Station #6	Station #7	Station #8					
_	Station #5	-	Time/Volume	Time/Volume	Time/Volume					
Drigin	Station #6	Time/Volume	-	Time/Volume	Time/Volume					
	Station #7	Time/Volume	Time/Volume	-	Time/Volume					
Ŭ	Station #8	Time/Volume	Time/Volume	Time/Volume	-					

From the initial travel time output, about half of the external/external trips do not have any vehicles or corresponding travel time information. This is because the travel demand model did not need to assign vehicles to these O-D pairs during the trip distribution step of the modeling process. We can force vehicles to traverse between these O-D pairs but it was decided to wait and add the actual trips from the forthcoming external O-D study, which is being performed by All Traffic Data.

#### Freeway Queue Measurement

Queue counters must be entered at the desired locations within VISSIM. Node evaluations can also provide queue data but these elements are typically incorporated at intersections. The trilevel ramp and I-94 westbound at the 45<sup>th</sup> St. off ramp have queue counters, which will provide the following information for the peak-hour period (note Appendix A):

- Average Queue Length (ft)
- Maximum Queue Length (ft)
- Number of Stops

VISSIM allows users to define parameters for vehicles to be considered in a queue condition. Typically, vehicles are considered queued in arterial networks if they travel less than 3.1 mph and leave the queue when they travel greater than 6.2 mph. Since vehicle speeds are significantly higher on freeway networks, this study will consider a vehicle as queued when it travels less than 15 mph and leaves the queue when it travels at least 30 mph.

#### **Node Evaluations**

Node evaluations will be incorporated at the ramp terminals to gather several types of data for the intersection approaches/movements (note Appendix B). Nodes must be drawn at the

intersections in such a manner to ensure proper data collection for all intersection approaches. When a vehicle crosses an edge of a node, its statistics are recorded and written to the output file when it leaves the node by crossing another edge of the node. Figure 7 illustrates the node for the Main Ave. S.E. and I-94 North Ramp (For future simulation scenarios, the nodes will be converted to polygons).



Figure 7. VISSIM node for Main Ave. S.E. and I-94 North Ramp.

The node evaluation output will provide intersection specific data. As previously stated, the output is recorded for vehicles between the time they enter and exit the node. However, delay time can also be collected at a specified distance prior to entering the node. This study will start capturing vehicle delay time 300 feet before the node (which is the default value). The data collected from the node evaluation will include the following:

- Volume
- Delay time (sec./veh.)
- Maximum Queue Length (ft)
- Average Queue Length (ft)

Since the nodes are drawn to capture intersection approach data, they must be drawn as large as possible to capture the possible delay time and queue length. A downfall of this process is that edges can exist that cross other links. An example of this occurrence is shown in Figure 6. To capture the northbound queue, the node was extended south of the westbound I-94 lanes. As a result, node statistics for vehicles traveling westbound on I-94 were recorded in the node evaluation file, which is shown in Table 6. ATAC staff went through each node's data and extracted only the data needed for the intersection evaluation (Table 7). It should be pointed out that the intersection delay value represents a weighted average for the intersection based on movement volume.

Node	Movement (from-to)	Veh(All)	Delay(All)	maxQueue	aveQueue
140	SE-SW	187	51.4	584.2	66.2
140	SE-N	619	18.9	526.5	34
140	SE-NW	335	28.2	634.9	143.9
140	NW-N	34	49.3	115.5	10.3
140	NW-SW	228	7.5	0	0
140	NW-SE	320	28.1	313.5	53.8
140	SE-NW	39	42.1	95.9	8.8
140	SE-SE	20	9.1	0	0
140	SE-N	13	38.6	108.8	2.5
140	N-SE	175	31.6	229.2	33.4
140	N-SW	316	39.4	347.2	82.6
140	N-NW	24	8.9	347.2	82.6
140	E-W	792	0	0	0
140	All	3102	20.5	634.9	39.8

Table 6. Raw Node Evaluation Data for Main Ave. S.E. & I-94 North Ramp.

 Table 7. Formatted Node Evaluation Data for Main Ave. S.E. & I-94 North Ramp.

 Node Location:
 Main Ave. (N. Side)
 140

	Node Location:		Main Ave (N. Side)		140							
	EB Approach		WB Approach		NB Approach			SB Approach				
	EBL	EBT	EBT EBR		WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	39	13	20	175	316	24	187	335	619	34	320	228
Delay Time/Veh. (s)	42.1	38.6	9.1	31.6	39.4	8.9	51.4	28.2	18.9	49.3	28.1	7.5
Max Queue (ft)	96	109	0	229	347	347	584	635	527	116	314	0
Avg. Queue (ft)	9	3	0	33	83	83	66	144	34	10	54	0
							Inters	ection	Delay	(sec/ve	h)	27.6

It should be pointed out that the intersection delay time may not correlate to those in the Highway Capacity Manual. First, VISSIM delay time is defined as a vehicle traveling less than its desired speed. Second, the delay time reported does not incorporate a peak-hour factor (PHF). Third, since the simulated traffic was based on target values for the mainline and ramp sections, the arterial traffic may not completely match the intersection counts (it was based on the travel demand model).

#### **Data Collection Points**

Data collection points are required to obtain point (location) specific MOE. These elements were incorporated on all travel lanes midway between interstate interchanges and on the ramps of the I-29 & I-94 Interchange (note Appendix C). The MOE are listed as follows:

- Modeled Volume (vph) Provided by the O-D Matrix from the F-M TDM
- Simulated Volume (vph) Peak hour volume provided by VISSIM
- Volume % Difference Difference between desired and actual volume
- Speed (mph) Average speed during the peak hour for all vehicles
- # of Lanes Number of lanes for freeway section
- Density (veh/ln/mi) Calculated using simulated volume, speed, # of lanes and adjusted flow rate
- Level of Service Thresholds ranging from A to F, which are based on density

To determine density and level of service (LOS) for the freeway weaving segments, the following two equations are used:

$$v = \frac{V}{PHF * f_{HV} * f_p} \qquad (Equation 24-1, 2000 \text{ HCM})$$

Where:

v = peak 15-min flow rate in an hour (pc/h), V = hourly volume (veh/h), PHF = peak-hour factor,  $f_{HV}$  = heavy-vehicle adjustment factor, and  $f_p$  = driver population factor.

$$D = \frac{(\nu/N)}{S}$$
 (Equation 24-6, 2000 HCM)

Where:

D = density (pc/mi/ln),

 $v_p$  = flow rate (pc/h/ln),

N = number of lanes, and

S = average passenger-car speed (mi/h).

The midpoint of the freeway interchanges are technically classified as basic freeway segments except for a portion of I-29 between I-94 and 13<sup>th</sup> Ave. S. The northbound and southbound sections are more accurately classified as weaving segments (Type B). To keep the density comparisons uniform, the level of service (LOS) thresholds used for this study will be based on freeway weaving segments (Table 8).

Level of Service	Density Range (pc/mi/ln)
А	0-10
В	>10-20
С	>20-28
D	>28-35
E	>35-43
F	>43

Table 8. LOS Thresholds of Freeway Weaving Segments

Source: Exhibit 24-2, 2000 HCM

To calculate the 15-minute passenger-car equivalent flow rate, data from several mainline count locations were calculated and averaged. The following factors will be used in the density and LOS analysis:

- Peak-Hour Factor: .78 (AM Peak), .87 (PM Peak)
- Trucks: 5% (AM Peak), 5% (PM Peak)
- Type of Terrain: Level
- Driver Population Factor: Familiar Users

The resulting calculations produce density adjustment factors for the AM and PM peak periods of .75 and .85, respectively. Table 9 illustrates sample data for I-94 Eastbound (between I-29 and 25<sup>th</sup> St.). The unadjusted density for this location was 22 compared to the adjusted value of 27.

I-94 Eastbound (between I-	29 and 25 <sup>th</sup> St.)
Modeled Vol. (vph)	3,936
Simulated Vol. (vph)	3,845
Volume % Difference	-2%
Speed (mph)	57.2
# of Lanes	3
Density (pc/mi/ln)	27
Level of Service	Ċ

Table 9. Sample Freeway Mainline Output

#### SUMMARY

This document provided an update for the simulation modeling effort of the Fargo-Moorhead Interstate Operations Study. Several core components of the simulation development were addressed in this document, including network geometry, traffic control devices, traffic volume data, and the proposed MOE. As we await the results of the external O-D study, we continue to investigate calibration parameters. Additional information will be provided as it becomes available.

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

#### 2008 PM - Network Performance

Total Delay Time (h)	456
Total Travel Time (h)	3631
Number of Active Vehicles	0
Number of Arrived Vehicles	52001
Total Stopped Delay (h)	177
Total Distance Traveled (mi)	167114

#### 2008 PM - Queue Measurement

	-	Fri-Level Merge	e	I-94 WB (45th St)				
Time	Avg	Max	Stop	Avg	Max	Stop		
PM Peak	1008	3225	1842	3	244	22		

#### Destination I-29 SB I-94 EB I-29 NB Time Period TT (sec) Vol TT (sec) Vol TT (sec) Vol 1630-1645 I-94 EB 1645-1700 1700-1715 1715-1730 I-29 SB I-94 WB I-29 NB Time Period TT (sec) TT (sec) Vol TT (sec) Vol Vol 1630-1645 **I-94 WB** 1645-1700 1700-1715 Origin 1715-1730 I-94 WB I-29 NB I-94 EB Time Period TT (sec) TT (sec) Vol Vol TT (sec) Vol 1630-1645 I-29 NB 1645-1700 1700-1715 1715-1730 I-94 WB I-29 SB I-94 EB Time Period TT (sec) Vol TT (sec) Vol TT (sec) Vol 1630-1645 I-29 SB 1645-1700 1700-1715 1715-1730

#### 2008 PM - Travel Time (Network)

		2000 1 1			9.1.11
	_			Destin	ation
			I-29	) SB	
		Time Period	TT (sec)	Vol	TT (s
		1630-1645	52	50	60
	I-94 EB	1645-1700	51	52	59
		1700-1715	51	54	59
		1715-1730	51	43	60
	/		I-29	) SB	
		Time Period	TT (sec)	Vol	TT (s
		1630-1645	110	79	60
	I-94 WB	1645-1700	107	83	59
		1700-1715	111	94	61
gin		1715-1730	107	80	60
Ori			I-94	WB	
-		Time Period	TT (sec)	Vol	TT (s
		1630-1645	111	31	62
	I-29 NB	1645-1700	105	34	62
		1700-1715	107	41	62
		1715-1730	108	32	62
	/		I-94	WB	
		Time Period	TT (sec)	Vol	TT (s
		1630-1645	54	169	62
	I-29 SB	1645-1700	57	163	62
		1700-1715	57	171	64
		1715-1730	53	146	61

### 2008 PM - Travel Time (I-29/I-94 In

iterchang	e)
-----------	----

I-94	EB	I-29	NB
sec)	Vol	TT (sec)	Vol
0	419	110	86
9	430	109	103
9	449	109	93
0	389	109	90
I-94	WB	I-29	NB
sec)	Vol	TT (sec)	Vol
0	389	55	282
9	418	54	293
1	423	57	316
0	374	55	267
I-29	NB	I-94	I EB
<b>I-29</b> sec)	NB Vol	<b>I-9</b> 4 TT (sec)	<b>EB</b> Vol
<b>I-29</b> sec) 2	NB Vol 298	<b>I-9</b> 4 TT (sec) 55	<b>EB</b> Vol 119
<b>I-29</b> Sec) 2 2	NB Vol 298 308	<b>I-9</b> 4 TT (sec) 55 57	<b>EB</b> Vol 119 140
<b>I-29</b> Sec) 2 2 2	NB           Vol           298           308           330	I-94 TT (sec) 55 57 89	<b>EB</b> Vol 119 140 114
<b>I-29</b> Sec) 2 2 2 2	NB           Vol           298           308           330           296	I-94 TT (sec) 55 57 89 129	EB Vol 119 140 114 141
I-29 sec) 2 2 2 2 2 1-29	NB           Vol           298           308           330           296           SB	I-94 TT (sec) 55 57 89 129 I-94	EB Vol 119 140 114 141 ↓EB
I-29 Sec) 2 2 2 2 2 2 2 2 2 2 5 8 5 8 5 8 5 8 5 5 8 5 2	NB           Vol           298           308           330           296           SB           Vol	I-94 TT (sec) 55 57 89 129 I-94 TT (sec)	EB Vol 119 140 114 141 EB Vol
I-29 Sec) 2 2 2 2 2 2 2 2 2 5 5 5 5 5 2	NB           Vol           298           308           330           296           SB           Vol           410	I-94 TT (sec) 55 57 89 129 I-94 TT (sec) 71	EB Vol 119 140 114 141 EB Vol 386
I-29 sec) 2 2 2 2 2 2 1-29 sec) 2 2	NB           Vol           298           308           330           296           SB           Vol           410           444	I-94 TT (sec) 55 57 89 129 I29 I29 I29 I71 (sec) 71 77	Vol         119         140         114         141         Vol         386         397
I-29 Sec) 2 2 2 2 2 2 3 ec) 2 2 4	NB           Vol           298           308           330           296           SB           Vol           410           444           456	I-94 TT (sec) 55 57 89 129 I-94 TT (sec) 71 77 149	Vol         119         140         114         141         Vol         386         397         452

Appendix B: Simulation Output (Node Evaluations)

	Node L	ocation	:	Sheyer	nne (N. 1	Side)	105					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume			474		0	533	31	391	0	0	823	61
Delay Time/Veh. (s)			13.3		0.0	4.7	5.0	0.4	0.0	0.0	1.8	1.1
Max Queue (ft)			0		0	0	0	0	0	0	0	0
Avg. Queue (ft)			0		0	0	0	0	0	0	0	0
							Int	ersectio	on Delay	y (sec/v	eh)	4.6
	Node L	ocation	:	Sheyer	nne (S. S	ide)	108					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	22	0	59				0	400	220	263	1032	0
Delay Time/Veh. (s)	39.9	0.0	14.5				0.0	2.3	1.7	4.7	0.5	0.0
Max Queue (ft)	0	0	0				0	0	0	53	53	0
Avg. Queue (ft)	0	0	0				0	0	0	0	0	0
0							Int	ersectio	on Delay	v (sec/v	eh)	2.4
	Node L	ocation	:	45th St	(N. Sid	e)	112			, , ,	,	
	FB	Approa	ach	WF	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				452	0	1067	89	1083	0	0	2027	242
Delay Time/Veh (s)				44 5	0.0	11 2	49.8	16.6	0.0	0.0	23.9	210
Max Queue (ft)				250	0.0	227	178	354	0.0	0.0	820	873
Avg Queue (ft)				74	0	44	28	57	0	0	242	76
/ Wg. Queue (11)				7 -	0		Int	ersectio	n Delay	/ (sec/v	eh)	21.8
								cruccuic	n Dela		ciij j	21.0
	Node I	ocation		/15th St	hiz z)	_ ا د	113					
	Node L	ocation	:	45th St	: (S. Side	e) ach	113 NP	Approx	ach	CD	Approc	
	Node L EB	Ocation	i: ach	45th St WE	t (S. Side Appro	e) ach	113 NB	Approa	ach	SB	Approa	ach
Volumo	Node L EB EBL	ocation Approa EBT	: ach EBR	45th St WE WBL	: (S. Side 3 Appro WBT	e) ach WBR	113 NB NBL	Approa	ach NBR	SB SBL	Approa SBT	sBR
Volume	Node L EB EBL 150	ocation Approa EBT 0	ch EBR 59	45th St WE WBL	(S. Side Appro WBT	e) ach WBR	113 NB NBL 0	Approa NBT 1027	ach NBR 404	SBL 0	Approa SBT 1336	sBR 1157
Volume Delay Time/Veh. (s)	Node L EBL 150 48.5	ocation Approa EBT 0 0.0	: ach EBR 59 6.3	45th St WE WBL	(S. Side Appro WBT	e) ach WBR	113 NB NBL 0 0.0	Approa NBT 1027 3.9	ach NBR 404 5.4	SBL 0 0.0	Approa SBT 1336 5.4	ach SBR 1157 4.1
Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EBL 150 48.5 243	ocation Approa EBT 0 0.0 0	: ach EBR 59 6.3 100	45th St WBL	t (S. Side Appro WBT	e) ach WBR	113 NBL 0 0.0 0	Approx NBT 1027 3.9 220	ach NBR 404 5.4 268	SBL 0 0.0 0	Approa SBT 1336 5.4 349	ach SBR 1157 4.1 607
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL 150 48.5 243 47	Approa EBT 0 0.0 0 0	: ach EBR 59 6.3 100 1	45th St WBL	(S. Side Appro WBT	e) ach WBR	113 NBL 0 0.0 0 0	Approa NBT 1027 3.9 220 13	ach NBR 404 5.4 268 10	SB SBL 0 0.0 0 0	Approa SBT 1336 5.4 349 27	ach SBR 1157 4.1 607 20
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL 150 48.5 243 47	Approa EBT 0 0.0 0	: ach EBR 59 6.3 100 1	45th St WBL	(S. Side Appro WBT	e) ach WBR	113 NBL 0 0.0 0 0 1nt	Approa NBT 1027 3.9 220 13 ersectio	Ach NBR 404 5.4 268 10 on Delay	SBL 0 0.0 0 0 0 y (sec/v	Approa SBT 1336 5.4 349 27 eh)	ach SBR 1157 4.1 607 20 6.2
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 150 48.5 243 47 Node L	Approa EBT 0 0.0 0 0 0 0 0	: ach EBR 59 6.3 100 1	45th St WBL	(S. Side Appro WBT	e) ach WBR e)	113 NB 0 0.0 0 0 0 1nt 124	Approa NBT 1027 3.9 220 13 ersectio	ach NBR 404 5.4 268 10 on Delay	SBL 0 0.0 0 0 y (sec/v	Approa SBT 1336 5.4 349 27 eh)	ach SBR 1157 4.1 607 20 6.2
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 150 48.5 243 47 Node L EB	Approa EBT 0 0.0 0 0 0 0 0 0 0 0	: EBR 59 6.3 100 1 : :	45th St WBL 25th St WE	(S. Side Appro WBT (N. Side Appro	e) ach WBR e) ach	113 NBL 0 0.0 0 0 Int 124 NB	Approa NBT 1027 3.9 220 13 ersectio	ach NBR 404 5.4 268 10 on Delay	SBL 0 0.0 0 0 y (sec/v SB	Approa SBT 1336 5.4 349 27 eh) Approa	ach SBR 1157 4.1 607 20 6.2 ach
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 150 48.5 243 47 Node L EBL	ocation Approa EBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	: EBR 59 6.3 100 1 : : ach EBR	45th St WBL	(S. Side Appro WBT (N. Side Appro WBT	e) ach WBR e) ach WBR	113 NBL 0 0.0 0 0 1nt 124 NBL	Approa NBT 1027 3.9 220 13 ersection Approa	ach NBR 404 5.4 268 10 on Delay ach NBR	SBL 0 0.0 0 0 (sec/v SBL	Approa SBT 1336 5.4 349 27 eh) Approa SBT	ach SBR 1157 4.1 607 20 6.2 ach SBR
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EBL 150 48.5 243 47 Node L EBL EBL	ocation Approa EBT 0 0.0 0 0 0 0 coation Approa EBT	: EBR 59 6.3 100 1 : ech EBR	45th St WBL 25th St WBL 257	(S. Side Appro WBT (N. Side Appro WBT 0	e) ach wBR e) ach wBR 216	113 NBL 0 0.0 0 0 1nt 124 NBL 0	Approa NBT 1027 3.9 220 13 ersectio Approa NBT 945	ach NBR 404 5.4 268 10 on Delay ach NBR 339	SBL 0 0.0 0 0 y (sec/v SBL 0	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332	ach SBR 1157 4.1 607 20 6.2 ach SBR 134
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EBL 150 48.5 243 47 Node L EBL EBL	ocation Approa EBT 0 0.0 0 0 0 ocation Approa EBT	: EBR 59 6.3 100 1 : ech EBR	45th St WBL 25th St WBL 257 52.4	(S. Side Appro WBT (N. Side Appro WBT 0 0.0	e) ach WBR e) ach WBR 216 8.6	113 NBL 0 0.0 0 0 1nt 124 NBL 0 0.0	Approa NBT 1027 3.9 220 13 ersectio Approa NBT 945 9.5	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4	SBL 0 0.0 0 0 (sec/v SBL 0 0.0	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6	ach SBR 1157 4.1 607 20 6.2 6.2 ach SBR 134 9.9
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EBL 150 48.5 243 47 Node L EBL EBL	Approa EBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	: EBR 59 6.3 100 1 : ech EBR	45th St WBL 25th St WBL 257 52.4 309	(S. Side Appro WBT (N. Side Appro WBT 0 0.0 309	e) ach WBR e) ach WBR 216 8.6 112	113 NBL 0 0.0 0 0 10 124 NBL 0 0.0 0.0	Approa NBT 1027 3.9 220 13 ersection Approa NBT 945 9.5 428	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4 379	SBL 0 0.0 0 0 0 (sec/v SBL 0 0.0 0.0	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6 722	ach SBR 1157 4.1 607 20 6.2 ach SBR 134 9.9 722
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 150 48.5 243 47 Node L EBL EBL	ocation Approa EBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	: EBR 59 6.3 100 1 : ech EBR	45th St WBL 25th St WBL 257 52.4 309 82	(S. Side Appro WBT (N. Side Appro WBT 0 0.0 309 82	e) ach WBR e) ach WBR 216 8.6 112 8	113 NBL 0 0.0 0 0 1nt 124 NBL 0 0.0 0 0 0	Approa NBT 1027 3.9 220 13 ersectic Approa 945 9.5 428 36	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4 379 5	SBL 0 0.0 0 0 (sec/v SBL 0 0.0 0 0 0	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6 722 74	ach SBR 1157 4.1 607 20 6.2 6.2 ach SBR 134 9.9 722 74
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 150 48.5 243 47 Node L EBL EBL	Approa EBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	: ach EBR 59 6.3 100 1 : ach EBR	45th St WBL 25th St WBL 25th St WBL 257 52.4 309 82	(S. Side Appro WBT (N. Side Appro WBT 0 0.0 309 82	e) ach WBR e) ach WBR 216 8.6 112 8	113 NBL 0 0.0 0 0 10 124 NBL 0 0.0 0 0 0 0 10 10	Approa NBT 1027 3.9 220 13 ersection Approa 0 Approa 945 9.5 428 36 ersection	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4 379 5 on Delay	SBL 0 0.0 0 0 0 y (sec/v SBL 0 0.0 0 0 0 y (sec/v	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6 722 74 eh)	ach SBR 1157 4.1 607 20 6.2 6.2 ach SBR 134 9.9 722 74 13.0
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 150 48.5 243 47 Node L EBL EBL	ocation Approa EBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	: ach EBR 59 6.3 100 1 : ach EBR	45th St WBL 25th St WBL 257 52.4 309 82 25th St	(S. Side Appro WBT (N. Side Appro WBT 0 0.0 309 82 (S. Side	e) ach WBR e) ach WBR 216 8.6 112 8	113 NBL 0 0.0 0 0 1nt 124 NBL 0 0.0 0 0 0 0 0 1nt 125	Approa NBT 1027 3.9 220 13 ersection Approa 945 945 945 945 36 ersection	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4 379 5 on Delay	SBL 0 0.0 0 0 (sec/v SBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6 722 74 eh)	ach SBR 1157 4.1 607 20 6.2 6.2 ach SBR 134 9.9 722 74 13.0
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 150 48.5 243 47 Node L EBL EBL	ocation Approa EBT 0 0.0 0 0 ocation Approa ocation Approa	: ach EBR 59 6.3 100 1 : ach EBR	45th St WBL 25th St WBL 25th St 25th St 309 82 25th St WE	(S. Side Appro WBT (N. Side Appro WBT 0 0.0 309 82 (S. Side Appro	e) ach WBR e) ach WBR 216 8.6 112 8 ach	113 NBL 0 0.0 0 0 1nt 124 NBL 0 0.0 0 0 0 0 1nt 125 NB	Approa NBT 1027 3.9 220 13 ersectio Approa 945 9.5 428 36 ersectio	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4 379 5 on Delay	SBL 0 0.0 0 0 0 (sec/v SBL 0 0.0 0 0 0 0 0 0 0 5 8 SBL 0 0 0 0 0 5 8 SBL 0 5 8 SBL 5 8 5 8 5 8 5 8 5 8 5 8 5 8 5 8 5 8 5	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6 722 74 eh)	ach SBR 1157 4.1 607 20 6.2 6.2 ach SBR 134 9.9 722 74 13.0
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 150 48.5 243 47 Node L EBL Node L EBL	ocation Approa EBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	: ach EBR 59 6.3 100 1 : ach EBR	45th St WBL 25th St WBL 25th St WBL 257 52.4 309 82 25th St WBL	(S. Side Appro WBT (N. Side Appro WBT 0 0.0 309 82 (S. Side Appro WBT	e) ach WBR e) ach WBR 216 8.6 112 8 (112 8 (112) 8 (11	113 NBL 0 0.0 0 0 1nt 124 NBL 0 0.0 0 0 0 0 0 1nt 125 NBL	Approa NBT 1027 3.9 220 13 ersectio Approa 945 9.5 428 36 ersectio	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4 379 5 on Delay	SB           0           0.0           SBL           SBL	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6 722 74 eh) Approa SBT	ach SBR 1157 4.1 607 20 6.2 6.2 6.2 6.2 6.2 72 74 134 9.9 722 74 13.0
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EBL 150 48.5 243 47 Node L EBL EBL EBL 155	ocation Approa EBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	: ach EBR 59 6.3 100 1 : ach EBR c ach EBR 353	45th St WBL 25th St WBL 25th St WBL 257 52.4 309 82 25th St WBL 56	(S. Side Appro WBT (N. Side Appro WBT 0 0.0 309 82 (S. Side Appro WBT 51	e) ach WBR e) ach WBR 216 8.6 112 8 ach 218 328	113 NBL 0 0.0 0 0 1nt 124 NBL 0 0.0 0 0 0 0 0 1nt 125 NBL 264	Approa NBT 1027 3.9 220 13 ersection Approa 945 945 945 945 945 945 945 945	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4 379 5 on Delay ach NBR 39	SBL 0 0.0 0 0 (sec/v SBL 0 0.0 0 0 0 (sec/v SBL 358	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6 722 74 eh) Approa SBT 1061	ach SBR 1157 4.1 607 20 6.2 6.2 ach SBR 134 9.9 722 74 13.0 74 13.0
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EBL 150 48.5 243 47 Node L EBL EBL Node L EBL 155 42.5	ocation Approa EBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	: ach EBR 59 6.3 100 1 : ach EBR ach EBR	45th St WBL 25th St 25th St WBL 257 52.4 309 82 25th St WBL 56 39.2	(S. Side Appro WBT (N. Side Appro WBT 0 0.0 309 82 (S. Side Appro WBT 51 41.7	e) ach WBR e) ach WBR 216 8.6 112 8 216 8.6 112 8 2 2 328 12.0	113 NB NBL 0 0.0 0 1nt 124 NB NBL 0 0 0.0 0 0 0 0 1nt 125 NB NBL 264 28.0	Approa NBT 1027 3.9 220 13 ersection Approa 945 9.5 428 36 ersection Approa NBT 945 9.5 428 36 ersection NBT 796 17.9	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4 379 5 on Delay ach NBR 339 16.7	SBL 0 0.0 0 0 0 (sec/v SBL 0 0.0 0 0 0 (sec/v SBL 358 21.0	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6 722 74 eh) Approa SBT 1061 13.8	ach SBR 1157 4.1 607 20 6.2 6.2 6.2 6.2 6.2 74 134 9.9 722 74 13.0 6 ch SBR 137 3.0
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EBL 150 48.5 243 47 Node L EBL EBL EBL 155 42.5 531	ocation Approa EBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	: ach EBR 59 6.3 100 1 : ach EBR	45th St WBL 25th St WBL 257 52.4 309 82 25th St 82 25th St WBL 56 39.2 217	<ul> <li>(S. Side</li> <li>Appro</li> <li>WBT</li> <li>WBT</li> <li>(N. Side</li> <li>Appro</li> <li>WBT</li> <li>0</li> <li>0.0</li> <li>309</li> <li>82</li> <li>(S. Side</li> <li>Appro</li> <li>WBT</li> <li>51</li> <li>41.7</li> <li>217</li> </ul>	e) ach WBR e) ach WBR 216 8.6 112 8 328 12.0 243	113 NBL 0 0.0 0 0 1nt 124 NBL 0 0 0.0 0 0 0 0 0 0 0 1nt 125 NBL 264 28.0 533	Approa NBT 1027 3.9 220 13 ersection Approa 945 945 945 945 945 945 945 945	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4 379 5 on Delay ach NBR 379 5 on Delay 4 379 5 0 0 16.7 0	SBL 0 0.0 0 0 0 (sec/v SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6 722 74 eh) Approa SBT 1061 13.8 433	ach SBR 1157 4.1 607 20 6.2 6.2 ach SBR 134 9.9 722 74 13.0 74 13.0 SBR 177 3.0 255
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 150 48.5 243 47 Node L EBL EBL 155 42.5 531 81	ocation Approa EBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	: ach EBR 59 6.3 100 1 : ach EBR ach EBR 353 14.2 423 25	45th St WBL 25th St WBL 25th St WBL 257 52.4 309 82 25th St WBL 56 39.2 217 26	<ul> <li>(S. Side</li> <li>Appro</li> <li>WBT</li> <li>WBT</li> <li>(N. Side</li> <li>Appro</li> <li>WBT</li> <li>0</li> <li>0.0</li> <li>309</li> <li>82</li> <li>(S. Side</li> <li>Appro</li> <li>WBT</li> <li>51</li> <li>41.7</li> <li>217</li> <li>26</li> </ul>	e) ach WBR e) ach WBR 216 8.6 112 8 ach 112 8 ach WBR 328 12.0 243 24	113 NBL 0 0.0 0 0 1nt 124 NBL 0 0.0 0 0 0 0 0 0 0 0 0 1nt 125 NBL 264 28.0 533 52	Approa NBT 1027 3.9 220 13 ersection Approa 945 9.5 428 36 ersection Approa 796 17.9 530 71	ach NBR 404 5.4 268 10 on Delay ach NBR 339 2.4 379 5 on Delay 5 on Delay 4 ach NBR 39 16.7 0 0	SBL 0 0.0 0 0 0 (sec/v SBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1336 5.4 349 27 eh) Approa SBT 1332 11.6 722 74 eh) Approa SBT 1061 13.8 433 53	ach SBR 1157 4.1 607 20 6.2 6.2 ach SBR 134 9.9 722 74 13.0 722 74 13.0 ach SBR 177 3.0 255 6

EBA     PER     EBA     EBA     EBA     EBA     WBA     WBA     NBA     NBA     SBL     SBT     SBA       EBL     EBA     EBA     WBA     WBA     NBA     NBA     SBL     SBA     SBA       Delay Time/Veh. (s)     I <td< th=""><th></th><th>Node L</th><th>ocation.</th><th>:</th><th>Univer</th><th>sity (N.</th><th>Side)</th><th>130</th><th></th><th></th><th></th><th></th><th></th></td<>		Node L	ocation.	:	Univer	sity (N.	Side)	130					
EBLEBTEBRWBLVBRNBLNBRNBLNBRSBLSBRSBRDelay Time/Veh. (s) <td></td> <td>EB</td> <td>Approa</td> <td>ach</td> <td>WE</td> <td>3 Appro</td> <td>ach</td> <td>NB</td> <td>Approa</td> <td>ach</td> <td>SB</td> <td>Approa</td> <td>nch</td>		EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	nch
VolumeVolum		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay Time/Veh. (s)         w         45.1         0.0         5.9         0.0         2.7         0.5         0.0         4.9         2.2.           Max Queue (ft)         w         281         0         164         0         152         195         0         395         0           Avg. Queue (ft)         w         S8         0         16         0         9         0         26         0           EB         Approach         WB         WB         NB         NB         NB         S8         S8         S8         S8           Volume         340         0         344         w         0         1008         510         0         153         310           Delay Time/Veh. (s)         38.0         0.2         244         w         0         0.08         10         0         133           Delay Time/Veh. (s)         38.0         0.2         244         w         0         280         0         1         33           Mode Location:         8th St (N. Side)         133         W         NB         NB         SB         Approach         SB         SB         SB           Mode Location:         8th St (	Volume				350	0	197	0	1098	247	0	1619	396
Max Queue (ft)         Image: constraint of the sector of the secto	Delay Time/Veh. (s)				45.1	0.0	5.9	0.0	2.7	0.5	0.0	4.9	2.2
Avg. Queue (ft)         Image: Control in the sector	Max Queue (ft)				281	0	164	0	152	195	0	395	0
Node Location:         University (S. Side)         129           EB Approach         WB Approach         NB Approach         SB Approach         SB Approach           Yolume         340         0         344         WB         NBL         NBL         NBR         SBL         SBT         SBR           Volume         340         0         344         WB         NBL         NBL         NBL         SBL         SBT         SBR           Max Queue (ft)         30         0         26         0         0         23         0         0         437         264           Avg. Queue (ft)         80         0         26         0         0         23         0         0         50         18           Intersection Delay (sec/vel)         9.4         133         0         0.0         50         18           Intersection Delay (sec/vel)         132         0         90         457         1444         0         0         904         894           Volume         132         0         90         457         1444         0         0         102         0         102         0         102         0         102         0	Avg. Queue (ft)				58	0	16	0	9	0	0	26	0
Node Location:         University (S. Side)         129           EB Approach         WB Approach         NB Approach         SB Approach         NB Approach         SB Approach         NB Approach         0         200         0         0         330         0.0         9.5         I         I         0         0         330         0.0         9.5         I         I         0         0         0         0         0         133         0         0         130         0         130         0         18         Intersection Delay (sec/vei)         9.4         184         0         0         904         894         0         100         0         88         100         0         102         0         995         28         0         0         102         0         102         0         102         0         102         0         102         0         102         0         102         0         102							1	Int	ersectic	on Delay	/ (sec/v	eh)	7.4
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Node L	ocation	:	Univer	sity (S. S	Side)	129			()	- 1	
EB         PF         PF         PF         NB         NB         NB         NB         NB         NB         SB		FB	Annroa	ach	\//F	Annro	ach	NB	Annroa	ach	SB	Annroa	h
$\begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		FRI	FBT	FBR	W/BI			NRI	NBT	NRR	SBI	SBT	SBR
	Volumo	240		244	VVDL	VVDT	VVDI		1009	E10	0	1652	210
Delay Time/ven. (s)         38.0         0.00         3.3         0.00         3.3         0.00         3.3         0.00         3.7         0.00         3.7         0.00         3.7         0.00         3.7         0.00         3.7         0.00         3.7         0.00         3.7         0.00         4.37         0.00         4.37         0.00         4.37         0.00         4.37         0.00         4.37         0.00         4.37         0.00         4.37         0.00         4.37         0.00         9.04         88         Note         SBL         SBL         SBL         SBL         SBR         SB		340	0	544 0 F				0	1008	210	0	1055	510
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Delay Time/ ven. (s)	38.0	0.0	9.5				0.0	7.4	0.8	0.0	9.1	0.7
Avg. Queue (it)     80     0     26     0     0     23     0     0     30     30       Node Location:     8th St (N. Side)     Intersection Delay (sec/vel)     9.4       Nde Approach     NB Approach     NB Approach     NB Approach     SB Approac	Max Queue (ft)	350	0	244				0	280	0	0	437	264
Intersection Delay (sec/ven/sec/sec/ven/sec/ven/sec/ven/sec/ven/sec/ven/sec/ven/sec/sec/ven/sec/ve	Avg. Queue (ft)	80	0	26				0	23	0	0	50	18
Node Location:         8th St (M. Side)         133         Volume         EB         VB         Approach         NB         Approach         NB         Approach         SB         Approach         SB         Approach         NB         NBT         NBR         SB         SB         SB         SB           Volume         EB         EB         EB         EB         ZC         0         90         457         1444         0         0         90         457         1444         0         0         894           Delay Time/Veh. (s)         I         I         169         169         0         888         511         0         0         858         0         0         858         0         0         858         0         0         858         0         0         858         0         0         858         0         0         858         0         0         102         0         102         0         102         0         102         100         102         100         102         100         102         100         102         100         102         100         102         100         102         100         102         100								Int	ersectio	on Delay	/ (sec/v	eh)	9.4
$ \begin{array}{ c c c c c c } \hline  c c c c c c c c c c c c c c c c c c $		Node L	ocation.	1:	8th St	(N. Side	)	133					
FBLEBTEBRWBLWBLNBRNBLNBRNBRSBLSBTSBRVolumeIII<		EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	hch
VolumeImageImageImageImageImageImageImageImageImageImageImageImageDelay Time/Veh.(s)ImageImag		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay Time/Veh. (s)         Image of the term of term	Volume				132	0	90	457	1444	0	0	904	894
$ \begin{array}{ c c c c c c } \begin{tabular}{ c c c c } \begin{tabular}{ c c c c c } \begin{tabular}{ c c c c c } \begin{tabular}{ c c c c c c c } \begin{tabular}{ c c c c c c c } \begin{tabular}{ c c c c c c c } \begin{tabular}{ c c c c c c c } \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$	Delay Time/Veh. (s)				26.9	0.0	8.9	25.2	5.0	0.0	0.0	23.1	11.6
Avg. Queue (ft)       Image: sector (ft) <thimage: (ft)<="" sector="" th=""> <thimage: sector<="" td=""><td>Max Queue (ft)</td><td></td><td></td><td></td><td>169</td><td>169</td><td>0</td><td>888</td><td>511</td><td>0</td><td>0</td><td>858</td><td>0</td></thimage:></thimage:>	Max Queue (ft)				169	169	0	888	511	0	0	858	0
Intersection Delay (sec/veh       13.9         Node Location:       8th St (S. Side)       13.9         Intersection Delay (sec/veh)       13.9         EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT SBR         Volume 943       0       943       13.9         Volume 943       0       84 by rowth       SB Approach         MBL WBT WBR NBL NBT NBR SBL SBT       SB Approach         Nade use (ft)       370       0       943       0       943       10       2379       0       943       10       2379       0       943       10       237       0       943       10       237       0       1314       135       83       0         OUBURE (http://www.protecolspan="4">Node Location:       20th St (N. Side)       Intersection Delay (sec/veh)       23.2         Nde Location:       20th St (N. Side)       NB Approach       <	Avg. Queue (ft)				20	20	0	95	28	0	0	102	0
Node Location:         8th St (S. Side)         134           EBL         EBT         EBR         WBL         WBT         WBR         NBL         NBT         NBR         SBL         SBT         SBR           Volume         943         0         818         Image: Colspan="4">Image: Colspan="4"         Sth St (S. Side)         Image: Colspan="4">Image: Colspan="4">Image: Colspan="4">Image: Colspan="4">Image: Colspan="4">Image: Colspan="4">Image: Colspan="4">Image: Colspan="4"           Volume         943         0         2379         Image: Colspan="4">Image: Colspan="4"           Volume	-							Int	ersectio	on Delay	/ (sec/v	eh)	13.9
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Node L	ocation	n:	8th St	(S. Side)	)	134					
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		FB	Approa	ach	WF	Appro	ach	NB	Approa	ach	SB	Approa	h
Volume         943         0         818         Image         No.         No.         No.         No.         No.         So.		FBI	FBT	FBR	WBI	WBT	WBR	NBI	NBT	NBR	SBI	SBT	SBR
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Volume	9/3	0	818				0	9/13	109	135	893	0
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Delay Time/Veh (s)	20 0	0.0	28.7				0.0	25.0	105	20.0	11.0	0.0
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Max Quoue (ft)	270	0.0	20.7				0.0	2J.J	121	105	12.0	0.0
Avg. Queue (it)       31       0       239       10       0       102       33       11       38       0         Intersection Delay Cole (it)       0       102       3       11       38       0         Node Location:       20th St (N. Side)       138       138       307         EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL       SBT       SBR         0       0       6       8       14       108       593       19       14       318       307         0       0       6       8       14       108       593       19       14       318       307         0       15       15       15       298       298       19       14       318       307         0       0       0       0       15       15       298       298       298       0       0       0       0         0       Avg. Queue (ft)       1       15       15       15       298       298       298       0       0       0       0         Node Location       20th S		370 01	0	2379				0	102	2	105	434 20	0
Node Location:         20th St (N. Side)         138           Node Location:         20th St (N. Side)         138         58         Approach         SB Ap	Avg. Queue (II)	81	0	299				U	102	5 Dolou	11	- 30 ob)	0 12 1
2011 St (N. Side)       138         ISB       VOID BE Approach       NB Approach       NB Approach       SB Approach         EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL       SBT       SBR         Volume       Image: Colspan="6">Image: Colspan="6">Image: Colspan="6">NB Approach       SBL       SBT       SBR         Volume       Image: Colspan="6">Image: Colspan="6">NB       NBL       NBR       SBL       SBT       SBR         Delay Time/Veh. (s)       Image: Colspan="6">Image: Colspan="6" Image: Colspan="6">Image: Colspan="6" Image: Colspa="6" Image: Colspan="6" Image: Colspan="6" Image: C		Nodol	ocotion		20+h C+	- (NL C: d	2)	120	ersectio	Di Delay	(sec/v	en)	25.2
$\begin{tabular}{ c c c c c } \hline \begin{tabular}{ c c c c c c } \hline \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		Node L	ocation	ı:	2011 5	. (IN. SIU	e)	138			6.0		
EBL       EBL       EBR       EBR       WBL       WBR       WBL       NBL       NBL       NBR       SBL		EB	Approa	acn	WE	3 Appro	acn	NB	Approa	acn	SB	Approa	ich CDD
Volume       Image: Constraint of the straint of the st		EBL	EBI	EBK	WBL	WBI	WBR	NBL	NBI	NBK	SBL	SRI	SBK
Delay Time/Veh. (s)       Image: section of the secting the section of the secting the secting the s	Volume				6	8	14	108	593	19	14	318	307
Max Queue (ft)       Image: style integral (ft)       Image: sty	Delay Time/Veh. (s)				8.4	8.1	6.6	2.1	0.6	0.5	4.7	0.7	1.6
Avg. Queue (ft)       Image: section of the section of	Max Queue (ft)				15	15	15	298	298	298	0	0	0
Intersection Delay (sec/vel)       1.1         Node UCation:       20th St (S. Side)       137         EB Approach       WB Approach       NB Approach       SB Approach         EBL       EBR       WB       WBR       NB       SB       SB         Volume       307       0       132       O       VBR       NBR       NBR       SB       SB       SB         O       132       O       0       0       0       0       SB       SB       SB       SB       SB       SB         O       132       O       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0       0        0	Avg. Queue (ft)				0	0	0	18	18	18	0	0	0
Node Location:       20th St (S. Side)       137 $\overline{BB} \ \overline{BB} \ $								Int	ersectic	on Delay	/ (sec/v	eh)	1.1
BB + proverse in the second		Node L	ocation	n:	20th St	: (S. Side	e)	137					
EBL         EBT         EBR         WBL         WBR         NBL         NBT         NBR         SBL         SBT         SBR           Volume         307         0         132         Image: Constraint of the state of the		EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	nch
Volume       307       0       132       •       •       0       412       0       0       327       0         Delay Time/Veh. (s)       11.1       0.0       6.0       •       •       0.0       8.4       0.0       0.0       7.7       0.0         Max Queue (ft)       277       0       79       •       •       0       290       0       0       183       0         Avg. Queue (ft)       20       0       0       •       •       0       25       0       0       17       0         Intersection Delay (sec/veh)       8.6		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay Time/Veh. (s)       11.1       0.0       6.0       Image: constraint of the state of the	Volume	307	0	132				0	412	0	0	327	0
Max Queue (ft)       277       0       79       0       200       0       290       0       0       183       0         Avg. Queue (ft)       20       0       0       0       25       0       0       17       0         Intersection Delay (sec/veh)       8.6	Delay Time/Veh. (s)	11.1	0.0	6.0				0.0	8.4	0.0	0.0	7.7	0.0
Avg. Queue (ft)         20         0         0         25         0         0         17         0           Intersection Delay (sec/veh)         8.6	Max Queue (ft)	277	0	79				0	290	0	0	183	0
Intersection Delay (sec/veh) 8.6	Avg. Queue (ft)	20	0	0				0	25	0	0	17	0
	0 - (**)		-	-				Int	ersectio	on Delay	/ (sec/v	eh)	8.6

Image         Image <t< th=""><th></th><th>Node L</th><th>ocation</th><th><u> </u></th><th>Main A</th><th>.ve (N. S</th><th>ide)</th><th>140</th><th></th><th></th><th></th><th></th><th></th></t<>		Node L	ocation	<u> </u>	Main A	.ve (N. S	ide)	140					
EBL         EBT         EBR         WBL         WBL         NBL         NBT         NBR         SBL         SBL <td></td> <td>EB</td> <td>Approa</td> <td>ich</td> <td>WE</td> <td>Appro</td> <td>ach</td> <td>NB</td> <td>Approa</td> <td>ach</td> <td>SB</td> <td>Approa</td> <td>ach</td>		EB	Approa	ich	WE	Appro	ach	NB	Approa	ach	SB	Approa	ach
Volume         38         12         152         172         313         25         181         326         607         36         317         236           Delay Time/Veh. (s)         32.6         25.0         14.0         26.8         36.9         39.7         21.0         14.5         36.4         24.3         6.5           Max Queue (ft)         6         2         0         24         71         71         57         80         1         7         4.3         0           May Queue (ft)         6         2         0         24         71         71         57         80         1         7         4.3         0         Intersection Delay (sec/veh)         23.4         0         14.3         0         14.3         0         14.3         0         14.3         0         0         0.399         0         0.388         105         0         0.4         14.4         14.4         0         0         0         0         0         14.4         14.4         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0         0 <t< td=""><td></td><td>EBL</td><td>EBT</td><td>EBR</td><td>WBL</td><td>WBT</td><td>WBR</td><td>NBL</td><td>NBT</td><td>NBR</td><td>SBL</td><td>SBT</td><td>SBR</td></t<>		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay Time/Veh. (s)         32.6         25.0         14.0         26.8         3.6.9         3.9         49.7         21.0         14.5         36.4         24.3         6.5           Max Queue (ft)         6         2         0         224         71         57         80         1         7         43         0           Avg. Queue (ft)         6         2         0         24         71         71         57         80         1         7         43         0           Node Location:         Main Ave (S. Side)         142         142         23.4         0.0         39.8         105           Delay Time/Veh. (s)         24.3         0.0         14.1         0         0.0         37.6         0         37.4         14.4         14.4           Max Queue (ft)         1068         0         161         0         0         37.6         0         37.6         0         37.8         35.491         34.91         34.91         34.91         34.91         34.91         34.91         34.91         34.91         34.91         36.5         37.6         0         0         37.6         30.0         0.77         28.5         37.6         0	Volume	38	12	15	172	313	25	181	326	607	36	317	236
Max Queue (ft)         71         85         0         202         385         385         271         591         226         125         374         0           Avg. Queue (ft)         6         2         0         24         71         71         57         80         1         7         43         0           Node Location:         Main Ave (S. Side)         142         142         142         58         887         588         588           Volume         699         0         193         0         0         399         0         0         398         105         21.8         11.4           Max Queue (ft)         1068         0         161         0         0         47         0         66         7           Law, Queue (ft)         138         0         7         1         12         0         47         0         66         7           Max Queue (ft)         138         0         7         2         0         13         25         531         0         0         7         286           Delay Time/Veh. (s)         2         0         7.8         0.5         0.2         0.0         <	Delay Time/Veh. (s)	32.6	25.0	14.0	26.8	36.9	3.9	49.7	21.0	14.5	36.4	24.3	6.5
Avg. Queue (ft)         6         2         0         24         71         71         57         80         1         7         43         0           Node Location:         Main Ave (S. Side)         Intersection Delay (sec/veh)         23.4         0         104         The sec (sec/veh)         23.4         10.1         10.1         10.1         Intersection Delay (sec/veh)         23.8         10.5           Delay Time/Veh. (s)         24.3         0.0         14.1         -         -         0.0         37.6         0.0         0.33.8         10.5           Delay Time/Veh. (s)         24.3         0.0         14.1         -         -         0.0         37.6         0.0         0.33.8         11.4           Max Queue (ft)         138         0         7         43.0         0.0         10.2         10.8         128         55.1         0.0         0.8         35.6         9.7         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10.8         10	Max Queue (ft)	71	85	0	202	385	385	271	591	226	125	374	0
Node Location:         Main Ave (S. Side)         Intersection Delay (sec/veh)         23.4           EB Approach         WB Approach         NB Approach         SB Approach<	Avg. Queue (ft)	6	2	0	24	71	71	57	80	1	7	43	0
Node Location:         Main Ave (S. Side)         142           EB Approach         WB Approach         NB Approach         SB Approach								Int	ersectic	on Delay	y (sec/v	eh)	23.4
		Node L	ocation	:	Main A	.ve (S. <u>S</u>	ide)	142					
$ \begin{tabular}{ c c c c c c c c c c c c c c c c c c c$		EB	Approa	ich	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Delay Time/Veh. (s)         24.3         0.0         14.1         Image: Constraint of the	Volume	699	0	193				0	399	0	0	398	105
Max Queue (tr)         1068         0         161         Image: formation of the state	Delay Time/Veh. (s)	24.3	0.0	14.1				0.0	19.8	0.0	0.0	21.8	11.4
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Max Queue (ft)	1068	0	161				0	376	0	0	335	491
Intersection         Intersection         Delay (sec/vel)         20.9           Node Location:         MN 336 (N. Side)         128         20.9         128         58         Approach         SB Approach         S	Avg. Queue (ft)	138	0	7				0	47	0	0	66	7
Node         Location:         MN 336 (N. Site)         128           EBA         EBA         EBR         WB         WBR         NBL         NBR         SBL         SB         SBR         SBR           Volume         Image: Site         EBR         WBL         WBR         WBR         NBI         NBR         SBL         SBI         SBR           Delay Time/Veh. (s)         Image: Site         9.2         0.0         7.8         0.5         0.2         0.0         0	<b>U</b>	<b>•</b>						Int	ersectic	on Delay	v (sec/v	eh)	20.9
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Node L	ocation		MN 33	6 (N. Sid	le)	128			/ <b>x</b> = .	,	<u>ا</u> ــــــــــ
$\begin{tabular}{ c c c c c c }  c c c c c c c c c c c c $		EB	Anproa	Ach	WE	Appro	ach	NB	Approa	ach	SB	Anproa	h
Volume         Image: Constraint of the sector of the		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
$ \begin{array}{ c c c c c c } \hline  c c c c c c c c c c c c c c c c c c $	Volume			-	2	0	13	25	531	0	0	77	286
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Delav Time/Veh. (s)				9.2	0.0	7.8	0.5	0.2	0.0	0.0	0.7	2.8
Mag Queue (ft)         Image of the sector	Max Queue (ft)				0	0	0	0	0	0	0	0	0
Node Location:       MN 336 (S. Side       Intersection Delay (sec/Veh)       1.2         Intersection Delay (sec/Veh)       1.2         Intersection Delay (sec/Veh)       1.2         IDE       MN 336 (S. Side)       107         EB       PProach       NB Approach       NB Approach       SB Approach         MB Approach       NB       NB       SB Approach       SB Approach       SB Approach       SB Approach       OB         Volume       CB       OD        OD	Avg. Queue (ft)				0	0	0	0	0	0	0	0	0
Node         Image         Mm 33 (s         Side         Image         <					-	-	-	Int	ersectio	n Delav	/ (sec/v	- eh)	1.2
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$								4		///	/ / ~ ~ - ,	C,	
$\begin to the transformed basis of tra$		Node L	ncation	•	MN 33	6 (S. Sid	'e)	107			, , ,	,	
Volume		Node L EB	ocation	: ch	MN 33 WE	6 (S. Sic	le) ach	107 NB	Anproa	۰ch	SB	Annroa	۰ch
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Node L EB FBL	ocation Approa FBT	: ich FBR	MN 33 WE WBL	6 (S. Sic Appro WBT	le) ach WBR	107 NB NBL	Approa NBT	ach NBR	SBL	Approa	ach SBR
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Volume	Node L EB EBL	ocation Approa EBT	: ich EBR	MN 33 WE WBL 20	6 (S. Sic 3 Appro WBT	le) ach WBR 504	107 NB NBL	Approa NBT	ach NBR 3	SBL 67	Approa SBT 12	ach SBR N
$\begin{array}{ c c c c c c c c c c c c c c c c c c c$	Volume	Node L EB EBL	ocation Approa EBT	: ich EBR	MN 33 WE WBL 20 8 4	6 (S. Sic 3 Appro WBT 0	le) ach WBR 504	107 NB NBL 0	Approa NBT 50	ach NBR 3	SBL 67 0.6	Approa SBT 12	sch SBR 0
Node Loc (IV)       Intersection Delay (sec/veh)       0.9         Intersection Delay (sec/veh)       0.9         Node Loc ation:       CR 20 (W. Side)       201         EBL       EBR       WB Approx       NB Approx       SB Approx         Delay Time/Veh. (s)       0.0       0.3       0.7       0.3       0.4       0.0       0.0       0.8       PProx       Intersection Delay (sec/veh)       0.9         Volume       0       167       45       4       50       0       187         Delay Time/Veh. (s)       0.0       0.0       0	Volume Delay Time/Veh. (s)	Node L EB EBL	ocation Approa EBT	: ich EBR	MN 33 WE WBL 20 8.4	6 (S. Sic 3 Appro WBT 0 0.0	le) ach WBR 504 0.7	107 NB NBL 0 0.0	Approa NBT 50 0.0	ach NBR 3 0.7	SB SBL 67 0.6	Approa SBT 12 0.0	ach SBR 0 0.0
Node Location:         CR 20 (W. Side)         201           INDE Approach         SB Approach           EBL         EBT         EBR         WBL         WBT         WBR         NBL         NBT         NBR         SBL         SBT         SBR           Olim         0         167         45         4         51         0         1cs         1cs         3B         3B <td>Volume Delay Time/Veh. (s) Max Queue (ft)</td> <td>Node L EB EBL</td> <td>ocation Approa EBT</td> <td>: ach EBR</td> <td>MN 33 WE WBL 20 8.4 0</td> <td>6 (S. Sic 3 Appro WBT 0 0.0 0</td> <td>le) ach WBR 504 0.7 0</td> <td>107 NB NBL 0 0.0 0</td> <td>Approa NBT 50 0.0 0</td> <td>ach NBR 3 0.7 0</td> <td>SB SBL 67 0.6 0</td> <td>Approa SBT 12 0.0 0</td> <td>ach SBR 0 0.0 0</td>	Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL	ocation Approa EBT	: ach EBR	MN 33 WE WBL 20 8.4 0	6 (S. Sic 3 Appro WBT 0 0.0 0	le) ach WBR 504 0.7 0	107 NB NBL 0 0.0 0	Approa NBT 50 0.0 0	ach NBR 3 0.7 0	SB SBL 67 0.6 0	Approa SBT 12 0.0 0	ach SBR 0 0.0 0
$ \begin{array}{ c c c c c } \hline  c c c c c c c c c c c c c c c c c c $	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL	ocation Approa EBT	EBR	MN 33 WE 20 8.4 0 0	6 (S. Sic 3 Appro WBT 0 0.0 0 0	le) ach WBR 504 0.7 0 0	107 NBL 0 0.0 0 0	Approa NBT 50 0.0 0 0	ach NBR 3 0.7 0 0	SB SBL 67 0.6 0 0	Approa SBT 12 0.0 0 0	ach SBR 0 0.0 0 0
$ \begin{array}{ c c c c c } \hline  c c c c c c } \hline  c c c c c c } \hline  c c c c c c c } \hline  c c c c c c } \hline  c c c c c c } \hline  c c c c c } \hline  c c c c c } \hline  c c c c } \hline  c c c } \hline  c c c } \hline  c } \hline  c c }  c }$	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL	ocation Approa EBT	EBR	MN 33 WE 20 8.4 0 0	6 (S. Sic Appro WBT 0 0.0 0 0	le) ach WBR 504 0.7 0 0	107 NBL 0 0.0 0 0 0 1nt 201	Approa NBT 50 0.0 0 0 ersectio	ach NBR 3 0.7 0 0 0 0 0 0	SB SBL 67 0.6 0 0 / (sec/vo	Approa SBT 12 0.0 0 0 eh)	ach SBR 0 0.0 0 0 0 0.9
Volume       0       167       45       4       51       0       167       167       78       0       187         Delay Time/Veh. (s)       0.0       0.3       0.7       0.3       0.4       0.0       160       160       9.2       0.0       8.8         Max Queue (ft)       0       0       0       0       0       0       160       160       9.2       0.0       8.8         Max Queue (ft)       0       0       0       0       0       0       160       160       9.2       0.0       8.8         Max Queue (ft)       0       0       0       0       0       0       160       160       0	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL Node L EB	ocation Approa EBT ocation	EBR EBR	MN 33 WE 20 8.4 0 0 CR 20 (	6 (S. Sic Appro WBT 0 0.0 0 0 W. Side	le) ach 504 0.7 0 0	107 NBL 0 0.0 0 0 0 1nt 201 NB	Approa NBT 50 0.0 0 ersectio	ach NBR 3 0.7 0 0 0 0 0 0 0 0 0	SB SBL 67 0.6 0 0 (sec/v	Approa SBT 12 0.0 0 0 eh)	ach SBR 0 0.0 0 0 0 0.9
Volume       0       107       43       4       51       0       10       70       0       107       107         Delay Time/Veh. (s)       0.0       0.3       0.7       0.3       0.4       0.0       0       9.2       0.0       8.8         Max Queue (ft)       0	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL Node L EB	ocation Approa EBT ocation Approa	: EBR EBR Ch FBR	MN 33 WE 20 8.4 0 0 CR 20 ( WE WBL	6 (S. Sic Appro WBT 0 0.0 0 0 W. Side Appro	le) ach WBR 504 0.7 0 0 0 0	107 NBL 0 0.0 0 0 0 0 1nt 201 NB NBL	Approa NBT 50 0.0 0 ersection Approa	ach NBR 3 0.7 0 0 0 0 n Delay ach	SBL 67 0.6 0 (sec/vo SBL	Approa SBT 12 0.0 0 0 eh) Approa	ach SBR 0 0.0 0 0 0 0.9 ach SBR
Delay Hilley vent (s)       0.0       0	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL Node L EBL O	ocation Approa EBT ocation Approa EBT	EBR Ch EBR Ch EBR	MN 33 WE WBL 20 8.4 0 0 0 CR 20 ( WE WBL	6 (S. Sic 3 Appro WBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	le) ach 504 0.7 0 0 0 3ch WBR	107 NBL 0 0.0 0 0 0 1nt 201 NBL	Approa NBT 50 0.0 0 ersectic Approa NBT	ach NBR 3 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SB SBL 67 0.6 0 0 (sec/v SB SBL 78	Approa SBT 12 0.0 0 0 eh) Approa SBT 0	ach SBR 0 0.0 0 0 0 0.9 ach SBR 187
Max Queue (n)         0	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EB EBL Node L EB EBL 0	ocation Approa EBT ocation Approa EBT 167	: EBR : Ch EBR 45 0.7	MN 33 WE 20 8.4 0 0 CR 20 ( WE WBL 4 0 3	6 (S. Sic Appro WBT 0 0.0 0 W. Side Appro WBT 51 0.4	le) ach WBR 504 0.7 0 0 0 *) ach WBR 0 0	107 NBL 0 0.0 0 0 0 0 1nto 201 NBL	Approa NBT 50 0.0 0 ersection Approa	ach NBR 3 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SBL 67 0.6 0 (sec/vo SBL 78 9 2	Approa SBT 12 0.0 0 0 eh) Approa SBT 0 0	ach SBR 0 0.0 0 0 0 0.9 ach SBR 187 8 8
Avg. Queue (it)       0	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EBL Node L EBL EBL 0 0.0	ocation Approa EBT ocation Approa EBT 167 0.3 0	: EBR : : : : : : : : : : : : : : : : : : :	MN 33 WE 20 8.4 0 0 CR 20 ( WE WBL 4 0.3 0	6 (S. Sic 3 Appro WBT 0 0.0 0 0 W. Side 3 Appro WBT 51 0.4 0	le) ach 504 0.7 0 0 0 0 0 wBR 0 0.0 0.0	107 NBL 0 0.0 0 0 0 0 1nt 201 NBL NBL	Approa NBT 50 0.0 0 ersection Approa NBT	ach NBR 3 0.7 0 0 0 0 n Delay	SB SBL 67 0.6 0 0 (sec/ve SBL 78 9.2 0	Approa SBT 12 0.0 0 0 eh) Approa SBT 0 0.0 0.0	ach SBR 0 0.0 0 0 0.9 ach SBR 187 8.8
Intersection Detay (decy (etc))       1.10         Node Location:       CR 20 (E. Side)       202         EB< Approver       SB Approver       SB Approver         EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT SBR         Volume       129       117       0       0       34       15       21       0       10       Cell       SBL       SBT       SBR         Delay Time/Veh. (s)       0.7       1.1       0.0       0.0       0.3       1.8       8.7       0.0       6.7       1.0       1.0       1.0         Max Queue (ft)       93       93       0       0       0       0       0       0       0       0       1.6         Avg. Queue (ft)       0       0       0       0       0       0       1.6       1.6	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft)	Node L EBL Node L EBL EBL 0 0.0 0	ocation Approa EBT ocation Approa EBT 167 0.3 0	: EBR EBR : : : : : : : : : : : : : : : : : : :	MN 33 WE 20 8.4 0 0 0 CR 20 ( WE WBL 4 0.3 0 0	6 (S. Sic Appro WBT 0 0.0 0 W. Side Appro WBT 51 0.4 0	le) ach WBR 504 0.7 0 0 0 0 0 0 0.0 0 0 0	107 NBL 0 0.0 0 0 0 1nt 201 NBL	Approa NBT 50 0.0 0 ersection Approa NBT	ach NBR 3 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SB SBL 67 0.6 0 0 (sec/vo (sec/vo SBL 78 9.2 0 0	Approa SBT 12 0.0 0 eh) Approa SBT 0 0.0 0 0	ach SBR 0 0.0 0 0 0 0 0 0 0 9 3 ch SBR 187 8.8 0 0
Node Location.     Chi 20 (L. Side)     202       EB Approach     NB Approach     SB Approach       EBL     EBT     EBR     WBL     WBT     WBR     NBL     NBR     SBL     SBT     SBR       Volume     129     117     0     0     34     15     21     0     10     Image: colspan="6">Image: colspan="6" Colspa="6" Colspan="6" Colspan="6" Colspan="6" Colspan="6" Colsp	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL Node L EBL O 0.0 0.0 0	ocation Approa EBT ocation Approa EBT 167 0.3 0 0	: EBR EBR : : : : : : : : : : : : : : : : : : :	MN 33 WE 20 8.4 0 0 0 CR 20 ( WE WBL 4 0.3 0 0 0	6 (S. Sic 3 Appro WBT 0 0.0 0 0 W. Side 3 Appro WBT 51 0.4 0 0 0	le) ach 504 0.7 0 0 0 0 wBR 0 0.0 0 0 0	107 NBL 0 0.0 0 0 0 0 1nt 201 NBL NBL	Approa NBT 50 0.0 0 ersection	ach NBR 3 0.7 0 0 0 n Delay ach NBR	SBL 67 0.6 0 0 (sec/v SBL 78 9.2 0 0 0	Approa SBT 12 0.0 0 eh) Approa SBT 0 0.0 0 0 0	ach SBR 0 0.0 0 0 0.9 ach SBR 187 8.8 0 0 0 4 6
Image: Construction         Constr	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL Node L EB EBL 0 0.0 0 0	ocation Approa EBT ocation Approa EBT 167 0.3 0 0	: EBR EBR : : : : : : : : : : : : : : : : : : :	MN 33 WE WBL 20 8.4 0 0 0 CR 20 ( WBL 4 0.3 0 0 0	6 (S. Sic 3 Appro WBT 0 0.0 0 0 W. Side 3 Appro WBT 51 0.4 0 0 0 51 0.4 0 0 0 51 0.4 0 0 0 0 0 0 0 0 0 0 0 0 0	le) ach 504 0.7 0 0 0 0 2) ach WBR 0 0.0 0 0 0	107 NBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa NBT 50 0.0 0 ersectic Approa NBT ersectic	ach NBR 3 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SB SBL 67 0.6 0 0 (sec/v) SBL 78 9.2 0 0 0 (sec/v)	Approa SBT 12 0.0 0 eh) Approa SBT 0 0.0 0 0 0 0 eh)	ach SBR 0 0.0 0 0 0.9 0.9 ach SBR 187 8.8 0 0 0 4.6
Volume       129       117       0       0       34       15       21       0       10       0       0         Delay Time/Veh. (s)       0.7       1.1       0.0       0.0       0.3       1.8       8.7       0.0       6.7       1.4       0	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL Node L EB EBL 0 0.0 0 0 0 0 Node L EB	ocation Approa EBT ocation Approa EBT 167 0.3 0 0 0 cation	: EBR : ich EBR 45 0.7 0 0 0	MN 33 WE WBL 20 8.4 0 0 0 CR 20 ( WBL 4 0.3 0 0 0 CR 20 (	6 (S. Sic Appro WBT 0 0.0 0 0 W. Side Appro WBT 51 0.4 0 0 E. Side)	le) ach WBR 504 0.7 0 0 0 0 0 0 0 0 0 0 0 0	107 NBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa NBT 50 0.0 0 ersection NBT ersection	ach NBR 3 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SBL 67 0.6 0 0 (sec/v SBL 78 9.2 0 0 0 (sec/v SBL 78 9.2 0 0 0 (sec/v	Approa SBT 12 0.0 0 0 eh) Approa SBT 0 0.0 0 0 eh)	ach SBR 0 0.0 0 0 0 0 0 0 3 ch SBR 187 8.8 0 0 0 4.6
Delay Time/Veh. (s)       0.7       1.1       0.0       0.0       0.3       1.8       8.7       0.0       6.7       Image: Constraint of the second	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL Node L EB EBL 0 0.0 0 0 0 Node L EB EBL	ocation Approa EBT ocation Approa EBT 167 0.3 0 0 ocation Approa	: EBR EBR : : : : : : : : : : : : : : : : : : :	MN 33 WE WBL 20 8.4 0 0 0 CR 20 ( WBL 4 0.3 0 0 CR 20 ( WE WBL	6 (S. Sic 3 Appro WBT 0 0.0 0 0 W. Side 3 Appro WBT 51 0.4 0 0 E. Side) 3 Appro	le) ach WBR 504 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	107 NBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa NBT 50 0.0 0 ersection Approa ersection	ach NBR 3 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SB           SBL           67           0.6           0           y (sec/v)           SBL           78           9.2           0           0           y (sec/v)	Approa SBT 12 0.0 0 eh) Approa SBT 0 0.0 0 0 0 eh) Approa	ach SBR 0 0.0 0 0 0 0.9 ach SBR 187 8.8 0 0 4.6
Delay Time/Ven. (s)       0.7       1.1       0.0       0.0       0.5       1.6       6.7       0.0       0.7       0.0         Max Queue (ft)       93       93       0 <td>Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)</td> <td>Node L EB EBL Node L EB EBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>ocation Approa EBT ocation Approa EBT 167 0.3 0 0 0 ocation Approa EBT</td> <td>: EBR EBR : Ch EBR Ch EBR Ch EBR</td> <td>MN 33 WE WBL 20 8.4 0 0 0 CR 20 ( WBL 4 0.3 0 0 0 CR 20 ( WBL 0 CR 20 (</td> <td>6 (S. Sic Appro WBT 0 0.0 0 0 W. Side Appro WBT 51 0.4 0 0 E. Side) Appro WBT 24</td> <td>le) ach WBR 504 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>107 NBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>Approa NBT 50 0.0 0 ersection Approa ersection Approa</td> <td>ach NBR 3 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>SB SBL 67 0.6 0 0 (sec/v) SB SBL 78 9.2 0 0 (sec/v) SB SBL SBL</td> <td>Approa SBT 12 0.0 0 eh) Approa SBT 0 0.0 0 eh) Approa SBT</td> <td>ach SBR 0 0.0 0 0 0 0 0 0 0 0 0 0 0 4.6 SBR ach SBR</td>	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL Node L EB EBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ocation Approa EBT ocation Approa EBT 167 0.3 0 0 0 ocation Approa EBT	: EBR EBR : Ch EBR Ch EBR Ch EBR	MN 33 WE WBL 20 8.4 0 0 0 CR 20 ( WBL 4 0.3 0 0 0 CR 20 ( WBL 0 CR 20 (	6 (S. Sic Appro WBT 0 0.0 0 0 W. Side Appro WBT 51 0.4 0 0 E. Side) Appro WBT 24	le) ach WBR 504 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	107 NBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa NBT 50 0.0 0 ersection Approa ersection Approa	ach NBR 3 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SB SBL 67 0.6 0 0 (sec/v) SB SBL 78 9.2 0 0 (sec/v) SB SBL SBL	Approa SBT 12 0.0 0 eh) Approa SBT 0 0.0 0 eh) Approa SBT	ach SBR 0 0.0 0 0 0 0 0 0 0 0 0 0 0 4.6 SBR ach SBR
Max Queue (ft)       93       93       0       0       0       0       0       0       0       0         Avg. Queue (ft)       0       0       0       0       0       0       0       0       0       0       0       0       0       0       1       1       1	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Avg. Queue (ft)	Node L EB EBL Node L EB EBL 0 0 0.0 0 0 0 Node L EB EBL 129	ocation Approa EBT ocation Approa EBT 167 0.3 0 0 ocation Approa EBT 117	: EBR EBR 45 0.7 0 0 : : ch EBR 0 0	MN 33 WE WBL 20 8.4 0 0 0 CR 20 ( WBL 4 0.3 0 0 CR 20 ( WBL 0 0	6 (S. Sic 3 Appro WBT 0 0.0 0 0 W. Side 3 Appro WBT 51 0.4 0 0 E. Side) 3 Appro WBT 34 0 3 0 3 0 0 0 0 0 0 0 0 0 0 0 0 0	le) ach WBR 504 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	107 NBL 0 0.0 0 0 0 0 1nt 201 NBL 201 NBL 202 NBL 202 NBL 202	Approa NBT 50 0.0 0 ersection Approa NBT ersection Approa	ach NBR 3 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SB           SBL           67           0.6           0           y (sec/v)           SBL           78           9.2           0           y (sec/v)           SBL           78           9.2           0           y (sec/v)           SBL           SBL           SBL	Approa SBT 12 0.0 0 eh) Approa SBT 0 0.0 0 0 eh) Approa SBT	ach SBR 0 0.0 0 0 0.9 ach SBR 187 8.8 0 0 4.6 SBR
Avg. Queue (IT) U U U U U U U U U U U U U U U U U U U	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EB EBL Node L EB EBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ocation Approa EBT ocation Approa EBT 167 0.3 0 0 0 ocation Approa EBT 117 1.1	: ach EBR : ch EBR 45 0.7 0 0 0 0 : ch EBR 0 0.0 0.0	MN 33 WE WBL 20 8.4 0 0 0 CR 20 ( WBL 4 0.3 0 0 0 CR 20 ( WBL 0 0.0 0.0	6 (S. Sic 3 Appro WBT 0 0.0 0 0 W. Side 3 Appro WBT 51 0.4 0 0 0 E. Side) 3 Appro WBT 34 0.3 0	le) ach WBR 504 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	107 NBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa NBT 50 0.0 0 ersection Approa NBT 0 0.0 0.0	ach NBR 3 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	SBL 67 0.6 0 0 (sec/v) SBL 78 9.2 0 0 0 (sec/v) (sec/v) SBL SBL	Approa SBT 12 0.0 0 0 eh) Approa SBT 0 0 0 0 0 0 0 0 0 0 0 0 0	ach SBR 0 0.0 0 0 0.9 ach SBR 187 8.8 0 0 4.6 SBR
	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL Node L EB EBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ocation Approa EBT ocation Approa EBT 167 0.3 0 0 0 ocation Approa EBT 117 1.1 93 0	: EBR EBR : Ch EBR 45 0.7 0 0 0 0 : EBR 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	MN 33 WE WBL 20 8.4 0 0 0 CR 20 ( WBL 4 0.3 0 0 0 CR 20 ( WBL 0 0 0.0 0 0	6 (S. Sic 3 Appro WBT 0 0.0 0 0 W. Side 3 Appro WBT 51 0.4 0 0 0 E. Side) 3 Appro WBT 34 0.3 0 0	le) ach WBR 504 0.7 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	107 NBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa NBT 50 0.0 0 ersection Approa NBT ersection Approa NBT 0 0.0 0.0	ach NBR 3 0.7 0 0 0 0 n Delay ach NBR ach NBR 10 6.7 0 0	SB SBL 67 0.6 0 0 (sec/v) SB SBL 78 9.2 0 0 (sec/v) SB SBL SBL SBL	Approa SBT 12 0.0 0 0 eh) Approa SBT 0 0.0 0 0 0 eh) Approa SBT	ach SBR 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0

	Node L	ocation.	:	19 Ave	(W. Sid	e)	205					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	0	223	37	0	244	603				37	0	27
Delay Time/Veh. (s)	0.0	2.1	1.3	0.0	3.0	2.3				9.4	0.0	1.4
Max Queue (ft)	0	113	0	0	119	246				91	0	0
Avg. Queue (ft)	0	2	0	0	2	0				2	0	0
				-			Int	ersectio	on Delay	y (sec/v	eh)	2.6
	Node L	.ocation	:	19 Ave	(E. Side	e)	206			-		
	EB	Approa	ach	W	B Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	0	158	101	0	826	63	16	0	584			
Delay Time/Veh. (s)	0.0	6.3	0.4	0.0	6.0	0.7	20.2	0.0	6.1			
Max Queue (ft)	0	158	98	0	174	0	80	0	136			
Avg. Queue (ft)	0	4	1	0	18	0	2	0	24			
	U	•	-	Ű	10	U	– Int	ersectio	n Delay	v (sec/v	eh)	5.7
	Node I	ocation	·	12th Δ	ve (W 9	Side)	209		JII Dela	, (300, 1	eny	017
	FB	Appros	n. Ach	12(11/)	Annro	ach	NB	Annro	ach	SB	Appros	h
	FRI	FBT	FRR	W/BI	WBT		NRI	NBT	NBR	SBI	SBT	SBR
Volumo		100	EDR		456	F02	NDL	NDT	NDR	62	0	
	0	400	1 6	0	450	1 2				24.2	0	10
Max Queue (ft)	0.0	2.5	1.0	0.0	2.2	1.2				54.2	0.0	1.0
Iviax Queue (It)	0	133	0	0	143	96				94	0	00
Avg. Queue (II)	0	3	U	0	4	0	ا مر ا			12	0 a.h.)	1
							Int	ersectic	n Dela	y (sec/v	en)	2.7
				1 2+1- 4		ا م ام	240					
	Node L	ocation	:	12th A	ve (E. Si	de)	210					
	Node L EB	ocation Approa	: ach	12th A WE	ve (E. Si 3 Appro	de) ach	210 NB	Approa	ach	SB	Approa	ach
	Node L EB EBL	ocation Approa EBT	i: ach EBR	12th A WE WBL	ve (E. Si 3 Appro WBT	de) ach WBR	210 NB NBL	Approa NBT	ach NBR	SB SBL	Approa SBT	ach SBR
Volume	Node L EB EBL 0	ocation Approa EBT 440	i: ach EBR 107	12th A WE WBL	ve (E. Si 3 Appro WBT 652	de) ach WBR 160	210 NB NBL 397	Approa NBT 0	ach NBR 490	SB SBL	Approa SBT	sBR
Volume Delay Time/Veh. (s)	Node L EBL 0 0.0	Approa EBT 440 5.4	: ach EBR 107 0.2	12th A WBL 0 0.0	ve (E. Si 3 Appro WBT 652 5.6	de) ach WBR 160 0.8	210 NB NBL 397 29.9	Approa NBT 0 0.0	ach NBR 490 7.3	SB SBL	Approa SBT	ach SBR
Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EBL 0 0.0 0	Approa EBT 440 5.4 176	: EBR 107 0.2 99	12th A WBL 0 0.0 0	ve (E. Si 3 Appro WBT 652 5.6 191	de) ach WBR 160 0.8 0	210 NBL 397 29.9 212	Approa NBT 0 0.0 0	ach NBR 490 7.3 232	SBL	Approa SBT	ach SBR
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB 0 0.0 0 0	Approa EBT 440 5.4 176 9	: EBR 107 0.2 99 0	12th A WE WBL 0 0.0 0 0	ve (E. Si 3 Appro WBT 652 5.6 191 11	de) ach WBR 160 0.8 0 0	210 NBL 397 29.9 212 47	Approa NBT 0 0.0 0 0	ach NBR 490 7.3 232 29	SBL	Approa SBT	ach SBR
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB EBL 0 0.0 0 0	Approa EBT 440 5.4 176 9	: ach EBR 107 0.2 99 0	12th A WE WBL 0 0.0 0 0	ve (E. Si 3 Appro WBT 652 5.6 191 11	de) ach WBR 160 0.8 0 0	210 NBL 397 29.9 212 47 Int	Approa NBT 0 0.0 0 0 ersectio	ach NBR 490 7.3 232 29 on Delay	SBL	Approa SBT 	ach SBR 9.6
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB 0 0.0 0 0 Node L	Approa EBT 440 5.4 176 9	: ach EBR 107 0.2 99 0	12th A WBL 0 0.0 0 0 0 0 Main A	ve (E. Si 3 Appro WBT 652 5.6 191 11 xve (W.	de) ach WBR 160 0.8 0 0 Side)	210 NBL 397 29.9 212 47 Int 213	Approa NBT 0 0.0 0 0 ersectio	ach NBR 490 7.3 232 29 on Delay	SBL SBL y (sec/v	Approa SBT eh)	ach SBR 9.6
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 Node L EB	ocation Approa EBT 440 5.4 176 9 ocation Approa	: ach EBR 107 0.2 99 0 0	12th A WBL 0 0.0 0 0 0 Main A WE	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 we (W. 3 Appro	de) ach 160 0.8 0 0 Side) ach	210 NBL 397 29.9 212 47 Int 213 NB	Approa NBT 0 0.0 0 ersectio	ach NBR 490 7.3 232 29 on Delay	SBL SBL y (sec/v SB	Approa SBT eh)	SBR 9.6
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 Node L EBL	Approa EBT 440 5.4 176 9 .ocation Approa EBT	: EBR 107 0.2 99 0 : : EBR	12th A WBL 0 0.0 0 0 Main A WBL	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 we (W. 3 Appro WBT	de) ach 160 0.8 0 0 Side) ach WBR	210 NBL 397 29.9 212 47 Int 213 NBL	Approa NBT 0 0.0 0 ersectio Approa	ach NBR 490 7.3 232 29 on Delay ach NBR	SBL SBL y (sec/v SB SBL	Approa SBT eh) Approa SBT	ach SBR 9.6 ach SBR
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EBL 0 0.0 0 0 Node L EBL 0	ocation Approa EBT 440 5.4 176 9 ocation Approa EBT 1113	: EBR 107 0.2 99 0 0 : ch EBR 539	12th A WBL 0 0.0 0 0 0 0 Main A WBL 0	ve (E. Si 3 Appro 652 5.6 191 11 xve (W. 3 Appro WBT 1361	de) ach 160 0.8 0 0 0 Side) ach WBR 617	210 NBL 397 29.9 212 47 Int 213 NBL NBL	Approa NBT 0 0.0 0 ersectio Approa	ach NBR 490 7.3 232 29 on Delay ach NBR	SBL SBL y (sec/v SBL 95	Approa SBT eh) Approa SBT 0	ach SBR 9.6 ach SBR 183
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EBL 0 0.0 0 0 Node L EBL 0 0.0	ocation Approa EBT 440 5.4 176 9 ocation Approa EBT 1113 3.7	: ach EBR 107 0.2 99 0 0 : : : : : : : : : : : : : : : :	12th A WBL 0 0.0 0 0 0 0 Main A WBL 0 0.0	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 we (W. 3 Appro WBT 1361 4.8	de) ach 160 0.8 0 0 Side) ach WBR 617 3.1	210 NBL 397 29.9 212 47 Int 213 NB NBL	Approa NBT 0 0.0 0 ersectic Approa NBT	ach NBR 490 7.3 232 29 on Delay ach NBR	SBL SBL y (sec/v SBL 95 36.0	Approa SBT eh) Approa SBT 0 0.0	ach SBR 9.6 Ach SBR 183 8.5
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EBL 0 0.0 0 0 0 Node L EBL 0 0.0 0.0	Approa EBT 440 5.4 176 9 .ocation Approa EBT 1113 3.7 232	: ach EBR 107 0.2 99 0 0 : ach EBR 539 5.9 232	12th A WBL 0 0.0 0 0 0 Main A WBL 0 0.0 0.0	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 we (W. 3 Appro WBT 1361 4.8 262	de) ach 160 0.8 0 0 0 Side) ach WBR 617 3.1 273	210 NBL 397 29.9 212 47 Int 213 NBL NBL	Approa NBT 0 0.0 0 ersectio Approa NBT	ach NBR 490 7.3 232 29 on Delay ach NBR	SBL SBL y (sec/v SBL 95 36.0 95	Approa SBT eh) Approa SBT 0 0.0 95	ach SBR 9.6 SBR 183 8.5 107
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 0 Node L EBL 0 0.0 0.0 0 0	Approa EBT 440 5.4 176 9 occation Approa EBT 1113 3.7 232 19	: ach EBR 107 0.2 99 0 0 : c ch EBR 539 5.9 232 19	12th A WBL 0 0.0 0 0 0 0 WBL 0 0.0 0 0 0 0 0	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 xve (W. 3 Appro WBT 1361 4.8 262 15	de) ach 160 0.8 0 0 0 Side) ach WBR 617 3.1 273 1	210 NBL 397 29.9 212 47 Int 213 NB NBL	Approa NBT 0 0.0 0 ersectio	ach NBR 490 7.3 232 29 on Delay ach NBR	SB SBL y (sec/v SBL 95 36.0 95 16	Approa SBT eh) Approa SBT 0 0.0 95 16	ach SBR 9.6 SBR 183 8.5 107 8
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 0 Node L EBL 0 0.0 0 0 0 0	ocation Approa EBT 440 5.4 176 9 ocation Approa EBT 1113 3.7 232 19	: ach EBR 107 0.2 99 0 0 : ach EBR 539 5.9 232 19	12th A WBL 0 0.0 0 0 0 Main A WBL 0 0.0 0 0 0 0	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 we (W. 3 Appro WBT 1361 4.8 262 15	de) ach 160 0.8 0 0 Side) ach WBR 617 3.1 273 1	210 NBL 397 29.9 212 47 Int 213 NBL NBL	Approa NBT 0 0.0 0 ersectic Approa NBT	ach NBR 490 7.3 232 29 on Delay ach NBR	SBL SBL y (sec/v SB SBL 95 36.0 95 16 y (sec/v	Approa SBT eh) Approa SBT 0 0.0 95 16 eh)	ach SBR 9.6 SBR 183 8.5 107 8 5.3
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 Node L EBL 0 0.0 0 0 0 0 0 0	Approa EBT 440 5.4 176 9 ocation Approa EBT 1113 3.7 232 19 ocation	: ach EBR 107 0.2 99 0 0 : cch EBR 539 5.9 232 19 :	12th A WBL 0 0.0 0 0 0 0 Wain A 0 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 3 Appro WBT 1361 4.8 262 15 xve (E. S	de) ach 160 0.8 0 0 0 Side) ach WBR 617 3.1 273 1 ide)	210 NBL 397 29.9 212 47 Int 213 NBL NBL	Approa NBT 0 0.0 0 ersectio	ach NBR 490 7.3 232 29 on Delay ach NBR	SB SBL y (sec/v SB SBL 95 36.0 95 16 y (sec/v	Approa SBT eh) Approa SBT 0 0.0 95 16 eh)	ach SBR 9.6 SBR 183 8.5 107 8 5.3
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 Node L EBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ocation Approa EBT 440 5.4 176 9 ocation Approa EBT 1113 3.7 232 19 ocation Approa	:: ach EBR 107 0.2 99 0 0 : Cach EBR 539 5.9 232 19 19 :	12th A WBL 0 0.0 0 0 Main A WBL 0 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 we (W. 3 Appro WBT 1361 4.8 262 15 we (E. S 3 Appro	de) ach 160 0.8 0 0 0 Side) ach 817 3.1 273 1 273 1 ide)	210 NBL 397 29.9 212 47 Int 213 NBL NBL	Approa NBT 0 0.0 0 ersectio Approa ersectio	ach NBR 490 7.3 232 29 on Delay ach NBR	SB SBL y (sec/v SB SBL 95 36.0 95 16 y (sec/v SB	Approa SBT eh) Approa SBT 0 0.0 95 16 eh)	ach SBR 9.6 9.6 Ach SBR 183 8.5 107 8 5.3 Ach
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 0 Node L EBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ocation Approa EBT 440 5.4 176 9 ocation Approa EBT 1113 3.7 232 19 ocation Approa EBT	: ach EBR 107 0.2 99 0	12th A WBL 0 0.0 0 0 0 Main A WBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 we (W. 3 Appro WBT 1361 4.8 262 15 we (E. S 3 Appro WBT	de) ach 160 0.8 0 0 0 Side) ach WBR 617 3.1 273 1 ide) ach WBR	210 NBL 397 29.9 212 47 Int 213 NBL Int 214 NB NBL	Approa NBT 0 0.0 0 ersectio Approa ersectio	ach NBR 490 7.3 232 29 on Delay ach NBR	SBL SBL y (sec/v SB SBL 95 36.0 95 16 y (sec/v SBL	Approa SBT eh) Approa SBT 0 0.0 95 16 eh) Approa SBT	ach SBR 9.6 SBR 183 8.5 107 8 5.3 ach SBR
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 Node L EBL 0 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ocation Approa EBT 440 5.4 176 9 ocation Approa EBT 1113 3.7 232 19 ocation Approa EBT 998	:: ach EBR 107 0.2 99 0 0 : c ch EBR 539 5.9 232 19 : c ch EBR 232	12th A WBL 0 0.0 0 0 0 Main A WBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 we (W. 3 Appro WBT 1361 4.8 262 15 we (E. S 3 Appro WBT 15 we (E. S 3 Appro	de) ach 160 0.8 0 0 0 Side) ach WBR 617 3.1 273 1 ide) ach WBR 127	210 NBL 397 29.9 212 47 Int 213 NBL NBL 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Approa NBT 0 0.0 0 ersection Approa NBT ersection Approa 0 0 0 0 0 0 0 0 0 0 0 0 0	ach NBR 490 7.3 232 29 on Delay ach NBR on Delay	SBL SBL (sec/v SBL 95 36.0 95 16 y (sec/v SBL SBL	Approa SBT eh) Approa SBT 0 0.0 95 16 eh) Approa SBT	ach SBR 9.6 9.6 SBR 183 8.5 107 8 5.3 ach SBR
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EBL 0 0.0 0 0 0 Node L EBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ocation Approa EBT 440 5.4 176 9 ocation Approa EBT 1113 3.7 232 19 ocation Approa EBT 998 2.4	:: ach EBR 107 0.2 99 0	12th A WBL 0 0.0 0 0 Main A WBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 we (W. 3 Appro WBT 1361 4.8 262 15 xve (E. S 3 Appro WBT 1878 3.9	de) ach 160 0.8 0 0 0 Side) ach WBR 617 3.1 273 1 273 1 ide) ach WBR 127 6.4	210 NBL 397 29.9 212 47 Int 213 NBL 0 Int 214 NBL 0 0.0	Approa NBT 0 0.0 0 ersectio Approa NBT ersectio Approa NBT 0 0.0	ach NBR 490 7.3 232 29 on Delay ach NBR ach NBR 168 7.7	SBL SBL y (sec/v SB SBL 95 36.0 95 36.0 95 16 y (sec/v SBL SBL	Approa SBT eh) Approa SBT 0 0.0 95 16 eh) Approa SBT	ach SBR 9.6 SBR 183 8.5 107 8 5.3 ach SBR SBR
Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EBL 0 0.0 0 0 0 Node L EBL 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ocation Approa EBT 440 5.4 176 9 ocation Approa EBT 1113 3.7 232 19 ocation Approa EBT 998 2.4 171	: ach EBR 107 0.2 99 0 0 : ach EBR 539 5.9 232 19 232 19 : ach EBR 227 0.4 169	12th A WBL 0 0.0 0 0 0 0 Main A WBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ve (E. Si 3 Appro WBT 652 5.6 191 11 11 3 Appro WBT 1361 4.8 262 15 3 Appro WBT 1878 3.9 266	de) ach 160 0.8 0 0 0 Side) ach WBR 617 3.1 273 1 ide) ach WBR 127 6.4 266	210 NBL 397 29.9 212 47 Int 213 NBL 0 Int 214 NBL 0 0.0 129	Approa NBT 0 0.0 0 ersection Approa NBT ersection Approa NBT 0 0.0 129	ach NBR 490 7.3 232 29 on Delay ach NBR ach NBR 168 7.7 103	SBL SBL y (sec/v SBL 95 36.0 95 16 y (sec/v SBL SBL	Approa SBT eh) Approa SBT 0 0.0 95 16 eh) Approa SBT	ach SBR 9.6 SBR 183 8.5 107 8 5.3 ach SBR
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Image <t< th=""><th>ŗ</th><th>Node L</th><th>ocation</th><th>.:</th><th>38th St</th><th>: &amp; 13th</th><th>Ave</th><th>231</th><th></th><th></th><th></th><th></th><th></th></t<>	ŗ	Node L	ocation	.:	38th St	: & 13th	Ave	231						
EBLEBTEBTEBTWBLWBLWBLNBLNBLNBLNBLNBLSBLSBTSBRDelay Time/Veh. (s) <td></td> <td>EB</td> <td>Approa</td> <td>ich</td> <td>WP</td> <td>Appro</td> <td>ach</td> <td>NB</td> <td>Approa</td> <td>ach</td> <td>SB</td> <td>Approa</td> <td>ach</td>		EB	Approa	ich	WP	Appro	ach	NB	Approa	ach	SB	Approa	ach	
Volume		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Delay Time/Veh. (s)         Image of the state of	Volume				463	0	183	0	335	350	271	208	0	
Max Queue (ft)         Image of the state of the s	Delay Time/Veh. (s)				14.1	0.0	6.1	0.0	5.8	4.3	9.3	6.5	0.0	
Avg. Queue (ft)         Image: Construct of the sector of the sect	Max Queue (ft)				188	188	151	0	147	0	164	164	0	
Intersection Delay (sec/veh)         8.3           Node Location:         13th Ave (E. Side)         Intersection Delay (sec/veh)         8.3           EB         EB Approach         WB Approach         NB Approach         SB Approach         SB           Delay Time/Veh. (s)         5.2.3         8.4         0.8         0.0         15.7         240         592         200         279            Max Queue (ft)         15         30         0         449         0         439         439         32            Max Queue (ft)         15         30         0         644         0         131         126         121             Node Location:         32nd Ave (W. Side)         NBR         NBL         NBT         NBR         SB Approach         SB Approach           WB Approach         WB Approach         NB Approach         SB Approach         SB Approach         SB Approach           Node Location:         32nd Ave (W. Side)         NBR         NBL         NBT         NBR         SB Approach         SB Approach           EB Approach         SB Approach         SB Approach         SB Approach         SB Approach         SB Approach	Avg. Queue (ft)				27	27	13	0	9	0	14	14	0	
Node         Location:         13th Ave (E. Side)         218         Set         Set </td <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td>Int</td> <td>ersectio</td> <td>on Delay</td> <td>y (sec/v</td> <td>eh)</td> <td>8.3</td>								Int	ersectio	on Delay	y (sec/v	eh)	8.3	
		Node L	ocation	:	י13t <u>h</u> A	ve (E. Si	de)	218						
EBLEBLEBRWBLWBLWBLNBLNBLNBRSBLSBLSBROlume54121527701517240592200279<		EB	Approa	ach	WF	3 Appro	ach	NB	Approa	ach	SB	Approa	ach	
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
	Volume	54	1215	277	0	1517	240	592	200	279				
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$	Delay Time/Veh. (s)	52.3	8.4	0.8	0.0	15.2	5.5	51.1	75.2	14.2				
Avg. Queue (ft)       15       30       0       64       0       131       126       121       Image (sec/veh)       19.9         Node Location:       32nd Ave (W. Side)       324         Node Location:       32nd Ave (W. Side)       324         Volume       0       1131       44       96       738       0       Image (Sec/veh)       188       SBL       SBL       SBL       SBT       SBR         Delay Time/Veh. (s)       0.0       12.7       0.8       46.6       6.5       0.0       Image (Sec/veh)       133       44       96       738       0       Image (Sec/veh)       42.5       0       387         Delay Time/Veh. (s)       0.0       12.7       0.8       46.6       6.5       0.0       Image (Sec/veh)       42.5       0       43.5         Avg. Queue (ft)       0       150       198       24.5       0       Image (Sec/veh)       20.7	Max Queue (ft)	134	303	0	0	449	0	489	489	493				
Node Location:         32nd Ave (W. Side)         19.9           EB Approach         WB Approach         NB Approach         SB Approach <td< td=""><td>Avg. Queue (ft)</td><td>15</td><td>30</td><td>0</td><td>0</td><td>64</td><td>0</td><td>131</td><td>126</td><td>121</td><td></td><td></td><td></td></td<>	Avg. Queue (ft)	15	30	0	0	64	0	131	126	121				
Node Location:         32nd Ave (W. Side)         224           EB         Approxth         NB Approxth         NB Approxth         SB Approxth<								Int	ersectio	on Delay	y (sec/v	eh)	19.9	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Node L	ocation	:	32nd A	ve (W.	Side)	224					<u></u>	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		EB	Approa	ach	WE	Appro	ach	NB	Approa	ach	SB	Approa	ach	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Volume	0	1131	44	96	738	0				820	0	387	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Delay Time/Veh. (s)	0.0	12.7	0.8	46.6	6.5	0.0				46.8	0.0	11.3	
Avg. Queue (ft)       0       58       0       26       18       0       Intersection       146       0       111         Avg. Queue (ft)       0       58       0       26       18       0       Intersection       146       0       111         Node Location:       32nd $\vee ve$ (E. Side)       225       20.7         EB       Approach       WB       Approach       NB       Approach       SB       Approach       SB       SB       SB       SB       SB         Volume       0       1677       270       0       791       838       48       0       77       I.       SB	Max Queue (ft)	0	401	0	198	245	0				425	0	432	
Intersection Delay (sec/vel)       20.7         Intersection Delay (sec/vel)       20.7         Node Location:       32nd Ave (E. Side)       225         EB       BPT EBR       WB Approach       NB Approach       SB Approach <t< td=""><td>Avg. Queue (ft)</td><td>0</td><td>58</td><td>0</td><td>26</td><td>18</td><td>0</td><td></td><td></td><td></td><td>146</td><td>0</td><td>111</td></t<>	Avg. Queue (ft)	0	58	0	26	18	0				146	0	111	
Node $\begin variable         225         SB Aprovements         SB Aprovements           EBL         EBT         EBR         WBL         WBT         WBR         NBL         NBT         NBR         SB         SBT         SBR           Olume         0         1677         270         0         791         838         48         0         777         4.0         4.0           Delay Time/Veh.(s)         0.0         2.7         1.6         0.0         2.4         2.0         39.0         0.0         9.1         4.0         4.0           Max Queue (ft)         0         476         269         0         185         0         109         90         9.0         1.0         4.0           Max Queue (ft)         0         14         44         0         4         0         11         0         4.0         1.0           Max Queue (ft)         0         14         44         0         4         0         11         0         4.0         1.0         1.0         1.0         1.0         1.0         1.0         1.0         1.0         1.0         1.0         1.0         1.0         1.0         1.0$	~							Int	ersectio	on Delay	v (sec/v	eh)	20.7	
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$								4	-		/ \ .	- ,		
$ \begin{array}{ c c c c c c c c c c c c c c c c c c c$		Node L	ocation	:	32nd A	ve (E. S	ide)	225		ì				
Volume       0       1677       270       0       791       838       48       0       77       is       is         Delay Time/Veh. (s)       0.0       2.7       1.6       0.0       2.4       2.0       39.0       0.0       9.1       is       is       is         Max Queue (ft)       0       476       269       0       185       0       109       0       90       is       is       is         Avg. Queue (ft)       0       14       44       0       4       0       10       0       4       is       <		Node L EB	ocation Approa	: ich	32nd A WB	ve (E. S Appro	ide) ach	225 NB	Approa	ıch	SB	Approa	ich	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $		Node L EB EBL	ocation Approa EBT	ich EBR	32nd A WE WBL	ve (E. S Appro WBT	ide) ach WBR	225 NB NBL	Approa NBT	ach NBR	SB SBL	Approa SBT	ach SBR	
Max Queue (ft)         0         476         269         0         185         0         109         0         90         Image (sec)         100           Avg. Queue (ft)         0         14         44         0         4         0         11         0         4         Image (sec)         3.0           Avg. Queue (ft)         0         14         44         0         4         0         11         0         4         Image (sec)/veb)         3.0           Node Location:         52nd Ave (W. Side)         228         228         587         SB         SB           Volume         0         89         23         9         71         0         1         223         0         113           Delay Time/Veb. (s)         0.0         4.9         2.4         4.6         4.9         0.0         1         33.7         0.0         1.7           Max Queue (ft)         0         113         0         92         92         0         1         1         0         1         33.7         0.0         1.7           Max Queue (ft)         0         1         1         0         1         1         0         1	Volume	Node L EB EBL	ocation Approa EBT 1677	i: ich EBR 270	32nd A WE WBL	ve (E. S Appro WBT 791	ide) ach WBR 838	225 NB NBL 48	Approa NBT 0	ach NBR 77	SB SBL	Approa SBT	ach SBR	
Avg. Queue (ft)       0       14       44       0       4       0       11       0       4       0       4       0       11       0       4       0       4       0       11       0       4       0       4       0       11       0       4       0       4       0       11       0       4       0       4       0       11       0       4       0       4       0       11       0       4       0       1       0       4       0       1       0       4       0       1       0       1       0       4       0       1       0       1       0       1       0       1       0       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1<	Volume Delay Time/Veh. (s)	Node L EB EBL 0 0.0	Ocation Approa EBT 1677 2.7	i: ich EBR 270 1.6	32nd A WE WBL 0 0.0	Ve (E. S Appro WBT 791 2.4	ide) ach WBR 838 2.0	225 NB NBL 48 39.0	Approa NBT 0 0.0	ach NBR 77 9.1	SB SBL	Approa SBT	ach SBR	
Node $2$ $1$ $1$ $2$ $1$ $2$ $1$ $2$ $1$ $1$ $2$ $1$ <th< td=""><td>Volume Delay Time/Veh. (s) Max Queue (ft)</td><td>Node L EB EBL 0 0.0 0</td><td>Approa EBT 1677 2.7 476</td><td>i: EBR 270 1.6 269</td><td>32nd A WE WBL 0 0.0 0</td><td>we (E. S Appro WBT 791 2.4 185</td><td>ide) ach WBR 838 2.0 0</td><td>225 NB NBL 48 39.0 109</td><td>Approa NBT 0 0.0 0</td><td>ach NBR 77 9.1 90</td><td>SB SBL</td><td>Approa SBT</td><td>ach SBR</td></th<>	Volume Delay Time/Veh. (s) Max Queue (ft)	Node L EB EBL 0 0.0 0	Approa EBT 1677 2.7 476	i: EBR 270 1.6 269	32nd A WE WBL 0 0.0 0	we (E. S Appro WBT 791 2.4 185	ide) ach WBR 838 2.0 0	225 NB NBL 48 39.0 109	Approa NBT 0 0.0 0	ach NBR 77 9.1 90	SB SBL	Approa SBT	ach SBR	
Node Location:         52nd Ave (W. Side)         228           INDE Approach         SB Approach         SB Approach           EBL         EBT         EBR         WBL         WBT         WBR         NBL         NBT         NBR         SBL         SBT         SBR           Volume         0         89         23         9         71         0         Image: Figure	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB 0 0.0 0	ocation Approa EBT 1677 2.7 476 14	ach EBR 270 1.6 269 44	32nd A WE WBL 0 0.0 0	ve (E. S Appro WBT 791 2.4 185 4	ide) ach WBR 838 2.0 0 0	225 NB 48 39.0 109 11	Approa NBT 0 0.0 0	ach NBR 77 9.1 90 4	SB SBL	Approa SBT	ach SBR	
Index bound of the product	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0	ocation Approa EBT 1677 2.7 476 14	ach EBR 270 1.6 269 44	32nd A WE WBL 0 0.0 0 0	ve (E. S Appro WBT 791 2.4 185 4	ide) ach WBR 838 2.0 0 0	225 NBL 48 39.0 109 11	Approa NBT 0 0.0 0 0 ersectio	ach NBR 77 9.1 90 4 un Delay	SBL	Approa SBT	ach SBR 3.0	
$ \begin{array}{ c c c } \hline  c c  +  c c  $	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB 0 0.0 0 0 Node L	Approa EBT 1677 2.7 476 14	a: EBR 270 1.6 269 44	32nd A WE WBL 0 0.0 0 0 0	ve (E. S Appro WBT 791 2.4 185 4 ve (W.	ide) ach WBR 838 2.0 0 0 Side)	225 NB NBL 48 39.0 109 11 Int 228	Approa NBT 0 0.0 0 ersectio	ach NBR 77 9.1 90 4 on Delay	SBL SBL / (sec/ve	Approa SBT 	ach SBR 3.0	
Volume       0       89       23       9       71       0       Image       Mark       Mark </td <td>Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)</td> <td>Node L EB 0 0.0 0 0 Node L EB</td> <td>Approa EBT 1677 2.7 476 14 ocation</td> <td>e: EBR 270 1.6 269 44 :</td> <td>32nd A WE WBL 0 0.0 0 0 52nd A WB</td> <td>ve (E. S Appro WBT 791 2.4 185 4 ve (W.</td> <td>ide) ach WBR 838 2.0 0 0 Side) ach</td> <td>225 NB NBL 48 39.0 109 11 Int 228 NB</td> <td>Approa NBT 0 0.0 0 ersectio</td> <td>ach NBR 77 9.1 90 4 on Delay</td> <td>SB SBL / (sec/vo</td> <td>Approa SBT eh)</td> <td>ach SBR 3.0</td>	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB 0 0.0 0 0 Node L EB	Approa EBT 1677 2.7 476 14 ocation	e: EBR 270 1.6 269 44 :	32nd A WE WBL 0 0.0 0 0 52nd A WB	ve (E. S Appro WBT 791 2.4 185 4 ve (W.	ide) ach WBR 838 2.0 0 0 Side) ach	225 NB NBL 48 39.0 109 11 Int 228 NB	Approa NBT 0 0.0 0 ersectio	ach NBR 77 9.1 90 4 on Delay	SB SBL / (sec/vo	Approa SBT eh)	ach SBR 3.0	
Delay Time/Veh. (s)       0.0       4.9       2.4       4.6       4.9       0.0       Image: Second sec	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 Node L EB	Approa EBT 1677 2.7 476 14 ocation Approa EBT	ach EBR 270 1.6 269 44 : ch EBR	32nd A WE WBL 0 0.0 0 0 0 0 52nd A WB WBL	ve (E. S Appro WBT 791 2.4 185 4 .ve (W. Appro WBT	ide) ach WBR 838 2.0 0 0 0 Side) ach WBR	225 NB NBL 48 39.0 109 11 Into 228 NB NBL	Approa NBT 0 0.0 0 ersectio Approa	ach NBR 77 9.1 90 4 on Delay ach NBR	SBL SBL / (sec/ve SBL	Approa SBT eh) Approa SBT	ach SBR 3.0 ach SBR	
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume	Node L EBL 0 0.0 0 0 Node L EBL 0	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89	ach EBR 270 1.6 269 44 : : : : : : : : : : : : : : : : : :	32nd A WE WBL 0 0.0 0 0 52nd A WB WBL 9	ve (E. S Appro WBT 791 2.4 185 4 ve (W. Appro WBT 71	ide) ach WBR 838 2.0 0 0 Side) ach WBR 0	225 NB NBL 48 39.0 109 11 Int 228 NB NBL	Approa NBT 0 0.0 0 ersectic Approa	ach NBR 77 9.1 90 4 on Delay	SB SBL / (sec/vo SB SBL 223	Approa SBT eh) Approa SBT O	ach SBR 3.0 ach SBR 113	
Mink Galacties (if)       0       113       0       32       0       1       0       1       0       1       0       48       0       1         Avg. Queue (ft)       0       2       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       1       0       1       0       1       1       0       1       1       0       1       1       0       1       1       1       0       1       1       1       0       1       1       1       0       1       1       1       1       1       0 <td>Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)</td> <td>Node L EBL 0 0.0 0 0 0 Node L EB EBL 0 0.0</td> <td>Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9</td> <td>ach EBR 270 1.6 269 44 : ich EBR 23 2.4</td> <td>32nd A WE WBL 0 0.0 0 0 0 0 52nd A WB WBL 9 4.6</td> <td>ve (E. S Appro WBT 791 2.4 185 4 ve (W. Appro WBT 71 4.9</td> <td>ide) ach WBR 838 2.0 0 0 0 Side) ach WBR 0 0.0</td> <td>225 NB NBL 48 39.0 109 11 Inte 228 NB NBL</td> <td>Approa NBT 0 0.0 0 ersectio Approa</td> <td>ach NBR 77 9.1 90 4 on Delay ach NBR</td> <td>SB SBL / (sec/vo SB SBL 223 33.7</td> <td>Approa SBT eh) Approa SBT 0 0.0</td> <td>ach SBR 3.0 ach SBR 113 1.7</td>	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L EBL 0 0.0 0 0 0 Node L EB EBL 0 0.0	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9	ach EBR 270 1.6 269 44 : ich EBR 23 2.4	32nd A WE WBL 0 0.0 0 0 0 0 52nd A WB WBL 9 4.6	ve (E. S Appro WBT 791 2.4 185 4 ve (W. Appro WBT 71 4.9	ide) ach WBR 838 2.0 0 0 0 Side) ach WBR 0 0.0	225 NB NBL 48 39.0 109 11 Inte 228 NB NBL	Approa NBT 0 0.0 0 ersectio Approa	ach NBR 77 9.1 90 4 on Delay ach NBR	SB SBL / (sec/vo SB SBL 223 33.7	Approa SBT eh) Approa SBT 0 0.0	ach SBR 3.0 ach SBR 113 1.7	
Intersection Delay (sec/veh)       16.3         Intersection Delay (sec/veh)       229         Intersection Delay (sec/veh)       SB Approach         Intersection Delay (sec/veh)       SB Approach         Intersection Delay (sec/veh)       16.3         Oligo Intersection Delay (sec/veh)       SB Approach         Intersection Delay (sec/veh)       SB Approach         Intersection Delay (sec/veh)       2.4         Intersection Delay (sec/veh)       2.4         Intersection Delay (sec/veh) <th co<="" td=""><td>Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)</td><td>Node L           EBL           0           0.0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0.0           0           0</td><td>Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113</td><td>ach EBR 270 1.6 269 44 : ich EBR 23 2.4 0</td><td>32nd A WE WBL 0 0.0 0 0 52nd A WE WBL 9 4.6 92</td><td>ve (E. S Appro WBT 791 2.4 185 4 ve (W. Appro WBT 71 4.9 92</td><td>ide) ach 838 2.0 0 0 0 Side) ach WBR 0 0.0 0.0</td><td>225 NB NBL 48 39.0 109 11 Into 228 NB NBL</td><td>Approa NBT 0 0.0 0 ersectic NBT</td><td>ach NBR 77 9.1 90 4 on Delay</td><td>SB SBL (sec/v) SB SBL 223 33.7 337</td><td>Approa SBT eh) Approa SBT 0 0.0 0.0</td><td>ach SBR 3.0 3.0 ach SBR 113 1.7 78</td></th>	<td>Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)</td> <td>Node L           EBL           0           0.0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0.0           0           0</td> <td>Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113</td> <td>ach EBR 270 1.6 269 44 : ich EBR 23 2.4 0</td> <td>32nd A WE WBL 0 0.0 0 0 52nd A WE WBL 9 4.6 92</td> <td>ve (E. S Appro WBT 791 2.4 185 4 ve (W. Appro WBT 71 4.9 92</td> <td>ide) ach 838 2.0 0 0 0 Side) ach WBR 0 0.0 0.0</td> <td>225 NB NBL 48 39.0 109 11 Into 228 NB NBL</td> <td>Approa NBT 0 0.0 0 ersectic NBT</td> <td>ach NBR 77 9.1 90 4 on Delay</td> <td>SB SBL (sec/v) SB SBL 223 33.7 337</td> <td>Approa SBT eh) Approa SBT 0 0.0 0.0</td> <td>ach SBR 3.0 3.0 ach SBR 113 1.7 78</td>	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft)	Node L           EBL           0           0.0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0.0           0           0	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113	ach EBR 270 1.6 269 44 : ich EBR 23 2.4 0	32nd A WE WBL 0 0.0 0 0 52nd A WE WBL 9 4.6 92	ve (E. S Appro WBT 791 2.4 185 4 ve (W. Appro WBT 71 4.9 92	ide) ach 838 2.0 0 0 0 Side) ach WBR 0 0.0 0.0	225 NB NBL 48 39.0 109 11 Into 228 NB NBL	Approa NBT 0 0.0 0 ersectic NBT	ach NBR 77 9.1 90 4 on Delay	SB SBL (sec/v) SB SBL 223 33.7 337	Approa SBT eh) Approa SBT 0 0.0 0.0	ach SBR 3.0 3.0 ach SBR 113 1.7 78
Node Location:       52nd Ave (E. Side)       229         EB Approach       SB Approach       SB Approach         EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBR       SBL       SBT       SBR         Volume       78       235       0       0       62       127       18       0       28       G       G       SBT       SBR         Delay Time/Veh. (s)       2.3       3.6       0.0       0.0       0.3       2.22       24.7       0.0       2.6       Ice       Ice<	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 0 Node L EBL 0 0.0 0.0 0	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113 2	ach EBR 270 1.6 269 44 : ich EBR 23 2.4 0 0	32nd A WE WBL 0 0.0 0 0 52nd A WB WBL 9 4.6 92 1	ve (E. S Appro WBT 791 2.4 185 4 ve (W. Appro WBT 71 4.9 92 1	ide) ach WBR 838 2.0 0 0 0 Side) ach WBR 0 0.0 0.0 0 0	225 NB NBL 48 39.0 109 11 Int 228 NB NBL	Approa NBT 0 0.0 0 ersectio Approa NBT	ach NBR 77 9.1 90 4 on Delay ach NBR	SBL SBL / (sec/vo SBL 223 33.7 337 48	Approa SBT eh) Approa SBT 0 0.0 0 0	ach SBR 3.0 3.0 ach SBR 113 1.7 78 1	
Note Electron.       S210 Aver (E. Side)       225         EB Approach       NB Approach       NB Approach       SB Approach         EBL       EBL       EBR       EBR       WBL       WBT       WBR       NBL       NBR       SBL       SBT       SBR         Volume       78       235       0       0       62       127       18       0       28       C       C         Delay Time/Veh. (s)       2.3       3.6       0.0       0.0       0.3       2.2       24.7       0.0       2.6       C       C         Max Queue (ft)       223       223       0       0       0       880       93       0       47       C       C         Avg. Queue (ft)       5       5       0       0       0       2       0       0       2       0       2       2       4	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L           EBL           0           0.0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0           0	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113 2	ach EBR 270 1.6 269 44 : ich EBR 23 2.4 0 0	32nd A WE WBL 0 0.0 0 0 0 52nd A WE WBL 9 4.6 92 1	ve (E. S Appro WBT 791 2.4 185 4 ve (W. Appro WBT 71 4.9 92 1	ide) ach WBR 838 2.0 0 0 0 0 Side) ach WBR 0 0.0 0 0 0	225 NB NBL 48 39.0 109 11 Int 228 NB NBL	Approa NBT 0 0.0 0 ersection Approa NBT	ach NBR 77 9.1 90 4 on Delay	SB SBL (sec/v SB SBL 223 33.7 337 48 (sec/v	Approa SBT eh) Approa SBT 0 0.0 0 0 0	ach SBR 3.0 3.0 ach SBR 113 1.7 78 1 16.3	
Image: Construction         Constr	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EBL 0 0.0 0 0 Node L EBL 0 0.0 0 0 0 0	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113 2	ach EBR 270 1.6 269 44 : ich EBR 23 2.4 0 0 0	32nd A WE WBL 0 0.0 0 0 52nd A WE WBL 9 4.6 92 1	ve (E. S Appro WBT 791 2.4 185 4 ve (W. Appro WBT 71 4.9 92 1	ide) ach 838 2.0 0 0 0 Side) ach WBR 0 0.0 0 0 0	225 NB NBL 48 39.0 109 11 Int 228 NB NBL	Approa NBT 0 0.0 0 ersectic Approa NBT ersectic	ach NBR 77 9.1 90 4 on Delay ach NBR	SB SBL (sec/v) (sec/v) SB SBL 223 33.7 337 48 / (sec/v)	Approa SBT eh) Approa SBT 0 0.0 0 0 0 eh)	ach SBR 3.0 3.0 ach SBR 113 1.7 78 1 16.3	
Volume       78       235       0       0       62       127       18       0       28       Image: Constraint of the constra	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB O O.O O O Node L EB EBL O O O O O O Node L EB	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113 2 ocation	ach EBR 270 1.6 269 44 : ich EBR 23 2.4 0 0 0	32nd A WE WBL 0 0.0 0 0 52nd A WE WBL 9 4.6 92 1 52nd A	ve (E. S Appro WBT 791 2.4 185 4 .ve (W. 3 Appro WBT 71 4.9 92 1 ve (E. S	ide) ach WBR 838 2.0 0 0 0 0 Side) ach WBR 0 0.0 0 0 0 0 0 0 0 0	225 NB NBL 48 39.0 109 11 Int 228 NB NBL	Approa 0 0.0 0 ersectio	ach NBR 77 9.1 90 4 on Delay	SB SBL (sec/v) SB SBL 223 33.7 337 48 (sec/v)	Approa SBT eh) Approa SBT 0 0.0 0 0 eh)	ach SBR 3.0 3.0 ach SBR 113 1.7 78 1 16.3	
Delay Time/Veh. (s)       2.3       3.6       0.0       0.0       0.3       2.2       24.7       0.0       2.6       Image: Constraint of the state of the st	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L EB O O.O O O Node L EB EBL O O O O O O O O O C O O C O O O O O O	Approz EBT 1677 2.7 476 14 ocation Approz EBT 89 4.9 113 2 ocation Approa	ach EBR 270 1.6 269 44 : ich EBR 23 2.4 0 0 0 : ich EBR	32nd A WE WBL 0 0.0 0 52nd A WE WBL 9 4.6 92 1 52nd A WB 52nd A	ve (E. S 3 Appro WBT 791 2.4 185 4 .ve (W. 3 Appro WBT 71 4.9 92 1 ve (E. S 3 Appro WBT	ide) ach WBR 838 2.0 0 0 0 0 Side) ach WBR 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	225 NB NBL 48 39.0 109 11 Int 228 NB NBL Int 229 NB	Approa NBT 0 0.0 0 0 ersection Approa ersection Approa	ach NBR 77 9.1 90 4 on Delay ach NBR	SB SBL (sec/v) (sec/v) SB SBL 223 33.7 337 48 / (sec/v) SB SBL SBL	Approa SBT eh) Approa SBT 0 0.0 0 0 0 0 2 h) Approa	ach SBR 3.0 3.0 ach SBR 1.13 1.7 78 1 16.3 ach SBR	
Delay Inne/ Vent. (s)       2.3       3.0       0.0       0.0       0.3       2.2       24.7       0.0       2.0         Max Queue (ft)       223       223       0       0       0       80       93       0       47       47         Avg. Queue (ft)       5       5       0       0       0       0       2       0       0       47	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	Node L           EBL           0           0.0           0      0           0 </td <td>Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113 2 ocation Approa EBT 235</td> <td>ach EBR 270 1.6 269 44 : Ch EBR 23 2.4 0 0 0 : Ch EBR</td> <td>32nd A WE WBL 0 0.0 0 0 52nd A WE WBL 9 4.6 92 1 52nd A WB 52nd A</td> <td>ve (E. S Appro WBT 791 2.4 185 4 .ve (W. Appro WBT 71 4.9 92 1 ve (E. S Appro WBT 5 2</td> <td>ide) ach WBR 838 2.0 0 0 0 Side) ach WBR 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>225 NB NBL 48 39.0 109 11 Int 228 NB NBL 229 NB NBL 229 NB</td> <td>Approa NBT 0 0.0 0 ersection Approa ersection Approa</td> <td>ach NBR 77 9.1 90 4 on Delay ach NBR ach NBR</td> <td>SBL SBL (sec/v) (sec/v) SBL 223 33.7 337 48 (sec/v) SBL SBL</td> <td>Approa SBT eh) Approa SBT 0 0.0 0 0 eh) Approa SBT</td> <td>ach SBR 3.0 3.0 ach SBR 113 1.7 78 1 16.3 ach SBR</td>	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113 2 ocation Approa EBT 235	ach EBR 270 1.6 269 44 : Ch EBR 23 2.4 0 0 0 : Ch EBR	32nd A WE WBL 0 0.0 0 0 52nd A WE WBL 9 4.6 92 1 52nd A WB 52nd A	ve (E. S Appro WBT 791 2.4 185 4 .ve (W. Appro WBT 71 4.9 92 1 ve (E. S Appro WBT 5 2	ide) ach WBR 838 2.0 0 0 0 Side) ach WBR 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	225 NB NBL 48 39.0 109 11 Int 228 NB NBL 229 NB NBL 229 NB	Approa NBT 0 0.0 0 ersection Approa ersection Approa	ach NBR 77 9.1 90 4 on Delay ach NBR ach NBR	SBL SBL (sec/v) (sec/v) SBL 223 33.7 337 48 (sec/v) SBL SBL	Approa SBT eh) Approa SBT 0 0.0 0 0 eh) Approa SBT	ach SBR 3.0 3.0 ach SBR 113 1.7 78 1 16.3 ach SBR	
Max Queue (it)       223       223       0       0       0       30       33       0       47         Avg. Queue (ft)       5       5       0       0       0       0       2       0       0       47	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Avg. Queue (ft)	Node L           EBL           0           0.0           0      0           0 </td <td>Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113 2 ocation Approa EBT 235 2.6</td> <td>ach EBR 270 1.6 269 44 : ach EBR 23 2.4 0 0 : ch EBR 0 0</td> <td>32nd A WE WBL 0 0.0 0 0 52nd A WE WBL 9 4.6 92 1 52nd A 92 1 52nd A WBL 0 0</td> <td>ve (E. S Appro WBT 791 2.4 185 4 .ve (W. Appro WBT 71 4.9 92 1 .ve (E. S Appro WBT 62 0.3</td> <td>ide) ach WBR 838 2.0 0 0 0 Side) ach WBR 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>225 NB NBL 48 39.0 109 11 Int 228 NB NBL 229 NB NBL 18 24 7</td> <td>Approa NBT 0 0.0 0 0 ersectic Approa ersectic Approa NBT 0 0 0 0 0 0 0 0 0 0 0 0 0</td> <td>ach NBR 77 9.1 90 4 on Delay ach NBR ach NBR ach NBR 28 2.6</td> <td>SB SBL (sec/v) SB SBL 223 33.7 337 48 (sec/v) SB SBL SBL</td> <td>Approa SBT eh) Approa SBT 0 0.0 0 0 0 eh) Approa SBT</td> <td>ach SBR 3.0 3.0 3.0 ach SBR 113 1.7 78 1 16.3 ach SBR</td>	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113 2 ocation Approa EBT 235 2.6	ach EBR 270 1.6 269 44 : ach EBR 23 2.4 0 0 : ch EBR 0 0	32nd A WE WBL 0 0.0 0 0 52nd A WE WBL 9 4.6 92 1 52nd A 92 1 52nd A WBL 0 0	ve (E. S Appro WBT 791 2.4 185 4 .ve (W. Appro WBT 71 4.9 92 1 .ve (E. S Appro WBT 62 0.3	ide) ach WBR 838 2.0 0 0 0 Side) ach WBR 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	225 NB NBL 48 39.0 109 11 Int 228 NB NBL 229 NB NBL 18 24 7	Approa NBT 0 0.0 0 0 ersectic Approa ersectic Approa NBT 0 0 0 0 0 0 0 0 0 0 0 0 0	ach NBR 77 9.1 90 4 on Delay ach NBR ach NBR ach NBR 28 2.6	SB SBL (sec/v) SB SBL 223 33.7 337 48 (sec/v) SB SBL SBL	Approa SBT eh) Approa SBT 0 0.0 0 0 0 eh) Approa SBT	ach SBR 3.0 3.0 3.0 ach SBR 113 1.7 78 1 16.3 ach SBR	
	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Volume Delay Time/Veh. (s)	Node L           EBL           0           0.0           0           0           0           0           0           0           0           0           0           0           0           0           0.0           0           0.0           0	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113 2 ocation Approa EBT 235 3.6 223	ach EBR 270 1.6 269 44 : Ch EBR 23 2.4 0 0 0 : Ch EBR 0 0 0.0 0 0 0	32nd A WE WBL 0 0.0 0 52nd A WE WBL 9 4.6 92 1 1 52nd A WBL 0 0.0 0.0	ve (E. S Appro WBT 791 2.4 185 4 .ve (W. 3 Appro WBT 71 4.9 92 1 .ve (E. S 3 Appro WBT 62 0.3 0	ide) ach WBR 838 2.0 0 0 0 0 Side) ach WBR 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	225 NB NBL 48 39.0 109 11 Int 228 NB NBL Int 229 NB NBL 18 24.7 93	Approa NBT 0 0.0 0 ersection Approa NBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0	ach NBR 77 9.1 90 4 on Delay ach NBR ach NBR ach NBR 28 2.6 47	SB SBL (sec/v) (sec/v) SB SBL 223 33.7 337 48 (sec/v) SB SBL	Approa SBT eh) Approa SBT 0 0.0 0 0 0 eh) Approa SBT	ach SBR 3.0 3.0 ach SBR 113 1.7 78 1 16.3 ach SBR	
• • • • • • • • • • • • • • • • • • • •	Volume Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft) Delay Time/Veh. (s) Max Queue (ft)	Node L         EBL         0         0.0         0      0	Approa EBT 1677 2.7 476 14 ocation Approa EBT 89 4.9 113 2 ocation Approa EBT 235 3.6 223 5	ach EBR 270 1.6 269 44 : ach EBR 23 2.4 0 0 0 : ich EBR 0 0.0 0 0 0	32nd A WE WBL 0 0.0 0 0 52nd A WE WBL 9 4.6 92 1 52nd A \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$ \$	ve (E. S Appro WBT 791 2.4 185 4 .ve (W. 3 Appro WBT 71 4.9 92 1 .ve (E. S 3 Appro WBT 62 0.3 0 0	ide) ach WBR 838 2.0 0 0 0 0 Side) ach WBR 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	225 NB NBL 48 39.0 109 11 Int 228 NB NBL 229 NB NBL 18 24.7 93 2	Approa NBT 0 0.0 0 ersection Approa NBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0	ach NBR 77 9.1 90 4 on Delay ach NBR ach NBR 2.6 47 0	SB SBL (sec/v) (sec/v) SB SBL 223 33.7 337 48 (sec/v) SB SBL SBL	Approa SBT eh) Approa SBT 0 0.0 0 0 eh) Approa SBT	ach SBR 3.0 3.0 ach SBR 113 1.7 78 1 16.3 ach SBR	

Appendix C: Simulation Output (Data Collection Points)

# I-29 Data Collection: 2008 PM Peak Hour



# I-94 Data Collection: 2008 PM Peak Hour





Data Collection Points (I-29/I-94 Interchange)

	1	2	3	4	5	6	7	8	9	10
Modeled Vol. (vph)	2346	631	349	192	530	386	1715	2244	140	1200
Simulated Vol. (vph)	2320	651	332	200	525	377	1663	2161	140	1151
Volume % Difference	-1%	3%	-5%	4%	-1%	-2%	-3%	-4%	0%	-4%
Speed (mph)	55	54	25	55	54	25	38	32	25	53
# of Lanes	2	1	1	1	1	1	1	1	1	1
Density (veh/ln/mi)	21	12	13	4	10	15	44	67	6	22
Level of Service	С	В	В	А	Α	В	E	F	А	С