

## Interstate Operations Study: Fargo-Moorhead Metropolitan Area

# Simulation Base Case Calibration and 2008 Simulation Results

### Technical Memorandum II

December 2008

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 provides the results of the 2008 simulation base cases for the Fargo-Moorhead Interstate Operations Study. The major sections of this document include an overview of the calibration procedures and the simulation results for both the 2008 AM and 2008 PM scenarios. The previous memorandum (Technical Memorandum I) discussed the simulation development process. The simulation analysis will produce numerical data and animation to evaluate the current freeway operations within the metropolitan 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 interchanges exist on I-29, which spans 9 miles. The original simulation network, which was constructed using PTV AG's VISSIM, was extended north and south to correlate with the external origin-destination (O-D) survey.

After error-checking was performed, the simulation base cases were calibrated to more accurately predict the traffic performance of the analysis area. Calibration is the process of adjusting the simulation model's parameters to reproduce local driver behavior and traffic performance characteristics. The primary calibration parameters of VISSIM relate to driver behavior, which is primarily governed by car-following and lane-changing models. This study focused on six parameters of the Weidemann 1999 car-following model (CC0 through CC5). The parameters that have the largest impact on driving behavior include CC0 (affects jam density and queue length), CC1 (affects saturation flow), and CC2 (affects following oscillation).

Several of VISSIM's lane-changing parameters were also adjusted during the calibration process. These parameters are related to both mandatory and discretionary lane changes. Adjusting the *Necessary lane change (route)*, *Safety distance reduction factor*, and *Maximum deceleration for cooperative braking* parameter sets were modified to more accurately model merge and weave areas. In addition, the *Look Ahead Distance* values were adjusted to more accurately reflect the starting point of mandatory lane changes. The values used for the parameters were based on previous research studies, as well as research performed as a part of this study.

A calibration methodology was developed based on the different operating conditions of various freeway sections. Once the critical sections were adjusted to replicate field observations, the calibration parameters were applied to the remaining links that exhibit similar operational conditions. On-ramp sections needed to be adjusted to allow accurate merging behavior with the freeway mainline, which modified car-following and lane changing parameters. When the critical on-ramp sections simulated traffic as observed in the field, the weave sections were addressed. The critical weave sections incorporated the on-ramp car-following parameters but required some additional modifications to the lane changing parameters. Next, the basic freeway sections were calibrated by adjusting car-following parameters and connector *Lane change* position values (primarily for the on- and off-ramps). Finally, the tri-level merge area was addressed, which encounters the most freeway congestion in the F-M area.

Once the 2008 AM and PM base cases were calibrated, the simulation results of these scenarios were produced. The AM peak period has significantly more traffic traveling westbound on I-94 and northbound on I-29. Density values for I-94 and I-29 ranged from 3 pc/mi/ln to 32 pc/mi/ln and 4 pc/mi/ln to 24 pc/mi/ln, respectively. The highest density values of the AM peak period were along the sections of I-94 from 20<sup>th</sup> St. (Moorhead, MN) to I-29, which exhibited densities between 27 pc/mi/ln and 32 pc/mi/ln (LOS C-D).

During the AM peak period, a few ramp terminals experienced congestion. The I-94 & Sheyenne St. Interchange experienced severe congestion due to the high number of vehicles making southbound left-turn and northbound through movements. The queues that developed for the southbound left-turn lane extended through the north ramp, which adversely affected traffic operations at that intersection.

The PM peak hour directional split was not as extreme as the AM peak hour; however, more traffic travels eastbound on I-94 and southbound on I-29 during the PM peak hour. Density values for I-94 and I-29 ranged from 2 pc/mi/ln to 26 pc/mi/ln and 6 pc/mi/ln to 27 pc/mi/ln, respectively. The sections of I-94 from 45<sup>th</sup> St. (Fargo, ND) to 20<sup>th</sup> St. (Moorhead, MN) provide density values ranging from 24 pc/mi/ln to 26 pc/mi/ln (LOS C).

During the PM peak period, the freeway system had a few weave/merge locations that experienced congestion. The westbound I-94 section between I-29 & 45<sup>th</sup> St. experienced congestion due to the traffic traveling from the north to the west from the I-29 & I-94 Interchange (northwest ramp) and merging with the westbound I-94 traffic. Since a significant number of vehicles traveling westbound on I-94 exit the freeway at 45<sup>th</sup> St., most vehicles are traveling in the right travel lane. Therefore, the vehicles traveling from I-29 (northwest ramp) had difficulty merging with the westbound I-94 traffic, causing average maximum queue lengths of approximately 450 ft.

The tri-level merge area (tri-level ramp and southeast ramp) experienced the most congestion during the PM peak period. Over 2,000 vehicles from two ramps merge into one lane during the PM peak hour, creating an average maximum queue length of over 2,000 ft to develop on the tri-level ramp.

Several ramp terminals also experienced congestion during the PM peak period. These ramp terminals include the I-94 & Sheyenne St. North Ramp (westbound vehicles from I-94 traveling south on Sheyenne St.), the I-94 & 45<sup>th</sup> St. South Ramp (southbound vehicles from 45<sup>th</sup> St. traveling east on I-94), and the I-94 & 8<sup>th</sup> St. (TH 75) South Ramp (eastbound vehicles from I-94 traveling north and south on 8<sup>th</sup> St.).

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#### **OVERVIEW**

This document provides the results of the 2008 Base Cases for the Fargo-Moorhead Interstate Operations Study (F-M IOS). The major sections of this document include an overview of the calibration procedures and the simulation results for both the 2008 AM and 2008 PM base cases. The previous memorandum (Technical Memorandum I) discussed the simulation development process.

#### **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. The original simulation network, which was constructed using PTV AG's VISSIM 5.1, was extended north and south to correlate with the external origin-destination (O-D) survey (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.

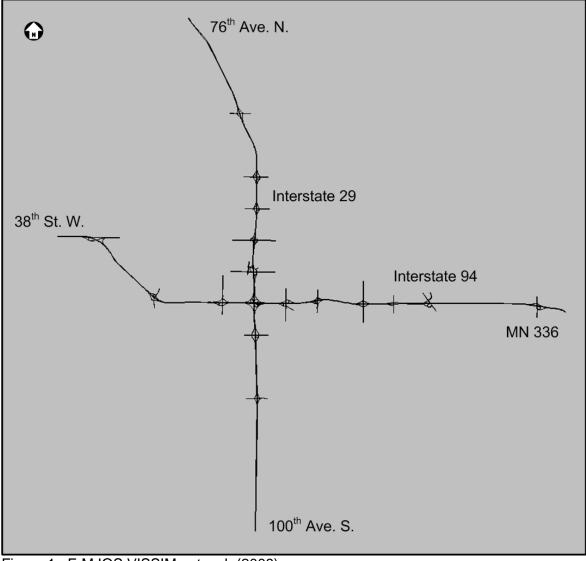


Figure 1. F-M IOS VISSIM network (2008)

#### **SIMULATION CALIBRATION**

After error-checking has been performed, the simulation base cases must be calibrated to more accurately predict the traffic performance of the analysis area. Calibration is the process of adjusting the simulation model's parameters to reproduce local driver behavior and traffic performance characteristics. Default values may be adequate for some instances; however, the user must calibrate the simulation network to ensure that local behavior is reflected in the model. In addition, users must be cautioned on adjusting only relevant parameters and realize the implications of adjusting such parameters.

The Federal Highway Administration (FHWA) has developed a toolbox for guiding traffic analysis projects. Volume III of the toolbox entitled "Guidelines for Applying Traffic Microsimulation Modeling Software" was consulted extensively during the Fargo-Moorhead Interstate Operations Study and Chapter 5 of the document specifically addresses simulation calibration (1).

Calibration is a systematic and iterative process, as shown in Figure 2. Users must be careful to avoid the never-ending circle of adjusting too many parameters and following a nonsequential manner. For example, a user may have a certain location (Site A) of the network calibrated but will have to reexamine this location after addressing an issue upstream (Site B), since the Site A modification could impact the downstream traffic.

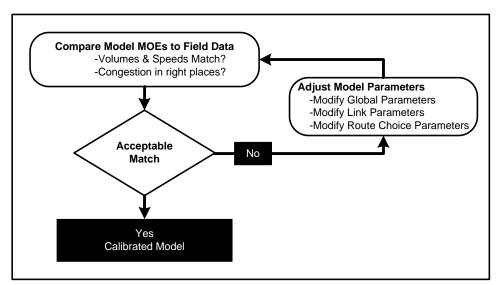


Figure 2. Microsimulation model calibration (1)

The Traffic Analysis Toolbox also recommends a three-step strategy for conducting simulation calibration, which includes capacity calibration, route choice calibration, and system performance calibration. The next section will discuss the main calibration parameters for the VISSIM simulation model and the procedures used for calibrating the 2008 AM Peak Hour and 2008 PM Peak Hour base cases.

#### **VISSIM DRIVING BEHAVIOR**

The driving behavior of VISSIM is primarily governed by both car-following and lane-changing models. Both models have numerous parameters to adjust and the user must use caution when making adjustments to these parameters. Early versions of VISSIM had one car following model (Wiedemann 74), while more recent versions also incorporate the Wiedemann 99 car following model, which is used for freeway applications.

The driving behavior is associated to various link types within the program, which include urban, freeway, footpath, etc. Users can modify the driving behavior of the default link types or create additional link types to be associated to the various roadway sections, e.g., basic freeway sections, on-ramp sections, weave sections, etc.

#### **VISSIM Driver Behavior Calibration Parameters**

The Weidemann 1999 car-following model has 10 parameters available for modifying. Users must use caution in adjusting these values since they can have a significant effect on the simulation output. Some key parameters include CC0 (affects jam density and queue length), CC1 (affects saturation flow), and CC2 (affects following oscillation). Several papers/projects have provided insight in adjusting the car-following parameters (2, 3, 4), which generally focus on the first five parameters, as described below (a complete explanation of the driving behavior parameters is provided in the VISSIM 5.1 User Manual (5):

- CC0: Desired distance (ft) between stopped cars.
- CC1: Headway time (sec.) that the driver wants to keep between vehicles.
- CC2: Following variation controls longitudinal oscillation in the car-following process.
- CC3: Threshold for entering car-following controls the start of the deceleration process
- CC4: Following threshold controls the speed differences during closing in the following process.
- CC5: Following threshold controls the speed differences during opening in the following process.

Several lane change parameters are available within the VISSIM simulation model for the user to modify. These parameters are related to both mandatory and discretionary lane changes. Adjusting the *Necessary lane change (route)*, *Safety distance reduction factor*, and *Maximum deceleration for cooperative braking* parameter sets may be required to more accurately model merge and weave areas. The *Waiting time before diffusion* parameter may be useful to reduce gridlock occurrences.

The VISSIM networks for the Fargo-Moorhead Interstate Operations Study incorporated eight different driving behavior parameter sets. Most of the parameters were identical among the parameter sets; however, each serves a specific facility/segment type that displayed unique driving behavior. The driving behavior sets were assigned to the appropriate link types and color coded to ensure proper assignment, as shown in Figure 3. The following driving behavior sets were used in the base cases:

- Urban (motorized): Urban links and off-ramps (dark blue)
- Freeway (free lane section): Basic freeway links (green)
- Sharp Curve: Loop ramp links (red)
- Trilevel Ramp: Tri-level ramp (orange)
- Onramp Merge: On-ramp merge sections (purple)
- Short Weave: Weave sections adjacent to I-29/I-94 interchange (cyan)
- Trilevel-SE Merge: Tri-level/SE Ramp merge area (yellow)
- Trilevel-SE Merge HV: Tri-level/SE Ramp merge area for trucks (yellow)

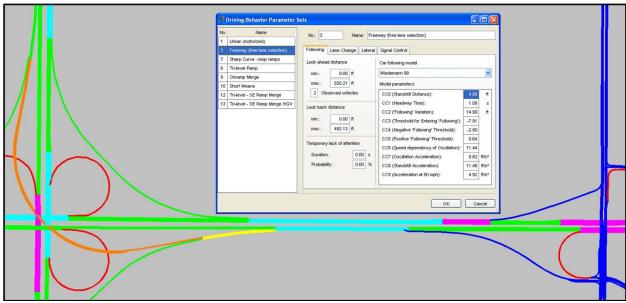


Figure 3. F-M IOS Driving behavior parameter sets

#### **VISSIM CALIBRATION**

The calibration of the 2008 AM Peak Hour and 2008 PM Peak Hour base cases occurred concurrently to ensure the driving behavior parameters would replicate traffic operations for both conditions. This study's calibration focused on calibrating the behavior of the freeway facility types/sections, which will be applied globally to all links in the network with that facility type.

Since the network is generally uncongested, except for the tri-level merge during a portion of the PM peak hour, field data cannot be used to calibrate network capacity. Therefore, maximum throughput tests were performed to estimate the capacity of the freeway sections. The simulated throughput from different link types ranged from approximately 2,100 vphpl to 2,300 vphpl. The capacity range is due to modifying the CC1 (Headway factor) parameter, which was performed for various link types to better replicate field conditions. In addition, modifications to lane changing parameters were made to merge and weave sections.

#### **Calibration Methodology**

Due to the different operating conditions of various freeway sections, a flowchart was used to calibrate the critical sections of the base cases (Figure 4). Once the critical sections were adjusted to replicate field observations, the calibration parameters were applied to the remaining links that exhibit similar operational conditions. On-ramp sections needed to be adjusted to allow accurate merging behavior with the freeway mainline, which included car-following and lane changing parameters. When the critical on-ramp sections simulated traffic as observed in the field, the weave sections were addressed. The critical weave sections incorporated the on-ramp car-following parameters but required some additional modifications to the lane changing parameters. Next, the basic freeway sections were calibrated by adjusting a few car-following parameters and connector *Lane change* position values, which are used to start the mandatory lane change for the on- and off-ramps. Finally, the tri-level merge area was addressed, which used similar car-following and lane changing parameters as the short weave behavior set. A tri-level merge heavy vehicle (HV) parameter set was used to create additional gaps for the merge area.

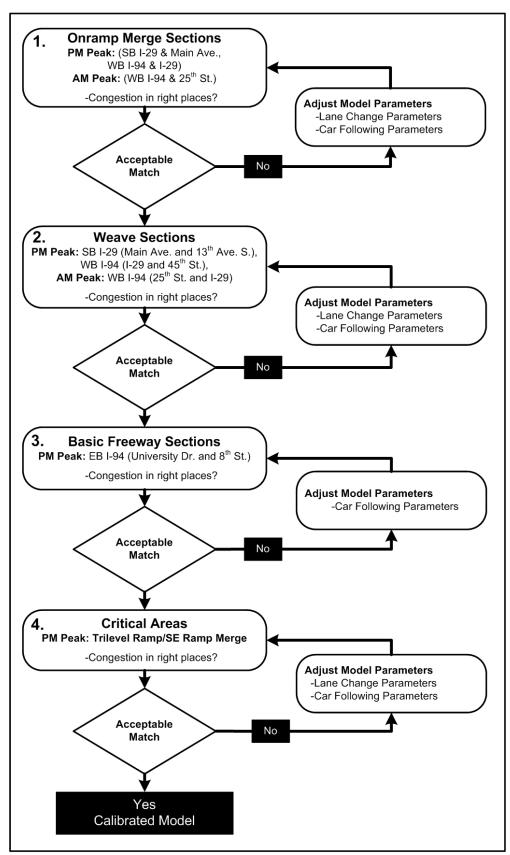


Figure 4. VISSIM calibration flowchart.

#### **Base Case Calibration Parameters**

As previously discussed, VISSIM has several parameters available for its car-following and lane changing models. ATAC consulted previous research and PTV America for using some of the calibration parameters. The initial car-following parameters (CC1-CC5) for this study were based on the research conducted by Sandeep et al. (4). Their research provided valuable information on some of the car following thresholds (CC3-CC5) and how it relates to the Next Generation Simulation (NGSIM) efforts. ATAC used these values for all freeway link types. However, modifications to CC1 and CC2 were required to replicate the observed conditions at the critical sections. A possible reason for these modifications are due to the characteristics of the US101 network (modeled by Sandeep et al.), which had freeway interchanges spaced every two miles or so. The Fargo-Moorhead network has interchanges spaced every mile and some weave sections are as short as 1,300 ft. It should be noted that different parameters could have been modifications prior to deciding on the final calibration parameters. The calibration parameters used for the F-M IOS are shown in Tables 1-3.

Table 1. F-M IOS Car-Following Calibration Parameters.

Car-Following	CC0 (ft)	CC1 (sec)	CC2 (ft)	CC3	CC4	CC5
Default Values	4.92	.90	13.12	-8.00	-0.35	0.35
US101 - Speed-Flow*	N/A	1.09	34.74	-7.91	-2.50	0.64
Freeway (Basic)	5.0 ft	1.09	15.0	-7.91	-2.50	0.64
On-ramp Merge	5.0 ft	.80	15.0	-7.91	-2.50	0.64
Short Weave	5.0 ft	.80	15.0	-7.91	-2.50	0.64
Tri-level Ramp	5.0 ft	.90	15.0	-7.91	-2.50	0.64
Tri-level/SE Merge	5.0 ft	.80	15.0	-7.91	-2.50	0.64
Tri-level/SE Merge HV	30.0 ft	.80	15.0	-7.91	-2.50	0.64
Sharp Curve	5.0 ft	1.40	15.0	-7.91	-2.50	0.64

<sup>\*</sup> Source: (4)

Table 2. F-M IOS Lane Change Calibration Parameters.

Lane Change: Necessary lane change	Max Decel. (own)	Max Decel. (trailing)	-1 fps <sup>2</sup> per dist. (own)	-1 fps <sup>2</sup> per dist. (trailing)	Accepted Decel. (own)	Accepted Decel. (trailing)
Default Values	-13.12	-9.84	200	200	-3.28	-1.64
Freeway	-13.12	-9.84	200	200	-3.28	-1.64
On-ramp Merge	-20.0	-20.0	50	25	-3.28	-3.28
Short Weave	-13.12	-9.84	200	200	-3.28	-1.64
Tri-level Ramp	-20.0	-20.0	50	25	-3.28	-3.28
Tri-level/SE Merge	-20.0	-20.0	50	25	-3.28	-3.28
Tri-level/SE Merge HV	-10.0	-20.0	50	25	-3.28	-3.28
Sharp Curve	-13.12	-9.84	200	200	-3.28	-1.64

Table 3. F-M IOS Lane Change Calibration Parameters.

Lane Change: Other key parameters	Wait time before diffusion (sec)	Safety distance reduction factor	Max. Decel. For coop. braking (fps <sup>2</sup> )
Default Values	60	0.60	-9.84
Freeway	9,000	0.60	-9.84
On-ramp Merge	9,000	0.20	-16.0
Short Weave	9,000	0.10	-16.0
Tri-level Ramp	9,000	0.20	-16.0
Tri-level/SE Merge	9,000	0.10	-16.0
Tri-level/SE Merge HV	9,000	0.10	-16.0
Sharp Curve	9,000	0.60	-9.84

Note: The simulation duration is 9,000 sec.

#### **Route Choice Calibration**

This study incorporated O-D matrices from the F-M Metro COG travel demand model, which uses Citilab's Cube program. The balanced target values from the peak-hour counts were entered into the travel demand model, which generated O-D pairs to produce the desired link volumes in the network. The O-D matrices were used in VISSIM and assigned to the base cases using the dynamic assignment feature. However, since other logical routes (e.g., a parallel route to the freeway) are not available, route choice calibration was not required. As part of the error-checking procedures, ATAC used PTV's VISUM travel demand model to read/review the VISSIM O-D paths to ensure that invalid paths did not exist.

#### **System Performance Calibration**

This component allows the user to calibrate the model to the overall network performance. Several MOEs can be compared between the simulation output and field data, including volume, speed, travel time, delay time, and queue length. Visual audits were primarily used for the link type calibration, which are qualitative in nature. However, the following quantitative criteria was used for calibration (Table 4). It should be noted that the simulation output is based on 30 simulation runs.

Table 4. F-M IOS Calibration Criteria.

Criteria and Measures	Calibration Accepted Targets
Hourly Flows (Simulated vs. Observed)	
Individual Link Flows	
Within 15% Flow between 700 - 2,700 vph	> 85% of locations
Within 100 vph, Flow < 700 vph	> 85% of locations
Within 400 vph, Flow >2,700 vph	> 85% of locations
GEH Statistic for Sum of All Link Flows	< 4 for sum of all link counts
Travel Time (Simulated vs. Target)	
Within 15% (or 1 min., if higher)	>85% of Cases

Source: (6)

#### **Simulation Runs**

To determine if an adequate number of simulation runs were performed, a statistical test was performed for each base case using the network delay time performance measure, which is shown below:

$$n = \left\{ \frac{\mathbf{Z}_{\alpha/2} \times \sigma}{\mathbf{E} \times \mu} \right\}^2$$

Where:

n = required number of simulation runs

 $Z_{\alpha/2}$  = 1.96 at a 95% confidence interval

 $\sigma$  = standard deviation (sample size of 30 simulation runs)

E = allowable percentage error (5%) μ = mean value (30 simulation runs)

Based on the statistical analysis for network delay time, the 2008 AM Peak Hour and 2008 PM Peak Hour scenarios require 3 and 1 runs, respectively (Table 5). These values represent the number of runs needed to be 95% confident that the actual delay time is within 5% of the average delay time from the 30 runs.

Table 5. Required Runs Based on Network Delay Time.

Base Case	μ (hr)	$\sigma$ (hr)	# of Runs	
PM Peak Hour	534.7	23.5	3.0	
AM Peak Hour	369.6	9.2	1.0	

#### **Link Volume**

The hourly traffic volume can be compared between modeled and observed based on individual links and the sum of the individual links. The basic freeway volumes from 14 Interstate-29 locations and 18 Intersate-94 locations were compared individually and as a whole. For the individual link volume comparison for the AM peak hour and PM peak hour differed from 0% to 3% and -1% to 2%, respectively (Tables 6 and 7). Therefore, 100% of the link counts meet accepted targets.

The GEH statistic is popular for traffic analysis applications, which accounts for the overall link flows between the simulated and observed conditions. The computed GEH value for the AM peak hour and PM peak hour were 3.1 and 1.1, respectively (Tables 8 and 9). Both of these values meet the criteria of less than 4.

$$GEH = \sqrt{\frac{(E-V)^2}{(E+V)/2}}$$

Where:

E = Simulated estimated volumeV = Field count (target volume)

Table 6. AM Peak Hour 2008: Freeway Volume Comparison

Interstate 29		Southbound	I	Northbound		
Freeway Mainline	Target Volume	Simulated Volume	% Difference	Target Volume	Simulated Volume	% Difference
CR 20 - 19th Ave. N	903	909	1%	497	505	2%
19th Ave. N - 12th Ave. N	1310	1320	1%	1176	1195	2%
12th Ave. N - Main Ave.	1450	1462	1%	2280	2320	2%
Main Ave 13th Ave. S	1592	1606	1%	3027	3073	2%
13th Ave. S - I-94	1711	1724	1%	3956	4005	1%
I-94 - 32nd Ave. S	1513	1535	1%	2512	2534	1%
32nd Ave. S - 52nd Ave. S	457	468	2%	1490	1507	1%
Interstate 94	Interstate 94 Eastbound Westbound					
Freeway Mainline	Target Volume	Simulated Volume	% Difference	Target Volume	Simulated Volume	% Difference
Main Ave Sheyenne St.	357	360	1%	672	686	2%
Sheyenne St 45th St.	1335	1345	1%	949	970	2%
45th St I-29	2321	2331	0%	1989	2026	2%
I-29 - 25th St.	2453	2476	1%	3368	3425	2%
25th St University Dr.	2638	2665	1%	3565	3615	1%
University Dr TH 75	2238	2260	1%	3734	3779	1%
TH 75 - 20th St.	1389	1418	2%	2650	2687	1%
20th St Main Ave.	982	1016	3%	2190	2219	1%
Main Ave MN 336	452	464	3%	1555	1558	0%

Table 7. AM Peak Hour 2008: GEH Statistic.

Total Link Volume (Target)	58,711
Total Link Volume (Simulated)	59,464
GEH Statistic	3.1

Table 8. PM Peak Hour 2008: Freeway Volume Comparison.

Interstate 29	Southbound				Northbound	
Freeway Mainline	Target Volume	Simulated Volume	% Difference	Target Volume	Simulated Volume	% Difference
CR 20 - 19th Ave. N	784	785	0%	1153	1168	1%
19th Ave. N - 12th Ave. N	1352	1358	0%	1641	1653	1%
12th Ave. N - Main Ave.	2457	2462	0%	2047	2060	1%
Main Ave 13th Ave. S	3406	3411	0%	2159	2174	1%
13th Ave. S - I-94	3607	3610	0%	2786	2789	0%
I-94 - 32nd Ave. S	2061	2060	0%	1922	1917	0%
32nd Ave. S - 52nd Ave. S	1047	1039	-1%	944	933	-1%
Interstate 94		Eastbound			Westbound	
Freeway Mainline	Target Volume	Simulated Volume	% Difference	Target Volume	Simulated Volume	% Difference
Main Ave Sheyenne St.	589	591	0%	313	313	0%
Sheyenne St 45th St.	1000	1008	1%	1216	1224	1%
45th St I-29	2411	2414	0%	2380	2399	1%
I-29 - 25th St.	3860	3871	0%	3147	3165	1%
25th St University Dr.	3609	3609	0%	3157	3177	1%
University Dr TH 75	3795	3803	0%	3028	3049	1%
TH 75 - 20th St.	2300	2321	1%	1876	1908	2%
20th St Main Ave.	1847	1878	2%	1458	1484	2%
Main Ave MN 336	1161	1168	1%	802	803	0%

Table 9. PM Peak Hour 2008 GEH Statistic

Total Link Volume (Target)	65,315
Total Link Volume (Simulated)	65,603
GEH Statistic	1.1

#### **Travel Time**

An external O-D study was performed by All Traffic Data during the AM and PM peak periods on September 10, 2008. The data collected from this study included pass-through trips and travel time for those trips, which assisted in this simulation study as well as the planning efforts using the regional travel demand model. The overall O-D capture rate was 87% (90% for cars and 60% for trucks). The sample sizes of the O-D trips during the peak periods ranged from 0 to 42. To get higher travel time samples from the simulation program, the larger O-D trip value from Cube or the O-D survey was used. If no trips were observed in the field between two O-D pairs, 10 trips were manual entered into the simulation matrices.

A few issues were noticed when processing the external O-D data. First, the time stamp for entering and exiting the study area did not include seconds (they were dropped). Therefore, the reported travel times from the survey could differ from the actual travel time by up to a minute. In addition, while comparing the simulating travel time to the survey travel time, significant differences were observed from one of the origins (SB I-29). Initially, we thought that it could be related to the simulation model (data collection locations or speed limits). However, after further

review, it appeared that the issue may be related to the time stamp of the field device(s) at this location. This seems the most logical since the average speed required to meet the reported travel time are unrealistic for the area (ranging from 75 to 84 mph). If the field travel times were subtracted by 3.5 minutes, the percent difference from the simulated travel time would range from -4% to 2% for both peaks. The travel time comparisons for the SB I-29 will not be included for the calibration criteria.

The O-D travel time between the survey and VISSIM were very similar. The travel time comparison for the AM peak hour and PM peak hour differed from -11% to 6% and -7% to -2%, respectively (Tables 10 and 11). These percent differences all meet the travel time calibration criteria.

Table 10. AM Peak Hour 2008: Travel Time Comparison

Orinin	Destination	O-D Survey	O-D Survey Travel Time		ravel Time	Travel Time
Origin	Destination	Volume	Avg. (min)	Volume	Avg. (min)	Comparison (%)
	SB I-29	3	14.3	10	12.8	-11%
EB I-94	NB I-29	0	0.0	10	15.3	N/A
	EB I-94	8	14.9	11	14.6	-2%
	SB I-29	0	0.0	18	16.5	N/A
WB I-94	NB I-29	7	18.0	32	17.2	-5%
	WB I-94	23	13.6	45	14.5	6%
	NB I-29	9	16.6	38	15.7	-5%
NB I-29	EB I-94	0	0.0	15	15.8	N/A
	WB I-94	5	13.6	10	13.9	2%
	SB I-29	10	12.7	23	16.5	30%
SB I-29	EB I-94	10	14.1	17	17.7	26%
	WB I-94	4	11.3	10	14.2	26%

Table 11. PM Peak Hour 2008: Travel Time Comparison

Ominuin	Dagtingtian	O-D Survey	Travel Time	VISSIM T	ravel Time	Travel Time
Origin	Destination	Volume	Avg. (min)	Volume	Avg. (min)	Comparison (%)
	SB I-29	9	13.2	12	13.0	-2%
EB I-94	NB I-29	5	15.8	6	15.0	-5%
	EB I-94	24	15.8	42	14.8	-6%
	SB I-29	0	0.0	13	16.5	N/A
WB I-94	NB I-29	22	17.7	43	17.0	-4%
	WB I-94	18	13.8	29	14.4	4%
	NB I-29	10	16.9	72	15.8	-7%
NB I-29	EB I-94	0	0.0	17	16.0	N/A
	WB I-94	9	14.6	11	13.8	-5%
	SB I-29	17	13.1	23	16.5	26%
SB I-29	EB I-94	16	14.8	22	18.2	23%
	WB I-94	4	11.5	8	14.7	27%

#### **BASE CASE VISSIM OUTPUT**

Several MOE were extracted from both the 2008 AM and 2008 PM base scenarios. The output from the 2008 AM scenario is located in Appendices A-C, while the 2008 PM data are provided in Appendices D-F. The output is based on 30 simulation runs for each base scenario using different seed numbers. The values reported for each measure of effectiveness (MOE) is the average value from the 30 runs. The project team identified several measures and locations which are summarized as follows:

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

The 2008 PM scenarios typically had higher values for the various performance measures since the PM scenario has higher traffic volume. During the overall network data collection period (simulation time 1,800 to 9,000), the 2008 AM scenario generated 42,030 vehicles, while the 2008 PM scenario generated 52,959 vehicles. The 2008 PM scenario produced 535 hours of total delay time compared to 370 hours of total delay time for the 2008 AM scenario.

Freeway queue length was measured at the tri-level merge area and WB I-94 between 45<sup>th</sup> St. and I-29. The AM peak hour only exhibited one stop at each location, equating to maximum queue lengths of 98 ft (tri-level merge) and 31 ft (WB I-94). The PM peak hour had significant congestion at the tri-level merge during the peak period, which developed a maximum queue length of 2,027 ft and 454 stops. The WB I-94 section had an average queue length of 439 ft and 49 stops.

The freeway mainline section output illustrates a defined directional split between the AM and PM peak periods. The AM peak has significantly more traffic traveling westbound on I-94 and northbound on I-29. Density values, which are represented in passenger cars per mile per lane (pc/mi/ln), for I-94 and I-29 ranged from 3 pc/mi/ln to 32 pc/mi/ln and 4 pc/mi/ln to 24 pc/mi/ln, respectively (Table 12 illustrates density thresholds). The highest density values of the AM

peak period were along the sections of I-94 from 20<sup>th</sup> St. to I-29, which exhibited densities between 27 pc/mi/ln and 32 pc/mi/ln (LOS C-D).

The PM peak hour directional split is not as drastic as the AM peak hour; however, higher traffic volumes exist traveling eastbound on I-94 and southbound on I-29. Density values for I-94 and I-29 ranged from 2 pc/mi/ln to 26 pc/mi/ln and 6 pc/mi/ln to 27 pc/mi/ln, respectively. The sections of I-94 from 45<sup>th</sup> St. to 20<sup>th</sup> St. provide density values ranging from 24 pc/mi/ln to 26 pc/mi/ln (LOS C). The highest density value and most congested area for both the AM and PM peak periods occurs at the tri-level merge area. Over 2,000 vehicles from two ramps (tri-level and southeast ramps) merge into one lane during the PM peak hour, creating a density of 51 pc/mi/ln. The congestion at this area occurs for approximately 15 minutes during the PM peak.

Table 12. LOS CRITERIA for Freeway Segments

Level of Service	Density (pc/mi/ln)
LOS A	0-10
LOS B	>10-20
LOS C	>20-28
LOS D	>28-35
LOS E	>35-43
LOS F	>43

Source: HCM 2000, Exhibit 24-2. LOS Criteria for Weaving Segments (7)

Depending on the peak period, several ramp terminals experience congestion for at least one movement/approach. A list of these intersections and the time period that incurs congestion is as follows:

- I-94 & Sheyenne St. North Ramp: AM (caused by south ramp congestion) and PM peak periods
- I-94 & Sheyenne St. South Ramp: AM peak period
- I-94 & 45<sup>th</sup> St. North Ramp: PM peak period (caused by south ramp congestion)
- I-94 & 45<sup>th</sup> St. South Ramp: PM peak period
- I-94 & 8<sup>th</sup> St. (TH 75) South Ramp: PM peak period

#### **SUMMARY**

This document provided an overview of the calibration procedures and the simulation output for both the 2008 AM and 2008 PM base cases. The PM peak hour had significant congestion at the tri-level merge (max queue of 2,027 ft) and queuing also occurred on the westbound I-94 section west of the I-29 & I-94 Interchange (max queue of 439 ft).

The AM peak period has significantly more traffic traveling westbound on I-94 and northbound on I-29. Density values for I-94 and I-29 ranged from 3 pc/mi/ln to 32 pc/mi/ln and 4 pc/mi/ln to 24 pc/mi/ln, respectively. The highest density values of the AM peak period were along the sections of I-94 from 20<sup>th</sup> St. to I-29, which exhibited densities from 27 pc/mi/ln to 32 pc/mi/ln (LOS C-D).

The PM peak hour directional split is not as drastic as the AM peak hour; however, higher traffic volumes exist traveling eastbound on I-94 and southbound on I-29. Density values for I-94 and I-29 ranged from 2 pc/mi/ln to 26 pc/mi/ln and 6 pc/mi/ln to 27 pc/mi/ln, respectively. The sections of I-94 from 45<sup>th</sup> St. to 20<sup>th</sup> St. provide density values ranging from 24 pc/mi/ln to 26

pc/mi/ln (LOS C). The highest density value and most congested area for both the AM and PM peak periods occurs at the tri-level merge area. Over 2,000 vehicles from two ramps (tri-level and southeast ramps) merge into one lane during the PM peak hour, creating a density of 51 pc/mi/ln. The congestion at this area occurs for approximately 15 minutes during the PM peak.

Once the study's steering review committee (SRC) approves the calibrated models, two future scenarios (mid-term and long-term) will be constructed and simulated. The mid-term scenario will represent the 2015 planning horizon while the long-term scenario will represent the 2025 planning horizon.

#### **REFERENCES**

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- Ambadipudi, Ravi, Paul Dorothy, and Randy Kill, Development and Validation of Large-Scale Microscopic Models, Transportation Research Board 85th Annual Meeting, Washington DC, January 2006.
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- Menneni, Sandeep, Carlos Sun, and Peter Vortisch, Microsimulation Calibration Using Speed-Flow Relationships, Transportation Research Board 87th Annual Meeting, Washington DC, January 2008.
- 5. PTV Planung Transport Verkehr AG, VISSIM User Manual Version 5.10, July 2008, Karlsruhe, Germany.
- 6. "Freeway System Operation Assessment," Paramics Calibration and Validation Guidelines (Draft), Technical Report I-33, Wisconsin DOT, District 2, June 2002.
- 7. Transportation Research Board, Highway Capacity Manual 2000, Washington D.C., 2000.

Appendix A: 2008 AM Simulation Output (Network Performance, Travel Time, Freeway Queues)

#### **Network Performance**

Total Delay Time (hr)	370
Total Travel Time (hr)	3,382
Number of Active Vehicles	0
Number of Arrived Vehicles	42,030
Total Stopped Delay (hr)	155
Total Distance Traveled (mi)	159,465

#### **Queue Measurement**

Time	Tr	i-Level Mer	ge	1-9	4 WB (45th	St)
Time	Avg.	Max.	Stop	Avg.	Max.	Stop
AM Peak	0	98	1	0	31	1

#### **Travel Time (Network)**

			Trave	el Time (Ne	twork)			
				Destin	ation			
			I-29	) SB	I-94	EB	I-29	NB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		0715-0730	12.5	2	14.6	3	15.2	2
	I-94 EB	0730-0745	12.9	2	14.6	3	15.3	2
		0745-0800	12.8	3	14.6	3	15.3	3
		0800-0815	12.8	3	14.7	3	15.5	3
			I-29	) SB	1-94	WB	I-29	NB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		0715-0730	16.5	4	14.4	10	17.1	7
	I-94 WB	0730-0745	16.5	4	14.3	10	17.0	7
		0745-0800	16.6	5	14.6	12	17.2	8
Origin		0800-0815	16.5	6	14.5	13	17.3	10
Ori			I-94	WB	I-29	NB	I-94	EB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		0715-0730	13.8	2	15.7	8	15.8	3
	I-29 NB	0730-0745	13.9	2	15.6	9	15.7	3
		0745-0800	14.0	3	15.8	10	15.9	4
		0800-0815	13.9	3	15.8	11	15.9	5
			1-94	WB	I-29	SB	I-94	EB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		0715-0730	14.6	2	16.6	5	17.6	4
	I-29 SB	0730-0745	12.6	2	16.5	5	17.7	4
		0745-0800	14.6	3	16.3	7	17.8	5
		0800-0815	14.6	3	16.5	6	17.8	5

## Appendix B: 2008 AM Simulation Output (Data Collection Points)

## I-29 Data Collection: 2008 AM Peak Hour

Southbound																																								
		C	R20	)		19t	h Ave	e. N		1	2th A	ve. N	1			Mai	n Ave	·.			13tl	h Ave	e. S					l-94					32n	d Ave	. S		52nd	Ave.	S	
Distance (ft.)	8050	650	1885	1150		570 10	015 10	30 104		-	835	840	765 22		455 7	35	230 12	215 7		30 945	550	230		3200		640 13	800 64	0 11:	50 28	85	2325		950	1395 6	625		770 16	645 5	10 19	00
Modeled Vol. (vph)					903				131					50						92					1711						1513	_				457				
Simulated Vol. (vph)					909				132					62						06					1724						1535					468				
Volume % Difference					1%				1%					%						%					1%						1%					2%				
Speed (mph)					74.6				56.	_			5	7.1					56						57.8						58.6	;				58.9				
# of Lanes					2				3	_			_	3						3					4						4					2				
Density (pc/mi/ln)					8				10	_			_	1						3					10						9					5				
Level of Service					Α				В					3					E	3					Α						Α					А				
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Distance (ft.)	9100	407	1000	775	7140 1	165 10	045 40	15 66	E 10E	5 020	024	765	E90 21	00	E2E 7	15	570 G	56 T	60 10	20 605	755	ee E	1210	200	1460	260 0	10 50	E 10	05 10	060 00	00 1240	255	1115	205 0	260	720 7100	760 1/	225 0	000 16	75
Distance (ft.) Modeled Vol. (vph)	0100	407	1980	115	497	100 10	045 10	10 00	117	8 630	921	700		80	o∠o /	40	3/0 6	JO /		27	755	000	1310		3956	200 9	10 50	3 48	oo 12	200 98	2512		1145	300 8	000	1490	700 16	535 B	16	013
Simulated Vol. (vph)					505	+			117				23			-		-		73					4005			-	-	-	2534			1	_	1507		-		_
Volume % Difference					2%	_	_		2%					%		+		+	29						1%			+	+	+	1%				+	1507		+	_	-
Speed (mph)					75	_	_		58.2					% 7		+		+		% 7.3					58			+	+	+	58.3				+	58.5		+	_	-
# of Lanes						+	+		3	_		-+		3		+	-+	+		3	+				58 4	-+	_	+	+	+		+		-+	+	2	-+	+	+	$\dashv$
Density (pc/mi/ln)					2	+	+		9	_		-+		_		+	-+	+		4	+				23	-+	_	+	+	+	3	+		-+	+	17	-+	+	+	$\dashv$
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Note: Density values were adjusted using the following data: Peak-hour factor = .78

Heavy vehicle percent = 5

This data increased the original density by 25%.

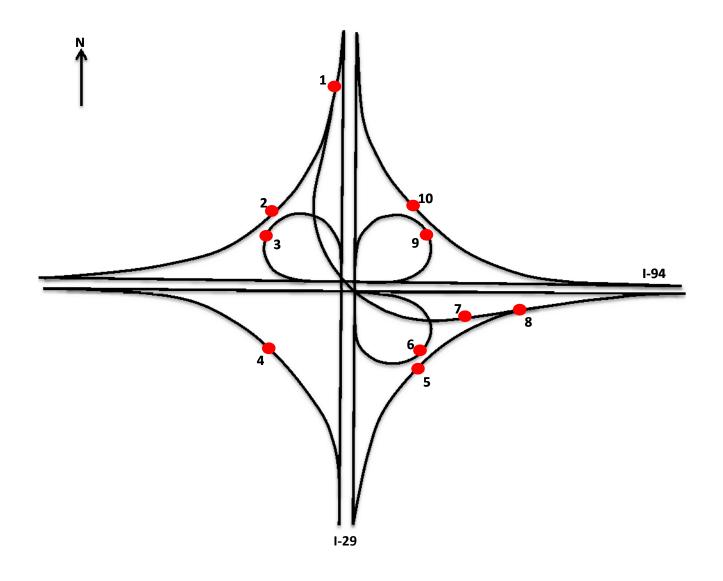
## I-94 Data Collection: 2008 AM Peak Hour

Main Ave.	Sheyenne St.	45th St.	I-29	25th St.	University Dr.	TH 75 20th S	t. Main Ave. MN 336
	·		0 465 1345 1365 405 1010 2453	795 930 990 2610  2638  2665  1% 58.4  3 20		520 2005 840 1740 455 \$ 1389 1418 2% 58.5 2 16	5645 285 1035 615 16635 710 1365 1080 2170 982 452 51016 464 53% 59.3 70 59.3 70 52 52 52 52 54 55 56 56 56 56 56 56 56 56 56 56 56 56
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672 686 2% 74.7	949 970 2%	1989 2026 2026 276 4 57.4	3368	3 3565 5 3615 1%	3734 3779 1%	525 1935 550 1880 970 4 2650 2 2687 2 1%	
	2660 575 1005 1440 11770 357 360 11% 75.2 2 2 3 3 A A A S S S S S S S S S S S S S S S	Main Ave.  Sheyenne St.  Sheyenne St.  Sheyenne St.  Sheyenne St.  Main Ave.  Sheyenne St.  Main Ave.  Sheyenne St.  Sheyenne St.	Main Ave.  Sheyenne St.  Sheyenne St.  45th St.  Sheyenne St.  Sheyenne St.  45th St.  Sheyenne St.  Main Ave.  Sheyenne St.  Sheyenne St.  45th St.	2660 575 1005 1440 11770 755 2050 1040 7520 705 930 1450 615 1570 760 465 1345 1365 405 1010  375	2800 575 1005 1440 1170 755 2850 1040 7520 705 930 1450 615 1570 760 485 1345 1365 405 11010 785 930 960 2610 2658 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	### April 1000   1440   11770   755   2050   1040   7520   770   800   1450   1151   1570   760   405   1345   1305   400   1010   705   800   900   740   1050   1120   4225   2234	## Application

Note: Density values were adjusted using the following data: Peak-hour factor = .78

Heavy vehicle percent = 5

This data increased the original density by 25%.



2008 AM: Data Collection Points (I-29/I-94 Interchange)

	1	2	3	4	5	6	7	8	9	10
Modeled Vol. (vph)	877	301	502	177	497	765	577	1074	193	1370
Simulated Vol. (vph)	885	302	514	176	499	769	584	1084	196	1392
Volume % Difference	1%	0%	2%	-1%	0%	0%	1%	1%	1%	2%
Speed (mph)	57	54	25	55	54	24	54	55	25	53
# of Lanes	2	1	1	1	1	1	1	1	1	1
Density (pc/mi/ln)	10	7	28	4	12	42	14	26	10	35

This data increased the original density by 25%.

<b>Appendix C:</b>	2008 AM	<b>Simulation</b>	Output	(Node	Evaluations)
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_	Node L	ocation	ı:	I-94 &	Sheyen	ne St (N	. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume			102		0	262	53	669	0	0	696	29
Delay Time/Veh. (s)			264.6		0	7.8	11.6	0.5	0	0	58.2	36.1
Max Queue (ft)			798		0	327	0	0	0	0	655	655
Avg. Queue (ft)			202		0	17	0	0	0	0	169	169
· · ·							Int	ersectio	n Delay	/ (sec/v	eh)	39.5
	Node L	ocation	ı:	I-94 &	Sheyen	ا ne St (S	. Side)				,	
	EB	Approa	ach	_	Appro			Approa	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	4	0	23				0	716	613	395	404	0
Delay Time/Veh. (s)	13.9	0	6.7				0	8.4	7.8	72.4	1.7	0
Max Queue (ft)	56	0	56				0	819	819	2182	80	0
Avg. Queue (ft)	0	0	0				0	115	115	864	6	0
11181 Quodo (11)		, ,	Ū							/ (sec/v		18.7
	Node I	.ocation		1-94 &	45th St	(N Side		crocotro	on Delay	(300)	C11 <i>j</i>	10.7
		Approa			3 Appro	`		Approa	ach	SR	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	LDL	LDI	LDIX	305	0	891	62	809	0	0	1181	70
Delay Time/Veh. (s)				41.1	0	10.7	33.5	7.9	0.0	0	11.8	6.7
Max Queue (ft)				329	0	521	152	246	0.0	0	746	173
Avg. Queue (ft)				51	0	41	132	246	0	0	746	2
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Ī		ocation			45th St	· .	)				•	
	EB	Approa	ach	WE	3 Appro	ach	) NB	Approa	ach	SB	Approa	ach
Volumo	EBL	Approa EBT	ech EBR			· .	) NB NBL	Approa NBT	ach NBR	SB SBL	Approa SBT	ach SBR
Volume	EBL 188	Approa EBT 0	ech EBR 86	WE	3 Appro	ach	NB NBL	Approa NBT 684	nch NBR 623	SB SBL 0	Approa SBT 853	sch SBR 632
Delay Time/Veh. (s)	EBL 188 39.2	Approa EBT 0 0	EBR 86 4.7	WE	3 Appro	ach	NBL O	Approa NBT 684 5.8	nch NBR 623 10.9	SB SBL 0	Approa SBT 853 3.9	sch SBR 632 8.5
Delay Time/Veh. (s) Max Queue (ft)	EBL 188 39.2 267	Approa EBT 0 0	EBR 86 4.7 108	WE	3 Appro	ach	) NBL 0 0	Approx NBT 684 5.8 417	nech NBR 623 10.9 417	SB SBL O O	Approa SBT 853 3.9 68	SBR 632 8.5 327
Delay Time/Veh. (s)	EBL 188 39.2	Approa EBT 0 0	EBR 86 4.7	WE	3 Appro	ach	) NBL 0 0 0	Approa NBT 684 5.8 417	NBR 623 10.9 417 50	SB SBL 0 0 0 0 0	Approa SBT 853 3.9 68 0	sch SBR 632 8.5 327 29
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 188 39.2 267 51	Approa EBT 0 0 0	86 4.7 108	WBL	Appro WBT	wbr	)  NBL  0  0  0  Int	Approa NBT 684 5.8 417	NBR 623 10.9 417 50	SB SBL O O	Approa SBT 853 3.9 68 0	SBR 632 8.5 327
Delay Time/Veh. (s) Max Queue (ft)	EBL 188 39.2 267 51 Node L	Approa EBT 0 0 0	86 4.7 108 1	WBL	3 Appro WBT 25th St	wBR WBR	)  NBL  0  0  0  Int	Approa NBT 684 5.8 417 50 ersectio	nBR 623 10.9 417 50 on Delay	SB SBL 0 0 0 0 0	Approa SBT 853 3.9 68 0 eh)	sch SBR 632 8.5 327 29 8.9
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 188 39.2 267 51 Node L	Approa EBT 0 0 0 0 0	86 4.7 108 1	WEL  I-94 &  WE	3 Appro WBT 25th St 3 Appro	WBR WBR (N. Side	)  NBL  0  0  0  Int	Approa NBT 684 5.8 417 50 ersection	nach NBR 623 10.9 417 50 on Delay	SB SBL 0 0 0 0 v (sec/v	Approa SBT 853 3.9 68 0 eh)	sch SBR 632 8.5 327 29 8.9
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EBL 188 39.2 267 51 Node L	Approa EBT 0 0 0	86 4.7 108 1	I-94 & WE	25th St WBT	(N. Side	)  NBL  0  0  0  Int  e)  NBL	Approa NBT 684 5.8 417 50 ersection	nach NBR 623 10.9 417 50 on Delay ach NBR	SB SBL 0 0 0 0 0 / (sec/v	Approa SBT 853 3.9 68 0 eh)	sch SBR 632 8.5 327 29 8.9
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL 188 39.2 267 51 Node L	Approa EBT 0 0 0 0 0	86 4.7 108 1	I-94 & WBL 275	25th St WBT WBT 25th St WBT 0	(N. Side ach WBR	)  NBL  0  0  0  Inter e)  NBL  0	Approa NBT 684 5.8 417 50 ersection Approa NBT 996	ach NBR 623 10.9 417 50 on Delay ach NBR 327	SB SBL 0 0 0 0 0 (sec/vi	Approa SBT 853 3.9 68 0 eh)	sach SBR 632 8.5 327 29 8.9 sach SBR 146
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EB EBL 188 39.2 267 51 Node L	Approa EBT 0 0 0 0 0	86 4.7 108 1	I-94 & WEL 275 57.1	25th St WBT 25th St Appro WBT 0	(N. Side ach WBR 396 15.2	)  NBL  0  0  0  Int e)  NBL  0  O  O  O  O  O  O  O  O  O  O  O  O	Approa NBT 684 5.8 417 50 ersection Approa NBT 996 9.2	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0	SB SBL 0 0 0 0 0 (sec/v) SB SBL 0 0	Approa SBT 853 3.9 68 0 eh) Approa SBT 832 10.6	8.5 327 29 8.9 8.6 146 11.5
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL 188 39.2 267 51 Node L	Approa EBT 0 0 0 0 0	86 4.7 108 1	I-94 & WBL WBL 275 57.1 507	25th St 3 Appro WBT 0 0.0 507	(N. Side ach WBR 396 15.2 399	)  NBL  0  0  0  Intel e)  NBL  0  0  O  O  O  O  O  O  O  O  O  O  O	Approa NBT 684 5.8 417 50 ersection Approa NBT 996 9.2 458	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0 148	SB SBL 0 0 0 (sec/v. SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 853 3.9 68 0 eh) Approa SBT 832 10.6 435	ach SBR 632 8.5 327 29 8.9 SBR 146 11.5 435
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EB EBL 188 39.2 267 51 Node L	Approa EBT 0 0 0 0 0	86 4.7 108 1	I-94 & WEL 275 57.1	25th St WBT 25th St Appro WBT 0	(N. Side ach WBR 396 15.2	NBL O O O O Int. E) NBL O O O	Approa NBT 684 5.8 417 50 ersection Approa NBT 996 9.2 458 38	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0 148 1	SB SBL 0 0 0 SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 853 3.9 68 0 eh) Approa SBT 832 10.6 435 48	8.5 327 29 8.9 8.6 146 11.5 435
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL 188 39.2 267 51 Node L EB EBL	Approa EBT 0 0 0 0 cocation Approa EBT	86 4.7 108 1	I-94 & WBL 275 57.1 507 111	25th St B Appro WBT 0 0.0 507 111	(N. Side ach WBR 396 15.2 399 41	)  NBL  0  0  0  Interval    NBL  0  0  Interval    In	Approa NBT 684 5.8 417 50 ersection Approa NBT 996 9.2 458 38	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0 148 1	SB SBL 0 0 0 (sec/v. SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 853 3.9 68 0 eh) Approa SBT 832 10.6 435 48	ach SBR 632 8.5 327 29 8.9 SBR 146 11.5 435
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL 188 39.2 267 51 Node L EB EBL	Approa EBT 0 0 0 0 ocation Approa EBT	EBR 86 4.7 108 1 :: ech EBR :: ::	I-94 & WBL 275 57.1 507 111	25th St 3 Appro WBT 0 0.0 507 111	(N. Side ach WBR 396 15.2 399 41	)  NBL  0  0  0  Int. e)  NBL  0  0  Int. o  1  Int. o  Int. o  Int. o  Int. o	Approa NBT 684 5.8 417 50 ersection Approa NBT 996 9.2 458 38 ersection	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0 148 1 on Delay	SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 853 3.9 68 0 eh) Approa SBT 832 10.6 435 48 eh)	ach SBR 632 8.5 327 29 8.9 ach SBR 146 11.5 435 48
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL 188 39.2 267 51 Node L EB EBL	Approa EBT 0 0 0 0 ocation Approa ocation	EBR 86 4.7 108 1 :: ach EBR :: ach	I-94 & WE WBL 275 57.1 507 111	25th St 3 Appro 25th St 3 Appro 0 0.0 507 111 25th St 3 Appro	(N. Side ach WBR 396 15.2 399 41 (S. Side ach	)  NBL  0  0  0  Interval    NBL  0  0  Interval    NBL  0  Interval    NBL  0  NBL  0  NBL  NBL  NBL  NBL  NB	Approx NBT 684 5.8 417 50 ersection Approx 996 9.2 458 38 ersection	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0 148 1 on Delay	SB SBL 0 0 0 (sec/v) SB SBL 0 0 0 0 / (sec/v) SB SBL SBL SBL SBL SBL SBL SBL SBL SBL	Approa SBT 853 3.9 68 0 eh) Approa 832 10.6 435 48 eh)	ach SBR 632 8.5 327 29 8.9 8ch SBR 146 11.5 435 48 14.2
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EBL 188 39.2 267 51 Node L EB EBL  Node L EB	Approa EBT 0 0 0 0 ocation Approa EBT	EBR 86 4.7 108 1 :: ach EBR	I-94 & WBL 275 57.1 507 111 I-94 & WE	25th St 3 Appro WBT 0 0.0 507 111 25th St 3 Appro WBT	(N. Side ach WBR 396 15.2 399 41 (S. Side ach WBR	)  NBL  0  0  0  Int e)  NBL  0  Int e)  NBL  NBL  NBL  NBL  NBL  NBL  NBL  NB	Approa NBT 684 5.8 417 50 ersection Approa NBT 996 9.2 458 38 ersection Approa NBT	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0 148 1 on Delay ach NBR	SB SBL 0 0 0 (sec/vi)  SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 853 3.9 68 0 eh) Approa SBT 832 10.6 435 48 eh)	ach SBR 632 8.5 327 29 8.9 ach SBR 146 11.5 435 48 14.2 ach SBR
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL   Node L   EB EBL    Node L   EB EBL    Node L   EB EBL    72	Approa EBT 0 0 0 0 ocation Approa EBT ocation Approa EBT	EBR 86 4.7 108 1 :: ach EBR EBR 75	I-94 & WE WBL 275 57.1 507 111 I-94 & WE WBL 15	25th St 3 Appro 25th St 3 Appro 0 0.0 507 111 25th St 3 Appro WBT 33	(N. Side ach WBR 396 15.2 399 41 (S. Side ach WBR 404	)  NBL  0  0  0  Int  NBL  0  0  Int  NBL  0  NBL  0  NBL  155	Approa NBT 684 5.8 417 50 ersection NBT 996 9.2 458 38 ersection NBT 834	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0 148 1 on Delay ach NBR 24	SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 832 10.6 435 48 eh)  Approa SBT 832 10.6 435 48 687	ach SBR 632 8.5 327 29 8.9 8ch SBR 146 11.5 435 48 14.2
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EB EBL    Node L    EB EBL    Node L    EB EBL    Node L    EB EBL    72    38.7	Approa EBT 0 0 0 ocation Approa EBT 92 43.1	EBR 86 4.7 108 1	I-94 & WBL 275 57.1 507 111 I-94 & WBL 41.4	25th St 3 Appro WBT 0 0.0 507 111 25th St 3 Appro WBT 33 37.1	(N. Side ach WBR 396 15.2 399 41 (S. Side ach WBR 404 15.1	)  NBL  0  0  0  Int e)  NBL  0  Int e)  NBL  NBL  NBL  NBL  NBL  NBL  NBL  NB	Approx NBT 684 5.8 417 50 ersection Approx NBT 996 9.2 458 38 ersection Approx NBT 834 14.0	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0 148 1 on Delay ach NBR	SB SBL 0 0 0 0 (sec/v) SB SBL 0 0 0 0 (sec/v) SB SBL 190 13.3	Approa SBT 853 3.9 68 0 eh) Approa SBT 832 10.6 435 48 eh) Approa SBT 888 881	ach SBR 632 8.5 327 29 8.9 ach SBR 146 11.5 435 48 14.2 ach SBR 235 3.0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL SB	Approa EBT 0 0 0 0 ocation Approa EBT ocation Approa EBT 92 43.1 263	EBR 86 4.7 108 1 EBR EBR 75 5.7 118	WE WBL  I-94 &  WBL  275  57.1  507  111  I-94 &  WE WBL  15  41.4  128	25th St 3 Appro 25th St 3 Appro 0 0.0 507 111 25th St 3 Appro WBT 3 Appro WBT 3 33 37.1 128	(N. Side ach WBR 396 15.2 399 41 (S. Side ach WBR 404	NBL 0 0 0 0 Int 0 0 0 Int 0 0 NBL 0 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Approx NBT 684 5.8 417 50 ersection NBT 996 9.2 458 38 ersection NBT 834 14.0 511	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0 148 1 on Delay ach NBR 24 12.1 0	SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 853 3.9 68 0 eh) Approa SBT 832 10.6 435 48 eh) Approa SBT 687 8.1 270	sch SBR 632 8.5 327 29 8.9 8.9 146 11.5 435 48 14.2 8ch SBR 235 3.0 177
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EB EBL    Node L    EB EBL    Node L    EB EBL    Node L    EB EBL    72    38.7	Approa EBT 0 0 0 ocation Approa EBT 92 43.1	EBR 86 4.7 108 1	I-94 & WBL 275 57.1 507 111 I-94 & WBL 41.4	25th St 3 Appro WBT 0 0.0 507 111 25th St 3 Appro WBT 33 37.1	(N. Side ach WBR 396 15.2 399 41 (S. Side ach WBR 404 15.1	NBL 0 0 0 0 Int e) NBB 0 0 Int 1 155 14.4 438 14	Approx NBT 684 5.8 417 50 ersection Approx 996 9.2 458 38 ersection Approx NBT 834 14.0 511 56	ach NBR 623 10.9 417 50 on Delay ach NBR 327 2.0 148 1 on Delay ach NBR 24 12.1 0 0	SB SBL 0 0 0 0 (sec/v) SB SBL 0 0 0 0 (sec/v) SB SBL 190 13.3	Approa SBT 832 10.6 435 48 eh)  Approa SBT 832 10.7 48 48 25 25 25 25 25 25 25 25 25 25 25 25 25	ach SBR 632 8.5 327 29 8.9 ach SBR 146 11.5 435 48 14.2 ach SBR 235 3.0

2008 AM Peak - Ramp	Cillini	Data										
	Node L	.ocation	ı:	I-94 &	Univers	ity Dr (ſ	N. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ich
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				391	0	341	0	1993	235	0	760	320
Delay Time/Veh. (s)				42.0	0	13.8	0.0	3.7	0.9	0	5.1	0.9
Max Queue (ft)				300	0	303	0	328	288	0	274	1080
Avg. Queue (ft)				67	0	44	0	23	1	0	14	177
	•	•					Int	ersectic	n Delay	/ (sec/v	eh)	8.1
	Node L	.ocation	ı:	I-94 &	Univers	ity Dr (S	S. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	nch
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	609	0	228				0	1604	278	0	1009	156
Delay Time/Veh. (s)	47.1	0	8				0.0	15.1	1.1	0	11.7	0.4
Max Queue (ft)	962	0	182				0	577	0	0	361	290
Avg. Queue (ft)	245	0	15				0	82	0	0	39	17
							Int	ersectic	n Delay	/ (sec/v	eh)	17.2
	Node L	.ocation	ı:	I-94 &	8th St/1	H75 (N	. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ich
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				126	0	145	612	1452	0	0	342	734
Delay Time/Veh. (s)				28.6	0	11.5	23.5	6.9	0	0	24.0	21.0
Max Queue (ft)				202	0	146	924	591	0	0	371	1080
Avg. Queue (ft)				23	0	5	156	41	0	0	34	177
								ersectio	n Delay	/ (sec/v	eh)	15.6
	Node L	ocation	1:	I-94 &	8th St/1	H75 (S.		ersectio	n Delay	/ (sec/v	eh)	15.6
	EB	Approa		WE	3 Appro	ach	Side) NB	Approa	ach	SB	Approa	ıch
	EBL	Approa EBT	ech EBR				Side) NB NBL	Approa NBT	ach NBR	SB SBL	Approa SBT	ich SBR
Volume	EB EBL 314	Approa EBT 0	ech EBR 786	WE	3 Appro	ach	Side) NB NBL 0	Approa NBT 1270	nch NBR 164	SB SBL 83	Approa SBT 386	sch SBR 0
Volume Delay Time/Veh. (s)	EBL 314 7.4	Approa EBT	ech EBR	WE	3 Appro	ach	Side) NB NBL	Approa NBT	ach NBR	SB SBL	Approa SBT	ich SBR
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 314 7.4 210	Approa EBT 0 0	EBR 786 29.6 755	WE	3 Appro	ach	Side)  NB  NBL  0  0  0	Approx NBT 1270 20.5 857	nech NBR 164 5.5 155	SB SBL 83 21.0 143	Approa SBT 386 7.4 213	SBR 0 0
Delay Time/Veh. (s)	EB EBL 314 7.4 210	Approa EBT 0	EBR 786 29.6	WE	3 Appro	ach	Side)  NB  NBL  0  0  0  0	Approa NBT 1270 20.5 857 135	nech NBR 164 5.5 155	SBL 83 21.0 143	Approa SBT 386 7.4 213 11	SBR 0 0 0
Delay Time/Veh. (s) Max Queue (ft)	EBL 314 7.4 210 17	Approa EBT 0 0 0	EBR 786 29.6 755 104	WBL	Appro WBT	wbr	Side)  NBL  0  0  0  Int	Approx NBT 1270 20.5 857	nech NBR 164 5.5 155	SBL 83 21.0 143	Approa SBT 386 7.4 213 11	SBR 0 0
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 314 7.4 210 17	Approa EBT 0 0 0	EBR 786 29.6 755 104	WBL	3 Appro WBT 20th St	ach WBR (N. Side	Side)  NBL  0  0  0  Int	Approa NBT 1270 20.5 857 135 ersectio	ach NBR 164 5.5 155 5 on Delay	SB SBL 83 21.0 143 6 / (sec/v	Approa SBT 386 7.4 213 11 eh)	och SBR 0 0 0 0 0
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 314 7.4 210 17 Node L	Approa EBT 0 0 0 0	786 29.6 755 104	WBL I-94 & WE	3 Appro WBT 20th St	WBR (N. Side	Side)  NBL  0  0  0  Intel  NBC	Approa NBT 1270 20.5 857 135 ersection	ach NBR 164 5.5 155 5 on Delay	SB SBL 83 21.0 143 6 / (sec/v	Approa SBT 386 7.4 213 11 eh)	0 0 0 0 0 19.0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EB EBL 314 7.4 210 17	Approa EBT 0 0 0	EBR 786 29.6 755 104	I-94 & WE	20th St WBT	(N. Side	Side)  NBL  0  0  0  Intel  NBL	Approa NBT 1270 20.5 857 135 ersection	ach NBR 164 5.5 155 5 on Delay ach NBR	SB SBL 83 21.0 143 6 / (sec/vec)	Approa SBT 386 7.4 213 11 eh)	och SBR 0 0 0 0 19.0 sch SBR
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL 314 7.4 210 17 Node L	Approa EBT 0 0 0 0	786 29.6 755 104	I-94 & WBL O	20th St WBT WBT 20th St WBT 20	(N. Side ach WBR	Side)  NBL  0  0  0  Intel  NBL  302	Approa NBT 1270 20.5 857 135 ersection Approa NBT 751	ach NBR 164 5.5 155 5 on Delay ach NBR 4	SB SBL 83 21.0 143 6 / (sec/vi	Approa SBT 386 7.4 213 11 eh) Approa SBT 252	0 0 0 0 19.0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EB EBL 314 7.4 210 17 Node L	Approa EBT 0 0 0 0	786 29.6 755 104	I-94 & WE WBL O 3.7	20th St B Appro WBT 20th St B Appro WBT 20 12.3	(N. Side ach WBR 3 7.9	Side)  NBL  0  0  0  Int e)  NBL  302  3.6	Approa NBT 1270 20.5 857 135 ersection Approa NBT 751 0.6	nsh NBR 164 5.5 155 5 on Delay ach NBR 4 0.5	SB SBL 83 21.0 143 6 / (sec/v SB SBL 16 6.4	Approa SBT 386 7.4 213 11 eh) Approa SBT 252 0.8	och SBR 0 0 0 0 19.0 ech SBR 140 2.5
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL 314 7.4 210 17 Node L EB EBL	Approa EBT 0 0 0 0	786 29.6 755 104	I-94 & WBL O 3.7 O	20th St 3 Appro WBT 20th St 3 Appro WBT 20 12.3	(N. Side ach WBR 3 7.9 0	Side)  NBL  0  0  0  Intel  NBL  302  3.6  316	Approa NBT 1270 20.5 857 135 ersection Approa NBT 751 0.6 316	ach NBR 164 5.5 155 5 on Delay ach NBR 4 0.5 316	SB SBL 83 21.0 143 6 / (sec/v. SB SBL 16 6.4 0	Approa SBT 386 7.4 213 11 eh) Approa SBT 252 0.8 0	0 0 0 0 19.0 ach SBR 140 2.5
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EB EBL 314 7.4 210 17 Node L EB EBL	Approa EBT 0 0 0 0	786 29.6 755 104	I-94 & WE WBL O 3.7	20th St B Appro WBT 20th St B Appro WBT 20 12.3	(N. Side ach WBR 3 7.9	Side)  NBL  0  0  0  Int e)  NBL  302  3.6  316  38	Approa NBT 1270 20.5 857 135 ersection Approa NBT 751 0.6 316 38	ach NBR 164 5.5 155 5 on Delay ach NBR 4 0.5 316 38	SB SBL 16 6.4 0 0	Approa SBT 386 7.4 213 11 eh) Approa SBT 252 0.8 0	och SBR 0 0 0 0 19.0 och SBR 140 2.5 0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL 314 7.4 210 17 Node L EB EBL	Approa EBT 0 0 0 0 cocation Approa EBT	EBR 786 29.6 755 104 a: EBR	I-94 & WBL O 3.7 O O	20th St 3 Appro 20th St 3 Appro WBT 20 12.3 0	(N. Side ach WBR 3 7.9 0 0	Side)  NBL  0  0  0  Intel  NBL  302  3.6  316  38  Int	Approa NBT 1270 20.5 857 135 ersection Approa NBT 751 0.6 316	ach NBR 164 5.5 155 5 on Delay ach NBR 4 0.5 316 38	SB SBL 16 6.4 0 0	Approa SBT 386 7.4 213 11 eh) Approa SBT 252 0.8 0	0 0 0 0 19.0 ach SBR 140 2.5
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL 314 7.4 210 17  Node L EB EBL	Approa EBT 0 0 0 0 ocation Approa EBT	EBR 786 29.6 755 104 EBR EBR	I-94 & WBL O 3.7 O O I-94 &	20th St B Appro WBT 20th St 20 12.3 0 0	(N. Side ach WBR 3 7.9 0 0 (S. Side	Side)  NBL  0  0  0  Int e)  NBL  302  3.6  316  38  Int	Approa NBT 1270 20.5 857 135 ersection Approa NBT 751 0.6 316 38 ersection	ach NBR 164 5.5 155 5 on Delay ach NBR 4 0.5 316 38 on Delay	SB SBL 16 6.4 0 0 (sec/vi	Approa SBT 386 7.4 213 11 eh) Approa SBT 252 0.8 0 0 eh)	ach SBR 0 0 0 19.0 140 2.5 0 0 1.7
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL 314 7.4 210 17 Node L EB EBL	Approa EBT 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	EBR 786 29.6 755 104 :: ach EBR	I-94 & WE WBL O 3.7 O O	20th St 3 Appro 20th St 3 Appro 20 12.3 0 0 20th St 3 Appro	(N. Side ach WBR 3 7.9 0 0 (S. Side ach	Side)  NBL  0  0  0  Int  NBL  302  3.6  316  38  Int  NBL	Approa NBT 1270 20.5 857 135 ersection Approa 316 38 ersection	ach NBR 164 5.5 155 5 Den Delay Ach NBR 4 0.5 316 38 Den Delay Ach	SB SBL 21.0 143 6 / (sec/v) SB SBL 16 6.4 0 0 / (sec/v) SB	Approa SBT 386 7.4 213 11 eh) Approa SBT 252 0.8 0 0 eh)	och SBR 0 0 0 0 19.0 ach SBR 140 2.5 0 0 1.7
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EB EBL 314 7.4 210 17  Node L EB EBL  Node L EB	Approa  EBT  0  0  0  ocation  Approa  EBT  ocation  Approa  EBT	EBR 786 29.6 755 104 EBR EBR EBR	I-94 & WBL O 3.7 O O I-94 &	20th St B Appro WBT 20th St 20 12.3 0 0	(N. Side ach WBR 3 7.9 0 0 (S. Side	Side)  NBL  0  0  0  Int e)  NBL  302  3.6  316  38  Int )  NBL	Approa NBT 1270 20.5 857 135 ersection Approa NBT 751 0.6 316 38 ersection Approa NBT	ach NBR 164 5.5 155 5 on Delay ach NBR 4 0.5 316 38 on Delay ach NBR	SB SBL	Approa SBT 386 7.4 213 11 eh) Approa SBT 252 0.8 0 0 eh)	ach SBR 0 0 0 19.0 140 2.5 0 1.7
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL 314 7.4 210 17 Node L EB EBL SBL SBBL 388	Approa EBT O O O O O O O O O O O O O O O O O O O	EBR 786 29.6 755 104 :: ach EBR EBR 17	I-94 & WE WBL O 3.7 O O	20th St 3 Appro 20th St 3 Appro 20 12.3 0 0 20th St 3 Appro	(N. Side ach WBR 3 7.9 0 0 (S. Side ach	Side)  NBL  0  0  0  Int e)  NBL  302  3.6  316  38  Int )  NBL  0	Approa NBT 1270 20.5 857 135 ersection NBT 751 0.6 316 38 ersection NBT 668	ach NBR 164 5.5 155 5 Den Delay Ach NBR 4 0.5 316 38 Den Delay Ach NBR O NBR O	SB SBL 21.0 143 6 / (sec/v) SB SBL 0 SBL O	Approa SBT 252 0.8 0 0 eh)  Approa SBT 252 SBT 252 SBT 252 SBT 253	ach SBR 0 0 0 0 19.0  ach SBR 140 2.5 0 0 1.7  ach SBR
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EB EBL 314 7.4 210 17 Node L EB EBL SBL 388 16.5	Approa EBT 0 0 0 0 ocation Approa EBT 0 0	EBR 786 29.6 755 104 EBR EBR 17 4.8	I-94 & WE WBL O 3.7 O O	20th St 3 Appro 20th St 3 Appro 20 12.3 0 0 20th St 3 Appro	(N. Side ach WBR 3 7.9 0 0 (S. Side ach	Side)  NBL  0  0  0  Intel  NBL  302  3.6  316  38  Intel  NBL  0  0	Approa NBT 1270 20.5 857 135 ersection Approa NBT 751 0.6 316 38 ersection Approa Approa NBT 668 10.5	ach NBR 164 5.5 155 5 on Delay ach NBR 4 0.5 316 38 on Delay ach NBR O O	SB SBL 16 6.4 0 0 (sec/v) SB SBL 0 0	Approa SBT 252 0.8 0 0 eh)  Approa SBT 252 1.1	ach SBR 0 0 0 19.0 ach SBR 140 2.5 0 0 1.7 ach SBR
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL 314 7.4 210 17 Node L EB EBL 388 16.5 359	Approa EBT O O O O O O O O O O O O O O O O O O O	EBR 786 29.6 755 104 :: ach EBR EBR 17	I-94 & WE WBL O 3.7 O O	20th St 3 Appro 20th St 3 Appro 20 12.3 0 0 20th St 3 Appro	(N. Side ach WBR 3 7.9 0 0 (S. Side ach	Side)  NBL  0  0  0  Int e)  NBL  302  3.6  316  38  Int )  NBL  0	Approa NBT 1270 20.5 857 135 ersection NBT 751 0.6 316 38 ersection NBT 668	ach NBR 164 5.5 155 5 Den Delay Ach NBR 4 0.5 316 38 Den Delay Ach NBR O NBR O	SB SBL 21.0 143 6 / (sec/v) SB SBL 0 SBL O	Approa SBT 252 0.8 0 0 eh)  Approa SBT 252 SBT 252 SBT 252 SBT 253	ach SBR 0 0 0 0 19.0  ach SBR 140 2.5 0 0 1.7  ach SBR

Intersection Delay (sec/veh)

Node Location: I-94 & Main Ave (N. Side)			
EB Approach WB Approach NB Approach	SB	Approa	ach
EBL EBT EBR WBL WBT WBR NBL NBT NBR	SBL	SBT	SBR
Volume         108         24         36         137         435         9         263         430         385	6	111	119
Delay Time/Veh. (s) 27.3 28.3 8.3 19.1 33.1 8.8 44.8 23.7 15.7	48.0	29.7	10.7
Max Queue (ft) 185   130   4   187   470   470   1020   973   489	64	182	0
Avg. Queue (ft)         18         5         0         15         99         99         148         121         30	2	20	0
Intersection Delay	(sec/v	eh)	26.1
Node Location: I-94 & Main Ave (S. Side)			
EB Approach WB Approach NB Approach	SB	Approa	ach
EBL EBT EBR WBL WBT WBR NBL NBT NBR	SBL	SBT	SBR
Volume         444         0         148         0         628         0	0	249	35
Delay Time/Veh. (s) 22.5 0 8.1 0.0 21.6 0	0	17.0	8.5
Max Queue (ft) 598 0 157 0 634 0	0	301	33
Avg. Queue (ft) 73 0 5 0 84 0	0	27	0
Intersection Delay	(sec/v	eh)	19.5
Node Location: I-94 & MN 336 (N. Side)			
EB Approach WB Approach NB Approach	SB	Approa	ach
EBL EBT EBR WBL WBT WBR NBL NBT NBR	SBL	SBT	SBR
Volume         2         0         43         14         219         0	0	47	591
Delay Time/Veh. (s)         5.8         0         7.0         0.6         0.1         0	0	1.2	2.3
Max Queue (ft) 0 0 115 0 0	0	0	0
Avg. Queue (ft) 0 0 2 0 0 0	0	0	0
Intersection Delay	, lcocky	1 \	
· · · · · · · · · · · · · · · · · · ·	(SEC/V	en)	1.9
Node Location: I-94 & MN 336 (S. Side)	(sec/v	en)	1.9
Node Location: I-94 & MN 336 (S. Side)  EB Approach WB Approach NB Approach	•	en) Approa	
	•	•	
EB Approach WB Approach NB Approach	SB	Approa	ach
EB Approach WB Approach NB Approach EBL EBT EBR WBL WBT WBR NBL NBT NBR	SB SBL	Approa SBT	ach SBR
EB Approach       WB Approach       NB Approach         EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR         Volume       17       0       193       0       41       5         Delay Time/Veh. (s)       7.5       0       0.7       0.0       0.0       0.9         Max Queue (ft)       0       0       0       0       0       0       0	SB SBL 37	Approa SBT 11	sch SBR 0
EB Approach       WB Approach       NB Approach         EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR         Volume       17       0       193       0       41       5         Delay Time/Veh. (s)       7.5       0       0.7       0.0       0.0       0.9         Max Queue (ft)       0       0       0       0       0       0       0         Avg. Queue (ft)       0       0       0       0       0       0       0	SB SBL 37 0.5 0	Approx SBT 11 0.1 0	SBR 0 0 0 0
EB Approach       WB Approach       NB Approach         EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR         Volume       17       0       193       0       41       5         Delay Time/Veh. (s)       7.5       0       0.7       0.0       0.0       0.9         Max Queue (ft)       0       0       0       0       0       0         Avg. Queue (ft)       0       0       0       0       0       0         Intersection Delay	SB SBL 37 0.5 0	Approx SBT 11 0.1 0	SBR 0 0
EB   EBT   EBR   WBL   WBT   WBR   NBL   NBT   NBR	SB SBL 37 0.5 0	Approx SBT 11 0.1 0	SBR 0 0 0 0 0
EB Approach   WB Approach   NB Approach	SB SBL 37 0.5 0 0 (sec/v	Approa SBT 11 0.1 0 0 eh)	och SBR 0 0 0 0 0 0 0 0.9
EB Approach       WB Approach       NB Approach         BBL       EBT       EBR       WBL       WBR       NBL       NBT       NBR         Volume       17       0       193       0       41       5         Delay Time/Veh. (s)       7.5       0       0.7       0.0       0.0       0.9         Max Queue (ft)       0       0       0       0       0       0       0         Avg. Queue (ft)       0       0       0       0       0       0       0       0         Node Location:       I-29 & CR 20 (W. Side)         EB Approach       WB Approach       NB Approach         EBL       EBL       EBR       WBL       WBT       WBR       NBL       NBR       NBR	SB SBL 37 0.5 0 0 (sec/vec/sBL	Approa SBT 11 0.1 0 0 eh)	SBR  O  O  O  O  O  SBR
EB   EBT   EBR   WBL   WBT   WBR   NBL   NBT   NBR	SB SBL 37 0.5 0 0 (sec/v	Approa SBT 11 0.1 0 0 eh)	och SBR 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
EB Approach   WB Approach   NB Approach	SB SBL 37 0.5 0 0 (sec/v SB SBL 26 6.9	Approa SBT 11 0.1 0 0 eh)	SBR  O  O  O  O  O  SBR
EB Approach   WB Approach   NB Approach	SB SBL 37 0.5 0 0 (sec/v) SB SBL 26 6.9 52	Approa SBT 11 0.1 0 0 eh) Approa SBT 0 0.0	ach SBR 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
EB   Approach   BB   Approach   BB   BB   BB   BB   BB   BB   BB	SB SBL 37 0.5 0 0 (sec/vi) SB SBL 26 6.9 52 0	Approa SBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ach SBR 0 0 0 0 0 0.9 ach SBR 7 5.3 52 0
EB Approach   WB Approach   NB Approach   NBR   NBR   NBR   NBR	SB SBL 37 0.5 0 0 (sec/vi) SB SBL 26 6.9 52 0	Approa SBT 0 0.0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ach SBR 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0
EB   Approach   EBR   EBR   WBL   WBT   WBR   NBL   NBT   NBR	SB SBL 37 0.5 0 0 (sec/vi) SB SBL 26 6.9 52 0 v (sec/vi)	Approa SBT 11 0.1 0 0 eh) Approa SBT 0 0.0 0 0	ach SBR 0 0 0 0 0 0.9 ach SBR 7 5.3 52 0 1.6
EB   Approach   BB   Approach   BB   Approach   BB   Approach   BB   BB   BB   BB   BB   BB   BB	SB SBL 37 0.5 0 0 (sec/v) SB SBL 26 6.9 52 0 v (sec/v) SB	Approa SBT 11 0.1 0 0 eh) Approa 0 0 0 0 eh)	ach SBR 0 0 0 0 0.9 ach SBR 7 5.3 52 0 1.6
EB   Approside   FB   EBR   WBL   WBR   NBL   NBT   NBR	SB SBL 37 0.5 0 0 (sec/vi) SB SBL 26 6.9 52 0 v (sec/vi)	Approa SBT 11 0.1 0 0 eh) Approa SBT 0 0.0 0 0	ach SBR 0 0 0 0 0 0.9 ach SBR 7 5.3 52 0 1.6
EB   Approach   EBR   WBL   WBR   NBL   NBT   NBR	SB SBL 37 0.5 0 0 (sec/v) SB SBL 26 6.9 52 0 v (sec/v) SB	Approa SBT 11 0.1 0 0 eh) Approa 0 0 0 0 eh)	ach SBR 0 0 0 0 0.9 ach SBR 7 5.3 52 0 1.6
EB   EBT   EBR   WBL   WBT   WBR   NBL   NBT   NBR	SB SBL 37 0.5 0 0 (sec/v) SB SBL 26 6.9 52 0 v (sec/v) SB	Approa SBT 11 0.1 0 0 eh) Approa 0 0 0 0 eh)	ach SBR 0 0 0 0 0.9 ach SBR 7 5.3 52 0 1.6
EB   Approach   EBR   WBL   WBR   NBL   NBT   NBR	SB SBL 37 0.5 0 0 (sec/v) SB SBL 26 6.9 52 0 v (sec/v) SB	Approa SBT 11 0.1 0 0 eh) Approa 0 0 0 0 eh)	ach SBR 0 0 0 0 0 0.9 ach SBR 7 5.3 52 0 1.6

Intersection Delay (sec/veh)

Max Queue (ft)

Avg. Queue (ft)

Intersection Delay (sec/veh)

2008 AM Peak - Ramp	Termina	al Data										
	Node L	.ocation	:	I-29 &	19 Ave	N (W. S	ide)					
	EB	Approa	ich	WE	3 Appro	ach	NB	Appro	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	0	220	27	0	229	499				91	0	29
Delay Time/Veh. (s)	0.0	3.6	2.3	0	4.5	2.6				9.6	0	1.5
Max Queue (ft)	0	135	0	0	144	271				143	0	0
Avg. Queue (ft)	0	4	0	0	4	1				6	0	0
								ersectio	on Delay	/ (sec/v	eh)	3.7
	Node L	ocation	:	I-29 &	19 Ave	N (E. Sid	de)					
		Approa			3 Appro			Appro	_		Approa	1
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	0	292	20	0	693	27	32	0	707			
Delay Time/Veh. (s)	0.0	7.6	0.2	0	8.2	0.8	20.4	0.0	7.9			
Max Queue (ft)	0	149	171	0	292	0	135	0	214			
Avg. Queue (ft)	0	8	3	0	30	0	4	0	33			
								ersectio	on Delay	/ (sec/v	eh)	8.0
		ocation			12th Av				,			
		Approa			3 Appro			Appro	_		Approa	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	0	327	103	0	832	247				86	0	127
Delay Time/Veh. (s)	0.0	2.3	0.6	0	3.6	0.7				32.9	0	3.2
Max Queue (ft)	0	120	0	0	269	112				160	0	144
Avg. Queue (ft)	0	3	0	0	12	0				18	0	5
								ersectio	on Delay	/ (sec/v	eh)	4.2
1		ocation		_	12th Av							
		Approa			3 Appro	1		Appro			Approa	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	0	381	32	0	562	50	514	0	696			
Delay Time/Veh. (s)	0.0	5.7	0.2	0	8.3	0.7	27.4	0	9.2			
Max Queue (ft)		149	130	0	250	0	279	0	298			
Avg. Queue (ft)	0	8	0	0	19	0	60	0	50	, ,		
								ersectio	on Delay	/ (sec/v	eh)	12.2
1		ocation			Main A							
		Approa			Appro	1		Appro	_		Approa	1
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	0	1111	185	0	963	186				102	0	131
Delay Time/Veh. (s)	0.0	3.4	4.0	0	1.6	0.8				41.7	0	7.0
Max Queue (ft)	0	219	219	0	140	343				163	0	141
Avg. Queue (ft)	0	11	11	0	4	1	ln±	orcost:	n Dolo	21	0 ob)	6 4.2
	Nada !	ocatio-		1 20 0	N/10in A-	ים /ד כי		ersectio	on Delay	, (sec/V	e11)	4.2
	mode L	ocation	•		Main A				-	C.D.		- ab
	רר	A	مام	\ A / F								
		Approa			Appro			Appro			Approa	1
Vil	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume Delay Time/Veh. (s)												

	Node L	.ocation	ı:	I-29 &	38th St							
	EB	Approa	ach	WB Ap	proach		NB	Appro	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				201	0	87	0	146	202	153	75	0
Delay Time/Veh. (s)				15.4	0	5.2	0	3.9	2.2	5.3	3.8	0
Max Queue (ft)				155	0	145	0	122	128	156	156	0
Avg. Queue (ft)				15	0	6	0	3	0	5	5	0
							Int	ersectio	n Delay	y (sec/v	eh)	6.5
	Node L	.ocation	:	I-29 &	13th Av	e S (E. S	Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Appro	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	45	822	151	0	974	140	352	304	509			
Delay Time/Veh. (s)	50.0	15.7	0.1	0	22.6	5.6	21.4	46.0	14.7			
Max Queue (ft)	146	288	122	0	375	0	506	505	510			
Avg. Queue (ft)	13	40	0	0	64	0	94	100	101			
<u> </u>		ı					Int	ersectio	n Delay	/ (sec/v	eh)	20.3
	Node L	.ocation	ı <b>:</b>	I-29 &	32nd Av	ve S (W.	. Side)					
	EB	Approa	ach		3 Appro			Appro	ach	SB	Approa	ach
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	0	1048	20	51	772	0				556	0	598
Delay Time/Veh. (s)		15.3	1.0	46.0	11.3	0				33.7	0.0	14.6
Max Queue (ft)	0	528	0	137	378	0				436	0	450
Avg. Queue (ft)	0	71	0	15	35	0				93	0	96
8 - ( - 7								_			<u> </u>	
							Int	ersectio	on Delav	v (sec/v	eh)	17.9
	Node L	.ocation	ı:	I-29 &	32nd Av	/e S (E. :		ersectio	on Delay	y (sec/v	eh)	17.9
		ocation			32nd Av 3 Appro		Side)				•	
	EB	ocation Approa		WE	3 Appro		Side)	Appro	ach		eh) Approa SBT	
Volume	EBL	Approa EBT	ech EBR	WBL	3 Appro WBT	ach WBR	Side) NB NBL	Approa NBT	ach NBR	SB	Approa	ach
Volume Delay Time/Veh. (s)	EBL 0	Approa EBT 1250	EBR 350	WBL 0	Appro WBT 758	wBR 882	Side) NB NBL 69	Approa NBT	ach NBR 146	SB	Approa	ach
Delay Time/Veh. (s)	EBL 0	Approa EBT 1250 3.7	EBR 350 2.0	WBL 0	Appro WBT 758 5.0	wBR 882 3.9	Side) NB NBL 69 35.1	Approa NBT 0	ach NBR 146 9.0	SB	Approa	ach
Delay Time/Veh. (s) Max Queue (ft)	EBL 0 0 0	Approa EBT 1250 3.7 428	EBR 350 2.0 294	WBL 0 0 0	758 5.0 231	wBR 882 3.9 51	NBL 69 35.1 153	Approx NBT 0 0	nBR 146 9.0 161	SB	Approa	ach
Delay Time/Veh. (s)	EBL 0	Approa EBT 1250 3.7	EBR 350 2.0	WBL 0	Appro WBT 758 5.0	wBR 882 3.9	NBL 69 35.1 153	Approa NBT 0 0 0	NBR 146 9.0 161	SB SBL	Approa SBT	sech SBR
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EBL 0 0 0 0 0	Approa EBT 1250 3.7 428 17	EBR 350 2.0 294 26	WBL 0 0 0 0 0	758 5.0 231	wBR 882 3.9 51	NBL 69 35.1 153 15	Approa NBT 0 0 0	NBR 146 9.0 161	SB	Approa SBT	ach
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EBL 0 0 0 0 Node L	Approa EBT 1250 3.7 428 17	EBR 350 2.0 294 26	WBL 0 0 0 0 0 0 0 1-29 &	3 Appro WBT 758 5.0 231 6	ach WBR 882 3.9 51 1	NBL 69 35.1 153 15 Int	Approa NBT 0 0 0 0 0	nsh NBR 146 9.0 161 9 on Delay	SB SBL / (sec/v	Approa SBT eh)	SBR 4.7
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EBL 0 0 0 0 Node L	Approa EBT 1250 3.7 428 17 ocation	EBR 350 2.0 294 26	WBL 0 0 0 0 0 0 0 1-29 &	758 5.0 231	ach WBR 882 3.9 51 1	NBL 69 35.1 153 15 Int	Approa NBT 0 0 0	nsh NBR 146 9.0 161 9 on Delay	SB SBL y (sec/v	Approa SBT eh)	ach SBR 4.7
Delay Time/Veh. (s) Max Queue (ft) Avg. Queue (ft)	EBL 0 0 0 0 Node L EBL	Approa EBT 1250 3.7 428 17 ocation Approa EBT	20 294 26 :	WBL 0 0 0 0 1-29 & WBL	Appro WBT 758 5.0 231 6 52nd Av Appro WBT	ach WBR 882 3.9 51 1 ve S (Waach WBR	NBL 69 35.1 153 15 Int Side)	Approx NBT 0 0 0 0 0 ersection	ach NBR 146 9.0 161 9 on Delay	SB SBL / (sec/v	Approa SBT eh)	A.7
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EBL 0 0 0 0 0 Node L EB EBL 0	Approa EBT 1250 3.7 428 17 ocation Approa EBT 217	20 294 26 :: ech EBR	WBL 0 0 0 0 1-29 & WBL 13	Appro WBT 758 5.0 231 6 52nd Av Appro WBT 83	ach WBR 882 3.9 51 1	NBL 69 35.1 153 15 Int Side)	Approx NBT 0 0 0 0 0 ersection	ach NBR 146 9.0 161 9 on Delay	SB SBL y (sec/v SB SBL 76	Approa SBT eh)	4.7 ach SBR
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EBL O O O O Node L EB EBL O O	Approa EBT 1250 3.7 428 17 ocation Approa EBT 217 3.6	2.0 2.0 2.94 2.6 :: ech EBR 8 2.2	WBL 0 0 0 0 0 1-29 & WBL 13 4.1	3 Appro WBT 758 5.0 231 6 52nd Av 3 Appro WBT 83 2.9	wBR 882 3.9 51 1 ve S (Waach WBR	NBL 69 35.1 153 15 Int Side)	Approx NBT 0 0 0 0 0 ersection	ach NBR 146 9.0 161 9 on Delay	SB SBL / (sec/v	Approa SBT eh) Approa SBT	4.7  ach SBR  4.7  ach SBR 28 1.1
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EBL 0 0 0 0 0 Node L EB EBL 0	Approa EBT 1250 3.7 428 17 ocation Approa EBT 217	20 294 26 :: ech EBR	WBL 0 0 0 0 1-29 & WBL 13	Appro WBT 758 5.0 231 6 52nd Av Appro WBT 83	ach WBR 882 3.9 51 1 ve S (Waach WBR 0	NBL 69 35.1 153 15 Int Side)	Approx NBT 0 0 0 0 0 ersection	ach NBR 146 9.0 161 9 on Delay	SB SBL (sec/v SB SBL 76 33.2	Approa SBT eh) Approa SBT 0	4.7 ach SBR
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL O O O O Node L EB EBL O O O	Approa EBT 1250 3.7 428 17 ocation Approa EBT 217 3.6 149	20 294 26 :: ach EBR 8 2.2	WBL 0 0 0 0 1-29 & WBL 13 4.1 98	3 Appro WBT 758 5.0 231 6 52nd Av 3 Appro WBT 83 2.9 98	ach WBR 882 3.9 51 1 ve S (Waach WBR 0 0	NBL  NBL  69  35.1  153  15  Int  Side)  NBL	Approx NBT 0 0 0 0 ersection	ach NBR 146 9.0 161 9 on Delay	SB SBL 76 33.2 172 17	Approa SBT eh) Approa SBT 0 0	4.7  ach SBR  4.7  ach SBR  73 0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL O O O Node L EB EBL O O O	Approa EBT 1250 3.7 428 17 cocation Approa EBT 217 3.6 149 4	EBR 350 2.0 294 26 :: ach EBR 8 2.2 0	WBL 0 0 0 0 1-29 & WBL 13 4.1 98	3 Appro WBT 758 5.0 231 6 52nd Av 3 Appro WBT 83 2.9 98 1	ach WBR 882 3.9 51 1 ve S (Waach WBR 0 0 0	NBL 69 35.1 153 15 Int Side) NBL	Approx NBT 0 0 0 0 ersection	ach NBR 146 9.0 161 9 on Delay	SB SBL 76 33.2 172	Approa SBT eh) Approa SBT 0 0	4.7 4.7 SBR 28 1.1 73
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL O O Node L EB EBL O O O O Node L	Approa EBT 1250 3.7 428 17 ocation Approa EBT 217 3.6 149 4	EBR 350 2.0 294 26 EBR 8 2.2 0 0	WBL 0 0 0 0 1-29 & WBL 13 4.1 98 1	3 Appro WBT 758 5.0 231 6 52nd Av 3 Appro WBT 83 2.9 98 1	ach WBR 882 3.9 51 1 ve S (Watch WBR 0 0 0 0 ve S (E.	NBL  69 35.1 153 15 Int Side) NBL	Approx NBT 0 0 0 0 ersection NBT	ach NBR 146 9.0 161 9 on Delay ach NBR	SB SBL 76 33.2 172 17 y (sec/v	Approa SBT eh) Approa SBT 0 0 0	4.7  4.7  SBR  28  1.1  73  0  8.6
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL O O O Node L EB EBL O O O O O EBB EBL EBL EBL EBB EBL EBB EBL EBB EBB	Approa EBT 1250 3.7 428 17 ocation Approa EBT 217 3.6 149 4	EBR 350 2.0 294 26 :: ach EBR 8 2.2 0 0 :: ach	WE WBL  0 0 0 0 1-29 & WE WBL 13 4.1 98 1	3 Appro WBT 758 5.0 231 6 52nd Av 3 Appro WBT 83 2.9 98 1	ach WBR 882 3.9 51 1 ve S (Wach WBR 0 0 0 0 ve S (E. ach	NBL 69 35.1 153 15 Int Side) NBL	Approx NBT 0 0 0 0 ersections Approx Approx	ach NBR 146 9.0 161 9 on Delay ach NBR	SB SBL 76 33.2 172 17 (sec/v	Approa SBT O O O O O O Approa	4.7  4.7  SBR  28  1.1  73  0  8.6
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EBL O O O Node L EB EBL O O O O S Rode L EB EBL EBL EBL EBL	Approa EBT 1250 3.7 428 17 ocation Approa EBT 3.6 149 4 ocation Approa EBT	EBR 350 2.0 294 26 EBR 8 2.2 0 0 C C C C C C C C C C C C C C C C C	WE WBL  0 0 0 0 1-29 & WE WBL 13 4.1 98 1	3 Appro WBT 758 5.0 231 6 52nd Av 3 Appro WBT 83 2.9 98 1 52nd Av 3 Appro WBT	wBR 882 3.9 51 1 ve S (Waach WBR 0 0 0	NBL  NBL  69  35.1  153  15  Int  Side)  NBL  Int  Side)  NBL	Approx NBT 0 0 0 0 ersection NBT Approx Approx NBT	ach NBR 146 9.0 161 9 on Delay ach NBR On Delay	SB SBL 76 33.2 172 17 y (sec/v	Approa SBT eh) Approa SBT 0 0 0	4.7  4.7  SBR  28  1.1  73  0  8.6
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL O O O O O O O O O O O O O O O O O O O	Approa EBT 1250 3.7 428 17 cocation Approa EBT 217 3.6 149 4 cocation Approa EBT	EBR 350 2.0 294 26 :: ach EBR 0 0 :: ach EBR 0	WE WBL  0 0 0 0 1-29 & WE WBL 13 4.1 98 1 1-29 & WE WBL 0	3 Appro WBT 758 5.0 231 6 52nd Av 3 Appro WBT 83 2.9 98 1 52nd Av 3 Appro WBT 71	ach WBR 882 3.9 51 1 ve S (Wach WBR 0 0 0 0 ve S (E. ach WBR 288	NBL Side) NBL 69 35.1 153 15 Int Side) NBL Int Side) NBL 25	Approx NBT 0 0 0 0 ersections Approx NBT Approx NBT	ach NBR 146 9.0 161 9 on Delay ach NBR On Delay ach NBR 17	SB SBL 76 33.2 172 17 (sec/v	Approa SBT O O O O O O Approa	4.7  4.7  SBR  28  1.1  73  0  8.6
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)	EBL 0 0 0 0 Node L EB EBL 0 0 0 Node L EB EBL 159 2.5	Approa EBT 1250 3.7 428 17 ocation Approa EBT 149 4 ocation Approa EBT 135 3.5	EBR 350 2.0 294 26 EBR 8 2.2 0 0 CE EBR 0	WE WBL  0 0 0 0 1-29 & WBL 13 4.1 98 1 1-29 & WE WBL 0 0	3 Appro WBT 758 5.0 231 6 52nd Av 3 Appro WBT 83 2.9 98 1 52nd Av 3 Appro WBT 71 2.4	ach WBR 882 3.9 51 1  ve S (Watch WBR 0 0 0 0 ve S (E. Sach WBR 288 3.6	NBL  69  35.1  153  15  Int  Side)  NBL  Int  Side)  NBL  25  28.8	Approx NBT 0 0 0 0 ersection Approx NBT Approx NBT 0 0	ach NBR 146 9.0 161 9 on Delay ach NBR NBR NBR 17 1.0	SB SBL 76 33.2 172 17 (sec/v	Approa SBT O O O O O O Approa	4.7  4.7  SBR  28  1.1  73  0  8.6
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EBL 0 0 0 0 0 Node L EB EBL 0 0 0 0 Node L EB EBL 159 2.5	Approa EBT 1250 3.7 428 17 cocation Approa EBT 217 3.6 149 4 cocation Approa EBT	EBR 350 2.0 294 26 :: ach EBR 0 0 :: ach EBR 0	WE WBL  0 0 0 0 1-29 & WE WBL 13 4.1 98 1 1-29 & WE WBL 0	3 Appro WBT 758 5.0 231 6 52nd Av 3 Appro WBT 83 2.9 98 1 52nd Av 3 Appro WBT 71	ach WBR 882 3.9 51 1 ve S (Wach WBR 0 0 0 0 ve S (E. ach WBR 288	NBL Side) NBL 69 35.1 153 15 Int Side) NBL Int Side) NBL 25	Approx NBT 0 0 0 0 ersections Approx NBT Approx NBT	ach NBR 146 9.0 161 9 on Delay ach NBR On Delay ach NBR 17	SB SBL 76 33.2 172 17 (sec/v	Approa SBT O O O O O O Approa	4.7  4.7  SBR  28  1.1  73  0  8.6

Intersection Delay (sec/veh)

Appendix D: 2008 PM Simulation Output (Network Performance, Travel Time, Freeway Queues)

#### **Network Performance**

Total Delay Time (hr)	535
Total Travel Time (hr)	4,223
Number of Active Vehicles	0
Number of Arrived Vehicles	52,959
Total Stopped Delay (hr)	190
Total Distance Traveled (mi)	193,612

#### **Queue Measurement**

Time	Tr	i-Level Mer	ge	I-9	4 WB (45th	St)
Time	Avg.	Max.	Stop	Avg.	Max.	Stop
PM Peak	184	2,027	454	19	439	49

#### **Travel Time (Network)**

			Trave	el Time (Ne	etwork)			
				Destir	ation			
			I-29	) SB	I-94	EB	I-29	NB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	13.0	3	14.8	10	15.5	2
	I-94 EB	1645-1700	13.1	3	14.8	10	14.1	1
		1700-1715	13.0	3	14.9	11	14.9	2
		1715-1730	13.0	3	14.8	10	15.6	2
			I-29	9 SB	I-94	WB	I-29	NB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	16.4	3	14.4	7	17.0	10
	I-94 WB	1645-1700	16.4	3	14.3	7	17.0	10
		1700-1715	16.5	3	14.4	8	17.1	11
Origin		1715-1730	16.5	4	14.3	8	17.1	11
Ori			I-94	WB	I-29	NB	I-94	EB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	13.7	3	15.8	17	15.9	4
	I-29 NB	1645-1700	13.7	3	15.8	17	15.9	4
		1700-1715	13.8	3	15.7	19	16.1	4
		1715-1730	13.9	3	15.7	19	16.1	4
			I-94	WB	I-29	SB	I-94	EB
		Time	TT (sec)	Vol	TT (sec)	Vol	TT (sec)	Vol
		1630-1645	14.8	2	16.5	6	17.9	5
	I-29 SB	1645-1700	14.2	2	16.4	5	18.0	5
		1700-1715	14.7	2	16.5	6	18.3	6
		1715-1730	14.9	2	16.5	6	18.4	6

## Appendix E: 2008 PM Simulation Output (Data Collection Points)

## I-29 Data Collection: 2008 PM Peak Hour

Southbound		CR	20		19	th Av	e. N		1	2th Av	/e. N			M	ain	Ave.			,	13th	Ave. S	}				I-94				;	32nd	l Ave.	. S		52nd	Ave	. S	
Distance (ft.)  Modeled Vol. (vph)  Simulated Vol. (vph)  Volume % Difference  Speed (mph)	8050	650 188	35 1150	7550 784 785 0% 74.6	570	1015 10	030 104	135: 135: 135: 0%	3	835	840 7	24	240 4 457 462 0%	55 735	23	30 121	5 7	740 1230 3406 3411 0% 50.2	945 5	550	230	3200	3607 3610 0% 57.3	640 1	300 6	640 1	150 28	85	2325 2061 2060 0% 58.4	285	950	1395 6	625	7200 1047 1039 -1% 58.3	770 1	645	510 19	00
# of Lanes Density (pc/mi/ln) Level of Service				2 6 A				3 9 A					3 17 B					3 27 C		S	South		4 19 B						4 10 B					2 10 B				
			ــر7			٠, ۲	7,-		<b>\</b>	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	(7,			_\^(	~		7,			<u> </u>							7,					<u></u> フ,						
Northbound	/	_/_	7_		ر کسر	<u>ን</u>	<u>\</u>		مہر	ΔΣ						· <u>&gt; ·</u>	7_		<b></b> ي اسر	1	North				ک_	C	<u> </u>			v-1	<u>,                                      </u>	<u> </u>			المراس			
Distance (ft.) Modeled Vol. (vph) Simulated Vol. (vph) Volume % Difference	8050	CR 650 188		7140 1153 1168 1%		9th Av		164 165 1%	5 830 1 3	2th Av		20	190 5 047 060			Ave.		2159 2174 1%			Ave. S		2786 2789 0%	260	910 5	I-94		260 99	1922 1917 0%	255		305 8			52nd			575
Speed (mph) # of Lanes Density (pc/mi/ln) Level of Service				74.4 2 9 A				58.6 3 11 B					8.4 3 14 B					58.5 3 15 B					58.9 4 14 B						58.7 3 13 B					59.2 2 9 A				

Note: Density values were adjusted using the following data: Peak-hour factor = .87

Heavy vehicle percent = 5

This data increased the original density by 15%.

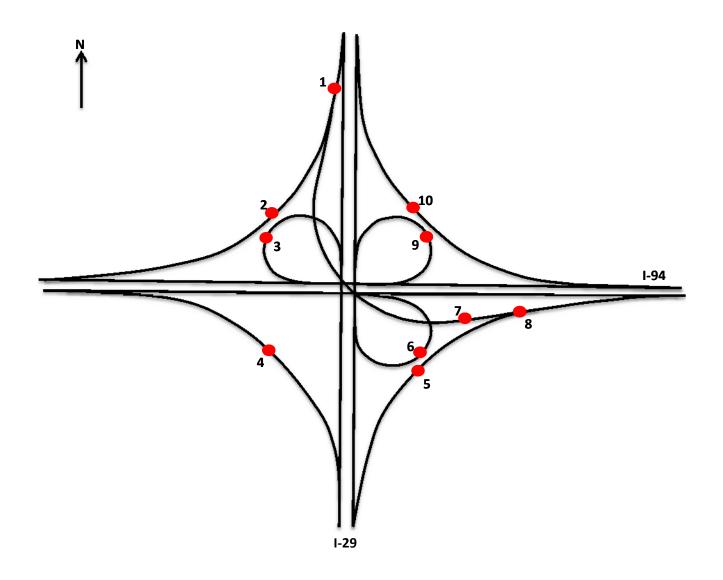
## I-94 Data Collection: 2008 PM Peak Hour

Eastbound	Main Ave.	Sheyenne St.	45th St.	I-29	25th St.	University Dr.	TH 75 20th St.	. Main Ave. MN 336
Distance (ft.) Modeled Vol. (vph) Simulated Vol. (vph) Volume % Difference Speed (mph) # of Lanes Density (pc/mi/ln) Level of Service	2660 575 1005 1440 11770 589 591 0% 74.9 2 5	755 2050 1040 7520 1000 1008 1% 74.4 2 8 A	705 930 1450 615 1570 760  2411  2414  0%  57.9  25  C		795 930 990 2610 9 0 3609 1 3609 0 4 58.2 3	960 740 1050 1125 4225 3795 3803 0% 57 3 26 C	520     2005     840     1740     455     56       2300     18       2321     18       1%     2       57.1     5       2     24     1	345 285 1035 615 16635 710 1365 1080 2170 378 1161 378 1168 378 1168 379 370 370 370 370 370 370 370 370 370 370
	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		_\\(\alpha\)		
Westbound					West	کردے۔	V-1	
Distance (ft.) Modeled Vol. (vph) Simulated Vol. (vph) Volume % Difference Speed (mph) # of Lanes Density (pc/mi/ln) Level of Service	75.1 2 2	Sheyenne St.    1035   835   870   260   785   810   121   122   136   146   1	6 2380 4 2399 1 1% 1 55.2 2 26	I-29  1490 440 535 945 650 1555 3147 3165 1% 57.6 3 22 C	7 3157 5 3177 1 1% 6 58.4 3 21	University Dr.  700 470 490 505 1170 4225  3028  3049  1%  58.3  3  20  C	1876 14 1908 14 2% 2 57.9 5 2	Main Ave. MN 336    Main Ave.   MN 336   MN 336

Note: Density values were adjusted using the following data: Peak-hour factor = .87

Heavy vehicle percent = 5

This data increased the original density by 15%.



2008 PM: Data Collection Points (I-29/I-94 Interchange)

	1	2	3	4	5	6	7	8	9	10
Modeled Vol. (vph)	2139	604	390	203	471	354	1542	2013	154	1135
Simulated Vol. (vph)	2147	607	392	202	472	357	1541	2014	156	1143
Volume % Difference	0%	1%	1%	0%	0%	1%	0%	0%	1%	1%
Speed (mph)	56	54	25	55	54	25	50	47	25	53
# of Lanes	2	1	1	1	1	1	1	1	1	1
Density (pc/mi/ln)	23	13	19	4	10	17	36	51	7	25

This data increased the original density by 15%.

Appendix F:	2008 PM	<b>Simulation</b>	Output	(Node	<b>Evaluations</b> )
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2008 PM Peak - Ramp 1												
	Node L	ocation	ı:	I-94 &	Sheyen	ne St (N	l. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ich
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume			473		0	526	27	389	0	0	830	59
Delay Time/Veh. (s)			19.4		0	7.2	5.5	0.4	0	0	1.7	1.0
Max Queue (ft)			563		0	483	0	0	0	0	0	0
Avg. Queue (ft)			106		0	42	0	0	0	0	0	0
							Int	ersectio	n Delay	y (sec/v	eh)	6.4
	Node L	ocation	ı:	I-94 &	Sheyen	ne St (S	. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ich
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	20	0	57				0	396	220	271	1032	0
Delay Time/Veh. (s)	23.2	0	14.4				0.0	1.2	1.3	4.8	0.4	0
Max Queue (ft)	91	0	91				0	0	0	227	75	0
Avg. Queue (ft)	0	0	0				0	0	0	10	0	0
							Int	ersectio	on Delay	y (sec/v	eh)	1.9
	Node L	ocation	ı:	I-94 &	45th St	(N. Side	<u>e)</u>					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ich
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				472	0	1055	92	1079	0	0	2046	247
Delay Time/Veh. (s)				50.3	0	15.6	40.1	20.0	0	0	84.1	123.2
Max Queue (ft)				1663	0	1839	190	474	0	0	3472	3476
Avg. Queue (ft)				172	0	155	24	77	0	0	2920	2604
								ersectio	n Delay	y (sec/v	eh)	53.7
·		ocation		I-94 &	45th St	(S. Side		ersectio	n Delay	y (sec/v	eh)	53.7
	EB	Approa	ach	WE	3 Appro	ach	) NB	Appro	ach	SB	Approa	ich
	EBL	Approa EBT	ech EBR			•	)	Approa NBT	ach NBR		Approa SBT	ich SBR
Volume	EB EBL 145	Approa EBT 0	ech EBR 64	WE	3 Appro	ach	) NB	Approa NBT 1035	ach NBR 426	SB SBL 0	Approa SBT 1337	sBR 1193
Delay Time/Veh. (s)	EBL 145 46.5	Approa EBT 0	ech EBR	WE	3 Appro	ach	) NBL	Approa NBT 1035 4.4	nch NBR 426 6.0	SB SBL	Approa SBT 1337 11.7	sBR 1193 8.1
Delay Time/Veh. (s) Max Queue (ft)	EBL 145 46.5 243	Approa EBT 0 0	EBR 64 5.7 109	WE	3 Appro	ach	) NBL 0 0	Approx NBT 1035 4.4 327	nech NBR 426 6.0 327	SB SBL 0 0 0	Approa SBT 1337 11.7 630	sch SBR 1193 8.1 1115
Delay Time/Veh. (s)	EBL 145 46.5	Approa EBT 0	EBR 64 5.7	WE	3 Appro	ach	) NB NBL 0 0 0	Approa NBT 1035 4.4 327 25	Ach NBR 426 6.0 327 25	SB SBL 0 0	Approa SBT 1337 11.7 630 49	SBR 1193 8.1 1115 204
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 145 46.5 243 46	Approa EBT 0 0 0	EBR 64 5.7 109	WBL	Appro WBT	wbr	)  NBL  0  0  0  Int	Approa NBT 1035 4.4 327 25	Ach NBR 426 6.0 327 25	SB SBL 0 0 0	Approa SBT 1337 11.7 630 49	sch SBR 1193 8.1 1115
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 145 46.5 243 46 Node L	Approa EBT 0 0 0	EBR 64 5.7 109 1	WBL	3 Appro WBT 25th St	ach WBR	)  NBL  0  0  0  Int	Approa NBT 1035 4.4 327 25	Ach NBR 426 6.0 327 25	SB SBL 0 0 0 0	Approa SBT 1337 11.7 630 49	SBR 1193 8.1 1115 204
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 145 46.5 243 46 Node L	Approa EBT 0 0 0 0 0	EBR 64 5.7 109 1	WEL  I-94 &  WE	3 Appro WBT 25th St 3 Appro	wBR WBR (N. Side	)  NBL  0  0  0  Intext	Approa NBT 1035 4.4 327 25 ersection	ach NBR 426 6.0 327 25 on Delay	SB SBL 0 0 0 0 y (sec/v	Approa SBT 1337 11.7 630 49 eh)	sch SBR 1193 8.1 1115 204 9.4
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EB EBL 145 46.5 243 46 Node L	Approa EBT 0 0 0	EBR 64 5.7 109 1	I-94 & WE	25th St WBT	(N. Side	)  NBL  0  0  0  Int  E)  NBL	Approa NBT 1035 4.4 327 25 ersection	Ach NBR 426 6.0 327 25 on Delay	SB SBL 0 0 0 0 (sec/v	Approa SBT 1337 11.7 630 49 eh)	sch SBR 1193 8.1 1115 204 9.4 sch SBR
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL 145 46.5 243 46 Node L	Approa EBT 0 0 0 0 0	EBR 64 5.7 109 1	I-94 & WBL 263	25th St WBT WBT 25th St WBT 0	(N. Side ach WBR	)  NBL  0  0  0  Intel e)  NBL  0	Approa NBT 1035 4.4 327 25 ersection Approa NBT 948	ach NBR 426 6.0 327 25 on Delay ach NBR 330	SB SBL 0 0 0 0 v (sec/v	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413	sch SBR 1193 8.1 1115 204 9.4 sch SBR 144
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EB EBL 145 46.5 243 46 Node L	Approa EBT 0 0 0 0 0	EBR 64 5.7 109 1	I-94 & WE WBL 263 47.6	25th St WBT 25th St Appro WBT 0	(N. Side ach WBR 226 8.3	NBL 0 0 0 0 0 Int e) NBL 0	Approa NBT 1035 4.4 327 25 ersection Approa NBT 948 9.5	ach NBR 426 6.0 327 25 on Delay ach NBR 330 1.8	SB SBL 0 0 0 0 0 y (sec/v SB SBL 0	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413 14.3	sch SBR 1193 8.1 1115 204 9.4 ech SBR 144 13.9
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL 145 46.5 243 46  Node L EB EBL	Approa EBT 0 0 0 0 0	EBR 64 5.7 109 1	I-94 & WBL WBL 263 47.6 389	25th St 3 Appro WBT 0 0.0 389	(N. Side ach WBR 226 8.3 170	)  NBL  0  0  0  Intel  NBL  0  0  O  O  O  O  O  O  O  O  O  O  O	Approx NBT 1035 4.4 327 25 ersection Approx NBT 948 9.5 345	ach NBR 426 6.0 327 25 on Delay ach NBR 330 1.8 114	SB SBL 0 0 0 (sec/v SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413 14.3 773	sch SBR 1193 8.1 1115 204 9.4 SBR 144 13.9 773
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EBL 145 46.5 243 46  Node L EB EBL	Approa EBT 0 0 0 0 0	EBR 64 5.7 109 1	I-94 & WE WBL 263 47.6	25th St WBT 25th St Appro WBT 0	(N. Side ach WBR 226 8.3	NBL O O O O Int E) NBL O O O	Approx NBT 1035 4.4 327 25 ersection Approx NBT 948 9.5 345 36	ach NBR 426 6.0 327 25 on Delay ach NBR 330 1.8 114	SB SBL 0 0 0 SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413 14.3 773 111	sch SBR 1193 8.1 1115 204 9.4 SBR 144 13.9 773 111
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL 145 46.5 243 46 Node L EB EBL	Approa EBT 0 0 0 0 ocation Approa EBT	EBR 64 5.7 109 1 1 :: ach EBR	I-94 & WBL 263 47.6 389 85	25th St 3 Appro WBT 0 0.0 389 85	(N. Side ach WBR 226 8.3 170 11	)  NBL  0  0  0  Intel  NBL  0  0  Intel  In	Approx NBT 1035 4.4 327 25 ersection Approx NBT 948 9.5 345 36	ach NBR 426 6.0 327 25 on Delay ach NBR 330 1.8 114	SB SBL 0 0 0 (sec/v SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413 14.3 773 111	sch SBR 1193 8.1 1115 204 9.4 SBR 144 13.9 773
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL 145 46.5 243 46 Node L EB EBL Node L	Approa EBT 0 0 0 0 ocation Approa EBT	EBR 64 5.7 109 1 1	I-94 & WE WBL 263 47.6 389 85	25th St 3 Appro WBT 0 0.0 389 85	(N. Side ach WBR 226 8.3 170 11	)  NBL  0  0  0  Int  2)  NBL  0  0  Int  1)	Approa NBT 1035 4.4 327 25 ersection Approa NBT 948 9.5 345 36 ersection	ach NBR 426 6.0 327 25 on Delay ach NBR 330 1.8 114 0 on Delay	SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413 14.3 773 111 eh)	nch SBR 1193 8.1 1115 204 9.4 nch SBR 144 13.9 773 111 13.9
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL 145 46.5 243 46 Node L EB EBL	Approa EBT 0 0 0 0 ocation Approa ocation Approa	EBR 64 5.7 109 1 :: ach EBR	I-94 & WE WBL 263 47.6 389 85	25th St 3 Appro WBT 25th St 3 Appro 0 0.0 389 85 25th St 3 Appro	(N. Side ach WBR 226 8.3 170 11 (S. Side ach	NBL 0 0 0 0 Int e) NBL 0 0 Int 0 NBL 0 NBL 0 NBL 0 NBL 0 NBL	Approa NBT 1035 4.4 327 25 ersection Approa 9.5 345 36 ersection	ach NBR 426 6.0 327 25 on Delay ach NBR 330 1.8 114 0 on Delay	SB SBL 0 0 0 (sec/v SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413 14.3 773 111 eh)	nch SBR 1193 8.1 1115 204 9.4 9.4 13.9 773 111 13.9
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EBL 145 46.5 243 46  Node L EB EBL  Node L EB	Approa EBT 0 0 0 0 ocation Approa Cocation Approa	EBR 64 5.7 109 1 :: ach EBR	I-94 & WBL 263 47.6 389 85 I-94 & WE	25th St 3 Appro WBT 0 0.0 389 85 25th St 3 Appro WBT	(N. Side ach WBR 226 8.3 170 11 (S. Side ach WBR	)  NBL  0  0  0  Int e)  NBL  0  0  Int e)  NBL  0  NBL  0  NBL  NBL  NBL  NBL  NB	Approa NBT 1035 4.4 327 25 ersection NBT 948 9.5 345 36 ersection NBT	ach NBR 426 6.0 327 25 on Delay ach NBR 330 1.8 114 0 on Delay	SB SBL 0 0 0 0 y (sec/v SB SBL 0 0 0 y (sec/v	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413 14.3 773 111 eh)	sch SBR 1193 8.1 1115 204 9.4 sch SBR 144 13.9 773 111 13.9
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL   Node L   EB EBL    Node L   EB EBL    Node L   EB EBL    144	Approa EBT 0 0 0 0 ocation Approa EBT ocation Approa EBT	EBR 64 5.7 109 1 1 EBR EBR EBR EBR EBR EBR EBR 351	I-94 & WE WBL 263 47.6 389 85 I-94 & WE WBL 57	25th St 3 Appro 25th St 3 Appro 0 0.0 389 85 25th St 3 Appro WBT 50	(N. Side ach WBR 226 8.3 170 11 (S. Side ach WBR 331	)  NBL  0  0  0  Int  NBL  0  0  Int  NBL  0  NBL  0  NBL  0  NBL  NBL  183	Approx NBT 1035 4.4 327 25 ersection NBT 948 9.5 345 36 ersection Approx NBT 808	ach NBR 426 6.0 327 25 on Delay ach NBR 330 1.8 114 0 on Delay ach NBR 45	SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413 14.3 773 111 eh) Approa SBT	nch SBR 1193 8.1 1115 204 9.4 9.4 13.9 773 111 13.9 nch SBR 288
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EB EBL 145  Node L EB EBL 144  49.1	Approa EBT 0 0 0 ocation Approa EBT 276 55.2	EBR 64 5.7 109 1 1	I-94 & WBL 263 47.6 389 85 I-94 & WBL 57 46.6	25th St 3 Appro WBT 0 0.0 389 85 25th St 3 Appro WBT 50 43.6	(N. Side ach WBR 226 8.3 170 11 (S. Side ach WBR 331 11.2	)  NBL  0  0  0  Intel e)  NBL  0  0  Intel e)  NBL  0  Intel e)  NBL  183  27.1	Approx NBT 1035 4.4 327 25 ersection Approx NBT 948 9.5 345 36 ersection Approx NBT 808 21.7	ach NBR 426 6.0 327 25 on Delay ach NBR 330 1.8 114 0 on Delay ach NBR 45 19.6	SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413 14.3 773 111 eh) Approa SBT 1052 14.7	ach SBR 1193 8.1 1115 204 9.4 6ch SBR 144 13.9 773 111 13.9 6ch SBR 288 4.0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL    Node L    EB EBL    Node L    EB EBL    Node L    EB EBL    144   49.1   965	Approa EBT 0 0 0 0 ocation Approa EBT ocation Approa EBT	EBR 64 5.7 109 1 1 EBR EBR EBR EBR EBR EBR EBR 351	I-94 & WE WBL 263 47.6 389 85 I-94 & WE WBL 57	25th St 3 Appro 25th St 3 Appro 0 0.0 389 85 25th St 3 Appro WBT 50	(N. Side ach WBR 226 8.3 170 11 (S. Side ach WBR 331	)  NBL  0  0  0  Int  NBL  0  0  Int  NBL  0  NBL  0  NBL  0  NBL  NBL  183	Approx NBT 1035 4.4 327 25 ersection NBT 948 9.5 345 36 ersection Approx NBT 808	ach NBR 426 6.0 327 25 on Delay ach NBR 330 1.8 114 0 on Delay ach NBR 45	SB SBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	Approa SBT 1337 11.7 630 49 eh) Approa SBT 1413 14.3 773 111 eh) Approa SBT	nch SBR 1193 8.1 1115 204 9.4 9.4 13.9 773 111 13.9 nch SBR 288

Intersection Delay (sec/veh)

•		ii Data										
	Node L	ocation	ı:	I-94 &	Univers	ity Dr (1	N. Side)					
	EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ich
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				353	0	186	0	1098	283	0	1639	379
Delay Time/Veh. (s)				44.7	0	6.8	0	2.8	0.8	0	5.6	2.9
Max Queue (ft)				268	0	175	0	189	166	0	498	1351
Avg. Queue (ft)				64	0	17	0	10	0	0	40	200
							Int	ersectio	n Delay	/ (sec/v	eh)	7.7
	Node L	ocation	ı:	I-94 &	Univers	ا ity Dr (S	S. Side)				•	
		Approa			3 Appro			Approa	ach	SB	Approa	nch
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	344	0	327				0	1041	541	0	1673	313
Delay Time/Veh. (s)	41.5	0	11.2				0	7.9	0.9	0	9.7	0.7
Max Queue (ft)		0	242				0	294	0.5	0	480	290
Avg. Queue (ft)	103	0	29				0	28	0	0	56	18
Avg. Queue (It)	103	U	23					ersectio				10.2
	Node L	ocation		1048	0+h C+/7	l H75 (N		ersectio	ni Dela	/ (3EC/ V	enj	10.2
Ī	_							A 10 10 11 0 1	- ala	CD	A 10 10 11 0 0	ala
		Approa		WBL	Appro WBT		NBL	Approa	NBR	SBL	Approa SBT	
V 1	EBL	EBT	EBR			WBR		NBT				SBR
Volume				127	0	96	449	1443	0	0	904	910
Delay Time/Veh. (s)				30.6	0	10.3	25.9	6.0	0	0	24.0	15.4
Max Queue (ft)				203	0	126	666	616	0	0	1063	1351
Avg. Queue (ft)				25	0	3	104	35	0	0	126	200
										, ,		
								ersectic	n Delay	/ (sec/v	eh)	15.5
	Node L					H75 (S.	Side)				Í	
	EB	Approa	ach	WE	3 Appro	ach	Side) NB	Approa	ach	SB	Approa	ıch
	EBL		ech EBR				Side)	Approa NBT		SB SBL	Approa SBT	
Volume	EB EBL 935	Approa EBT 0	ech EBR 799	WE	3 Appro	ach	Side) NB NBL 0	Approa NBT 954	nch NBR 114	SB SBL 136	Approa SBT 895	sch SBR 0
Delay Time/Veh. (s)	EBL 935 24.7	Approa EBT 0 0	EBR 799 47.9	WE	3 Appro	ach	Side) NB NBL	Approa NBT 954 25.3	nch NBR 114 4.2	SB SBL 136 23.8	Approa SBT 895 12.0	sch SBR 0
Delay Time/Veh. (s) Max Queue (ft)	EBL 935 24.7 548	Approa EBT 0 0	ech EBR 799	WE	3 Appro	ach	Side) NB NBL 0	Approa NBT 954	nch NBR 114 4.2 129	SB SBL 136	Approa SBT 895	sch SBR 0
Delay Time/Veh. (s)	EBL 935 24.7 548	Approa EBT 0 0	EBR 799 47.9	WE	3 Appro	ach	Side)  NB  NBL  0  0  0	Approa NBT 954 25.3 532 115	NBR 114 4.2 129 3	SB SBL 136 23.8 209 16	Approa SBT 895 12.0 409	SBR 0 0 0
Delay Time/Veh. (s) Max Queue (ft)	EBL 935 24.7 548 90	Approa EBT 0 0 0	EBR 799 47.9 2387	WBL	Appro WBT	wBR	Side)  NBL  0  0  0  Int	Approx NBT 954 25.3 532	NBR 114 4.2 129 3	SB SBL 136 23.8 209 16	Approa SBT 895 12.0 409	SBR 0 0
Delay Time/Veh. (s) Max Queue (ft)	EBL 935 24.7 548	Approa EBT 0 0 0	EBR 799 47.9 2387	WBL	Appro WBT	ach	Side)  NBL  0  0  0  Int	Approa NBT 954 25.3 532 115 ersectio	NBR 114 4.2 129 3 on Delay	SB SBL 136 23.8 209 16	Approa SBT 895 12.0 409	SBR 0 0 0
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 935 24.7 548 90	Approa EBT 0 0 0	EBR 799 47.9 2387 0	WBL	Appro WBT	ach WBR	Side)  NBL  0  0  0  Int	Approa NBT 954 25.3 532 115	NBR 114 4.2 129 3 on Delay	SB SBL 136 23.8 209 16 / (sec/v	Approa SBT 895 12.0 409	0 0 0 0 0 26.1
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 935 24.7 548 90	Approa EBT 0 0 0	EBR 799 47.9 2387 0	WBL	Appro WBT	ach WBR	Side)  NBL  0  0  0  Int	Approa NBT 954 25.3 532 115 ersectio	NBR 114 4.2 129 3 on Delay	SB SBL 136 23.8 209 16 / (sec/v	Approa SBT 895 12.0 409 43 eh)	0 0 0 0 0 26.1
Delay Time/Veh. (s) Max Queue (ft)	EB EBL 935 24.7 548 90 Node L	Approa EBT 0 0 0 0 0 ocation	EBR 799 47.9 2387 0	WE WBL	Appro WBT WBT 20th St	WBR WBR (N. Side	Side)  NBL  0  0  0  Interest	Approa NBT 954 25.3 532 115 ersection	nach NBR 114 4.2 129 3 on Delay	SB SBL 136 23.8 209 16 / (sec/ve	Approa SBT 895 12.0 409 43 eh)	0 0 0 0 0 26.1
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EB EBL 935 24.7 548 90 Node L	Approa EBT 0 0 0 0 0 ocation	EBR 799 47.9 2387 0	I-94 & WE	20th St WBT	(N. Side	Side)  NBL  0  0  0  Inter  NBL	Approa NBT 954 25.3 532 115 ersection	nch NBR 114 4.2 129 3 on Delay ach NBR	SB SBL 136 23.8 209 16 / (sec/v	Approa SBT 895 12.0 409 43 eh)	och SBR 0 0 0 0 26.1
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL 935 24.7 548 90 Node L	Approa EBT 0 0 0 0 0 ocation	EBR 799 47.9 2387 0	I-94 & WBL 7	20th St WBT WBT 20th St 3 Appro WBT	(N. Side	Side)  NBL  0  0  0  Intel  NBL  NBL  106	Approa NBT 954 25.3 532 115 ersection Approa NBT 600	ach NBR 114 4.2 129 3 on Delay ach NBR 20	SB SBL 136 23.8 209 16 / (sec/v	Approa SBT 895 12.0 409 43 eh) Approa SBT 318	0 0 0 0 26.1
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EBL 935 24.7 548 90 Node L EB EBL	Approa EBT 0 0 0 0 0 ocation	EBR 799 47.9 2387 0	I-94 & WBL 7 7.3	20th St WBT WBT 20th St 3 Appro WBT 7 9.8	(N. Side ach WBR	Side)  NBL  0  0  0  Interval    NBL  106  2.3	Approa NBT 954 25.3 532 115 ersection Approa NBT 600 0.7	ach NBR 114 4.2 129 3 on Delay ach NBR 20 0.5	SB SBL 136 23.8 209 16 / (sec/v SB SBL 12 4.7	Approa SBT 895 12.0 409 43 eh) Approa SBT 318 1.1	och SBR 0 0 0 0 26.1 och SBR 310 1.8
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL 935 24.7 548 90 Node L EB EBL	Approa EBT 0 0 0 0 0 ocation	EBR 799 47.9 2387 0	I-94 & WBL 7 7.3 0	20th St 3 Appro WBT 20th St 3 Appro WBT 7 9.8 0	(N. Side ach WBR 13 8.7 0	Side)  NBL  0  0  0  Interval    NBL  106  2.3  306  21	Approa NBT 954 25.3 532 115 ersection Approa NBT 600 0.7 306	ach NBR 114 4.2 129 3 on Delay ach NBR 20 0.5 306 21	SB SBL 136 23.8 209 16 (sec/vi) SB SBL 12 4.7 0 0	Approa SBT 895 12.0 409 43 eh) Approa SBT 318 1.1 0	0 0 0 0 26.1 ach SBR 310 1.8
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL 935 24.7 548 90 Node L EB EBL	Approa EBT 0 0 0 0 ocation Approa EBT	EBR 799 47.9 2387 0	I-94 & WBL 7 7.3 0 0	20th St 3 Appro 20th St 3 Appro WBT 7 9.8 0	(N. Side ach WBR 13 8.7 0	Side)  NBL  0  0  0  Intel  NBL  106  2.3  306  21  Intel  Intel	Approa NBT 954 25.3 532 115 ersection Approa NBT 600 0.7 306 21	ach NBR 114 4.2 129 3 on Delay ach NBR 20 0.5 306 21	SB SBL 136 23.8 209 16 (sec/vi) SB SBL 12 4.7 0 0	Approa SBT 895 12.0 409 43 eh) Approa SBT 318 1.1 0	och SBR 0 0 0 0 26.1 och SBR 310 1.8 0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL 935 24.7 548 90 Node L EB EBL Node L	Approa EBT 0 0 0 0 ocation Approa EBT	EBR 799 47.9 2387 0 ::	I-94 & WBL 7 7.3 0 0	20th St 3 Appro 20th St 3 Appro WBT 7 9.8 0	(N. Side ach WBR 13 8.7 0 0 (S. Side	Side)  NBL  0  0  0  Int. e)  NBL  106  2.3  306  21  Int. )	Approa NBT 954 25.3 532 115 ersection Approa NBT 600 0.7 306 21	ach NBR 114 4.2 129 3 on Delay ach NBR 20 0.5 306 21 on Delay	SB SBL 136 23.8 209 16 / (sec/vi	Approa SBT 895 12.0 409 43 eh) Approa SBT 318 1.1 0	och SBR 0 0 0 0 26.1 och SBR 310 1.8 0 0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EB EBL 935 24.7 548 90 Node L EB EBL Node L	Approa EBT 0 0 0 0 ocation Approa EBT	EBR 799 47.9 2387 0 ::	I-94 & WBL 7 7.3 0 0	20th St 3 Appro 20th St 3 Appro WBT 7 9.8 0 0	(N. Side ach WBR 13 8.7 0 0 (S. Side	Side)  NBL  0  0  0  Int. e)  NBL  106  2.3  306  21  Int. )	Approa NBT 954 25.3 532 115 ersection Approa NBT 600 0.7 306 21 ersection	ach NBR 114 4.2 129 3 on Delay ach NBR 20 0.5 306 21 on Delay	SB SBL 136 23.8 209 16 / (sec/vi	Approa SBT 895 12.0 409 43 eh) Approa SBT 318 1.1 0 0 eh)	och SBR 0 0 0 0 26.1 och SBR 310 1.8 0 0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EB EBL 935 24.7 548 90 Node L EB EBL EBL EBL	Approa EBT 0 0 0 0 ocation Approa EBT	EBR 799 47.9 2387 0	I-94 & WE WBL 7 7.3 0 0 U I-94 & WE	20th St 3 Appro 20th St 3 Appro 9.8 0 0	(N. Side ach WBR 13 8.7 0 0 (S. Side ach	Side)  NBL  0  0  0  Interview  NBL  106  2.3  306  21  Interview  NBL	Approa NBT 954 25.3 532 115 ersection Approa NBT 600 0.7 306 21 ersection Approa Approa Approa	ach NBR 114 4.2 129 3 on Delay ach NBR 20 0.5 306 21 on Delay ach NBR	SB SBL 136 23.8 209 16 (sec/vi) SBL 12 4.7 0 0 (sec/vi) SBL SBL SBL SBL SBL SBL SBL SBL SBL	Approa SBT 12.0 409 43 eh)  Approa SBT 318 1.1 0 0 eh)  Approa SBT	ach SBR 0 0 0 0 26.1  ach SBR 310 1.8 0 0 1.3
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL 935 24.7 548 90  Node L EB EBL   Node L EB EBL   1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	Approa EBT 0 0 0 0 ocation Approa EBT 0	EBR 799 47.9 2387 0	I-94 & WE WBL 7 7.3 0 0 U I-94 & WE	20th St 3 Appro 20th St 3 Appro 9.8 0 0	(N. Side ach WBR 13 8.7 0 0 (S. Side ach	Side)  NBL  0  0  0  Interval    NBL  106  2.3  306  21  Interval    NBL	Approa NBT 954 25.3 532 115 ersection Approa 0.7 306 21 ersection Approa Approa Approa Approa NBT 413	ach NBR 114 4.2 129 3 on Delay ach NBR 20 0.5 306 21 on Delay	SB SBL 136 23.8 209 16 / (sec/v) SB SBL 12 4.7 0 0 / (sec/v) SB	Approa SBT 895 12.0 409 43 eh) Approa SBT 318 1.1 0 0 eh)	ach SBR 0 0 0 0 26.1 SBR 310 1.8 0 0 1.3 SBR 0 0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EB EBL 935 24.7 548 90  Node L EB EBL   Node L EB EBL   12.8	Approa EBT 0 0 0 ocation Approa EBT 0	EBR 799 47.9 2387 0	I-94 & WE WBL 7 7.3 0 0 U I-94 & WE	20th St 3 Appro 20th St 3 Appro 9.8 0 0	(N. Side ach WBR 13 8.7 0 0 (S. Side ach	Side)  NBL  0  0  0  Intel  NBL  106  2.3  306  21  Intel  NBL  0  0  O  O  O  O  O  O  O  O  O  O  O	Approa NBT 954 25.3 532 115 ersection Approa NBT 600 0.7 306 21 ersection Approa Approa NBT 413 10.0	ach NBR 114 4.2 129 3 on Delay ach NBR 20 0.5 306 21 on Delay ach NBR 0 0	SB SBL 136 23.8 209 16 / (sec/vi	Approa SBT 895 12.0 409 43 eh) Approa SBT 318 1.1 0 0 eh) Approa SBT 318 1.1	ach SBR 0 0 0 0 26.1  ach SBR 310 1.8 0 0 1.3  ach SBR 0 0
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EB EBL 935 24.7 548 90  Node L EB EBL    EBL    12.8 273	Approa EBT 0 0 0 0 ocation Approa EBT 0	EBR 799 47.9 2387 0	I-94 & WE WBL 7 7.3 0 0 U I-94 & WE	20th St 3 Appro 20th St 3 Appro 9.8 0 0	(N. Side ach WBR 13 8.7 0 0 (S. Side ach	Side)  NBL  0  0  0  Int  NBL  106  2.3  306  21  Int  NBL  0	Approa NBT 954 25.3 532 115 ersection Approa 0.7 306 21 ersection Approa Approa Approa Approa NBT 413	ach NBR 114 4.2 129 3 on Delay ach NBR 20 0.5 306 21 on Delay ach NBR 0	SB SBL 136 23.8 209 16 / (sec/v) SB SBL 12 4.7 0 0 / (sec/v) SB SBL 0	Approa SBT 895 12.0 409 43 eh) Approa SBT 318 1.1 0 0 eh)	ach SBR 0 0 0 0 26.1  ach SBR 310 1.8 0 0 1.3  ach SBR 0

Intersection Delay (sec/veh)

Avg. Queue (ft)

	Node L	ocation	:	I-94 &	Main A	ve (N. Si	ide)					
	EB	Approa	ich	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	nch
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	37	13	17	175	325	26	179	313	595	33	321	241
Delay Time/Veh. (s)	36.6	40.5	10.4	28.5	36.4	7.1	46.9	25.0	17.9	48.1	23.5	8.7
Max Queue (ft)	121	113	0	243	385	385	661	932	434	110	326	0
Avg. Queue (ft)	8	3	0	30	80	80	66	116	10	9	47	0
							Int	ersectic	n Delay	/ (sec/v	eh)	25.1
	Node L	ocation	:	I-94 &	Main A	/e (S. Si	de)					
		Approa			3 Appro			Approa			Approa	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	658	0	165				0	429	0	0	400	112
Delay Time/Veh. (s)	25.3	0	13.0				0	20.8	0	0	23.7	14.6
Max Queue (ft)		0	174				0	434	0	0	535	229
Avg. Queue (ft)	154	0	6				0	54	0	0	83	2
								ersectic	n Delay	/ (sec/v	eh)	22.0
		ocation			MN 336	-						
		Approa			3 Appro			Approa			Approa	ich
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				1	0	13	25	532	0	0	78	283
Delay Time/Veh. (s)				5.2	0	7.1	0.6	0.2	0	0	0.7	1.5
Max Queue (ft)				0	0	78	0	0	0	0	0	0
Avg. Queue (ft)				0	0	1	0	0	0	0	0	0
								ersectio	n Delay	/ (sec/v	eh)	8.0
,	Node L	ocation	:	I-94 &	MN 336	(S. Sid	e)					
		Approa			3 Appro			Approa			Approa	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume				17	0	506	0	51	2	68	11	0
Delay Time/Veh. (s)				8.1	0.0	1.3	0	0.0	0.4	0.6	0.1	0
Max Queue (ft)				60	0	60	0	0	0	0	0	0
Avg. Queue (ft)				0	0	$\sim$		$\sim$	0		$\sim$	
					Ū	0	0	0	_	0	0	0
							Int	ersectio	_	_		1.3
		ocation		I-29 &	CR 20 (\	W. Side	Int	ersectio	n Delay	/ (sec/v	eh)	1.3
	EB	Approa	ich	I-29 & WE	CR 20 (\ 3 Appro	W. Side) ach	Int	ersection	on Delay	/ (sec/v	eh) Approa	1.3 nch
	EB EBL	Approa EBT	ech EBR	I-29 & WE	CR 20 (\ 3 Appro WBT	W. Side) ach WBR	Int	ersectio	n Delay	/ (sec/v SB SBL	eh) Approa SBT	1.3 ach SBR
Volume	EB EBL 0	Approa EBT 165	EBR 37	I-29 & WE WBL 4	CR 20 (\ 3 Appro- WBT 50	W. Side ach WBR 0	Int	ersection	on Delay	SB SBL 79	Approa SBT 0	1.3 ach SBR 187
Delay Time/Veh. (s)	EBL 0	Approa EBT 165 0.3	EBR 37 0.7	I-29 & WE WBL 4 0.7	CR 20 (\ 3 Appro- WBT 50 0.5	W. Side ach WBR 0	Int	ersection	on Delay	SB SBL 79 8.3	Approa SBT 0	1.3 ech SBR 187 8.0
Delay Time/Veh. (s) Max Queue (ft)	EBL 0 0 0	Approa EBT 165 0.3	EBR 37 0.7	I-29 & WE WBL 4 0.7 12	CR 20 (\ 3 Appro- WBT 50 0.5 12	W. Side ach WBR 0 0	Int	ersection	on Delay	SB SBL 79 8.3 161	Approa SBT 0 0	1.3 sch SBR 187 8.0 161
Delay Time/Veh. (s)	EBL 0	Approa EBT 165 0.3	EBR 37 0.7	I-29 & WE WBL 4 0.7	CR 20 (\ 3 Appro- WBT 50 0.5	W. Side ach WBR 0	NB NBL	Approa NBT	on Delay ach NBR	SB SBL 79 8.3 161 3	Approa SBT 0 0	1.3 sch SBR 187 8.0 161 3
Delay Time/Veh. (s) Max Queue (ft)	EBL 0 0 0 0 0	Approa EBT 165 0.3 0	BR 37 0.7 0	I-29 & WE WBL 4 0.7 12 0	CR 20 (\ B Appro- WBT 50 0.5 12	W. Side ach WBR 0 0 0	NB NBL	ersection	on Delay ach NBR	SB SBL 79 8.3 161 3	Approa SBT 0 0	1.3 sch SBR 187 8.0 161
Delay Time/Veh. (s) Max Queue (ft)	EBL 0 0 0 0 Node L	Approa EBT 165 0.3 0 0	EBR 37 0.7 0	I-29 & WE WBL 4 0.7 12 0	CR 20 (\)  RAPPRO  WBT  50  0.5  12  0  CR 20 (E	W. Side ach WBR 0 0 0	NBL Int	Approa NBT ersection	on Delay  ach  NBR  on Delay	SB SBL 79 8.3 161 3 / (sec/v	Approa SBT 0 0 0 0	1.3 SBR 187 8.0 161 3 4.3
Delay Time/Veh. (s) Max Queue (ft)	EBL 0 0 0 0 Node L	Approa EBT 165 0.3 0 0 ocation	BR 37 0.7 0 0 0 ::	I-29 & 6 WBL 4 0.7 12 0	CR 20 (\)  RAPPRO  BAPPRO  O.5  12  O  CR 20 (E)  RAPPRO	W. Side ach WBR 0 0 0 0	NB NBL	Approa NBT ersection	on Delay ach NBR on Delay	SB SBL 79 8.3 161 3 / (sec/v	Approa SBT 0 0 0 0 eh)	1.3 ach SBR 187 8.0 161 3 4.3
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EBL O O O O Node L EB EBL	Approa EBT 165 0.3 0 0 ocation Approa	EBR 37 0.7 0 0 ::	I-29 & WE WBL 4 0.7 12 0	CR 20 (\)  RAPPRO  SO  0.5  12  0  CR 20 (E)  RAPPRO  WBT	W. Side ach WBR 0 0 0 0	NBL Int	Approa NBT ersection	on Delay  ach  NBR  on Delay  ach  NBR	SB SBL 79 8.3 161 3 / (sec/v	Approa SBT 0 0 0 0	1.3 SBR 187 8.0 161 3 4.3
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EBL O O O O Node L EB EBL 127	Approa EBT 165 0.3 0 0 ocation Approa EBT 117	ech EBR 37 0.7 0 0 :	I-29 & 6 WBL 4 0.7 12 0 I-29 & 6 WBL 0	CR 20 (VB Approx 0.5 12 0 CR 20 (EB Approx WBT 33	W. Side ach WBR 0 0 0 0 . Side) ach WBR	Int.  NB  NBL  Int.  NB  NBL  21	Approa NBT ersection	on Delay  ach  Delay  ach  NBR  NBR  12	SB SBL 79 8.3 161 3 / (sec/v	Approa SBT 0 0 0 0 eh)	1.3 ach SBR 187 8.0 161 3 4.3
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EBL O O O O Node L EB EBL	Approa EBT 165 0.3 0 0 ocation Approa	EBR 37 0.7 0 0 ::	I-29 & WE WBL 4 0.7 12 0	CR 20 (\)  RAPPRO  SO  0.5  12  0  CR 20 (E)  RAPPRO  WBT	W. Side ach WBR 0 0 0 0	NBL Int	Approa NBT ersection	on Delay  ach  on Delay  ach  NBR	SB SBL 79 8.3 161 3 / (sec/v	Approa SBT 0 0 0 0 eh)	1.3 ach SBR 187 8.0 161 3 4.3

Intersection Delay (sec/veh)

2008 PM Peak - Ramp 1	Termina	ıl Data											
	Node Location: I-29 & 19 Ave N (W. S						ide)						
	EB	Approa	ach	WE	3 Appro	ach	NB	Appro	ach	SB	Approa	ach	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Volume	0	322	33	0	243	615				56	0	24	
Delay Time/Veh. (s)	0	2.5	1.9	0	3.2	3.0				9.0	0	1.5	
Max Queue (ft)	0	143	0	0	140	292				116	0	0	
Avg. Queue (ft)	0	4	0	0	3	1				3	0	0	
							Int	ersectio	on Delay	y (sec/v	eh)	3.1	
	Node L	ocation	:	I-29 &	19 Ave	N (E. Sid	de)						
	EB	Approa	ach	WE	3 Appro	ach	NB	Appro	ach	SB	Approa	ach	
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Volume	0	325	54	0	843	77	15	0	606				
Delay Time/Veh. (s)	0	6.5	0.3	0	7.6	1.0	22.7	0	7.5				
Max Queue (ft)	0	151	158	0	319	0	95	0	196				
Avg. Queue (ft)	0	8	2	0	34	0	2	0	27				
							Intersection Delay (sec/veh) 7						
	Node Location: I-29 & 12th Ave N (W							· · · · · · · · · · · · · · · · · · ·					
		_		WB Approach			NB Approach			60			
	EB	Approa	ach	WE	Appro	acn	NB	Appro	acn	SB	Approa	ach	
	EBL EBL	Approa EBT	ech EBR	WBL	WBT	wBR	NBL	NBT	NBR	SBL	SBT	SBR	
Volume												SBR 45	
Volume Delay Time/Veh. (s)	EBL	EBT	EBR	WBL	WBT	WBR				SBL	SBT	SBR	
Delay Time/Veh. (s) Max Queue (ft)	0 0 0	EBT 490	EBR 642 2.2 0	WBL 0	WBT 396 1.9 144	WBR 564 1.5 120				SBL 58	SBT 0	SBR 45	
Delay Time/Veh. (s)	EBL 0 0	EBT 490 2.1	EBR 642 2.2	WBL 0 0	WBT 396 1.9	WBR 564 1.5	NBL	NBT	NBR	58 30.4 138 11	SBT 0 0 0 0 0	SBR 45 1.5 106 1	
Delay Time/Veh. (s) Max Queue (ft)	0 0 0	EBT 490 2.1 145	EBR 642 2.2 0	WBL 0 0 0	WBT 396 1.9 144	WBR 564 1.5 120	NBL	NBT	NBR	58 30.4 138	SBT 0 0 0 0 0	SBR 45 1.5 106	
Delay Time/Veh. (s) Max Queue (ft)	0 0 0 0	EBT 490 2.1 145	EBR 642 2.2 0	WBL 0 0 0 0	WBT 396 1.9 144	WBR 564 1.5 120 0	NBL	NBT	NBR	58 30.4 138 11	SBT 0 0 0 0 0	SBR 45 1.5 106 1	
Delay Time/Veh. (s) Max Queue (ft)	EBL 0 0 0 0 Node L	EBT 490 2.1 145 3 ocation	EBR 642 2.2 0 0	WBL 0 0 0 0 0 1-29 &	WBT 396 1.9 144 3 12th Av 3 Appro	WBR 564 1.5 120 0 ee N (E. aach	NBL Int Side)	NBT ersection	NBR on Delay	SBL 58 30.4 138 11 y (sec/v	SBT 0 0 0 0 0 eh)	SBR 45 1.5 106 1 2.7	
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)	EBL 0 0 0 0 0 Node L EB	EBT 490 2.1 145 3 ocation Approa	EBR 642 2.2 0 0	WBL 0 0 0 0 1-29 & WBL	WBT 396 1.9 144 3 12th Av 3 Appro WBT	WBR 564 1.5 120 0 ee N (E. ach	Int Side) NBL	ersection Approx NBT	NBR on Delay ach NBR	SBL 58 30.4 138 11 y (sec/v	SBT 0 0 0 0 0 eh)	SBR 45 1.5 106 1 2.7	
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume	EBL  O  O  O  Node L  EB  EBL  O	EBT 490 2.1 145 3 ocation Approa	EBR 642 2.2 0 0 0	WBL 0 0 0 0 0 0 0 WE WBL 0	WBT 396 1.9 144 3 12th Av 3 Appro WBT 791	WBR 564 1.5 120 0 ee N (E. ach WBR 149	Int Side) NB NBL 169	ersection  Approx  NBT  O	on Delay	SBL 58 30.4 138 11 y (sec/v	SBT 0 0 0 0 0 eh)	SBR 45 1.5 106 1 2.7	
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EBL 0 0 0 0 Node L EB EBL 0	EBT 490 2.1 145 3 ocation Approa EBT 445 3.5	EBR 642 2.2 0 0 :: ach EBR 103 0.2	WBL 0 0 0 0 1-29 & WBL	WBT 396 1.9 144 3 12th Av 3 Appro WBT 791 5.0	WBR 564 1.5 120 0 e N (E. ach WBR 149 1.0	Int Side) NBL 169 31.3	ersection  Approx  NBT  0  0.0	nBR on Delay ach NBR 494 8.1	SBL 58 30.4 138 11 y (sec/v	SBT 0 0 0 0 0 eh)	SBR 45 1.5 106 1 2.7	
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL 0 0 0 Node L EB EBL 0 0 0	EBT 490 2.1 145 3 ocation Approa EBT 445 3.5 150	EBR 642 2.2 0 0 0 :: ach EBR 103 0.2 112	WBL 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	WBT 396 1.9 144 3 12th Av 3 Appro WBT 791 5.0 276	WBR 564 1.5 120 0 ee N (E. ach WBR 149 1.0 4	Int Side) NBL 169 31.3 167	ersection  Approx  NBT  0  0.0  0	nBR on Delay ach NBR 494 8.1 184	SBL 58 30.4 138 11 y (sec/v	SBT 0 0 0 0 0 eh)	SBR 45 1.5 106 1 2.7	
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)	EBL 0 0 0 Node L EB EBL 0 0 0	EBT 490 2.1 145 3 ocation Approa EBT 445 3.5	EBR 642 2.2 0 0 :: ach EBR 103 0.2	WBL 0 0 0 0 1-29 & WBL 0 0	WBT 396 1.9 144 3 12th Av 3 Appro WBT 791 5.0	WBR 564 1.5 120 0 e N (E. ach WBR 149 1.0	NBL Int Side) NBL 169 31.3 167 26	ersection  Approx  NBT  0  0.0  0	nBR on Delay ach NBR 494 8.1 184 22	SBL 58 30.4 138 11 y (sec/v SB SBL	SBT  0  0  0  0 eh)	SBR 45 1.5 106 1 2.7 ach SBR	
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	BBL  O  O  O  Node L  EB  EBL  O  O  O	EBT 490 2.1 145 3 ocation ApproxEBT 445 3.5 150 5	EBR 642 2.2 0 0 0 :: ach EBR 103 0.2 112	WBL 0 0 0 0 1-29 & WBL 0 0 0	WBT 396 1.9 144 3 12th Av 3 Appro WBT 791 5.0 276 18	WBR 564 1.5 120 0 ee N (E. ach WBR 149 1.0 4 0	Int Side) NBL 169 31.3 167 26 Int	ersection  Approx  NBT  0  0.0  0	nBR on Delay ach NBR 494 8.1 184 22	SBL 58 30.4 138 11 y (sec/v	SBT  0  0  0  0 eh)	SBR 45 1.5 106 1 2.7	
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL  O  O  O  Node L  EB  EBL  O  O  O  O  Node L	EBT 490 2.1 145 3 ocation Approa EBT 445 3.5 150 5 ocation	EBR 642 2.2 0 0 0 :: ach EBR 103 0.2 112 0	WBL 0 0 0 0 1-29 & WBL 0 0 0 1-29 &	WBT 396 1.9 144 3 12th Av 3 Appro WBT 791 5.0 276 18 Main Av	WBR 564 1.5 120 0 ee N (E. ach WBR 149 1.0 4 0	Int Side) NBL 169 31.3 167 26 Int	ersection  Approx  NBT  0  0.0  0	nBR on Delay ach NBR 494 8.1 184 22	SBL 58 30.4 138 11 y (sec/v SB SBL	SBT  0  0  0  0 eh)	SBR 45 1.5 106 1 2.7 ach SBR	
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL 0 0 0 0 Node L EB EBL 0 0 0 Node L	EBT 490 2.1 145 3 ocation Approa EBT 445 3.5 150 5 ocation Approa	EBR 642 2.2 0 0 0 :: ach EBR 103 0.2 112 0	WBL 0 0 0 0 1-29 & WBL 0 0 0 1-29 & WBL WBL 0 0 0 0	WBT 396 1.9 144 3 12th Av 3 Appro WBT 791 5.0 276 18 Main Av	WBR 564 1.5 120 0 e N (E. ach WBR 149 1.0 4 0	Int Side)  NBL 169 31.3 167 26 Int Side)  NB	ersection  Approx  NBT  0  0.0  0  ersection  Approx	NBR on Delay ach NBR 494 8.1 184 22 on Delay	SBL  58  30.4  138  11  y (sec/v  SB  SBL	SBT  0 0 0 0 eh)  Approx eh)	SBR 45 1.5 106 1 2.7 ach SBR 7.0	
Delay Time/Veh. (s)  Max Queue (ft)  Avg. Queue (ft)  Volume  Delay Time/Veh. (s)  Max Queue (ft)	EBL  O  O  O  Node L  EB  EBL  O  O  O  O  Node L	EBT 490 2.1 145 3 ocation Approa EBT 445 3.5 150 5 ocation	EBR 642 2.2 0 0 0 :: ach EBR 103 0.2 112 0	WBL 0 0 0 0 1-29 & WBL 0 0 0 1-29 &	WBT 396 1.9 144 3 12th Av 3 Appro WBT 791 5.0 276 18 Main Av	WBR 564 1.5 120 0 ee N (E. ach WBR 149 1.0 4 0	Int Side)  NBL 169 31.3 167 26 Int Side)	ersection  Approx  NBT  0  0.0  0  0 ersection	nBR on Delay ach NBR 494 8.1 184 22 on Delay	SBL 58 30.4 138 11 y (sec/v SB SBL	SBT  0 0 0 0 eh)  Approx SBT  eh)	SBR 45 1.5 106 1 2.7 ach SBR	

	EB Approach WB Approach					NB Approach			SB	ich		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	0	1114	415	0	1358	788				88	0	169
Delay Time/Veh. (s)	0	3.4	5.0	0	3.0	3.3				41.3	0	7.2
Max Queue (ft)	0	254	254	0	214	289				148	0	132
Avg. Queue (ft)	0	17	17	0	11	1				19	0	7
								ersectio	n Delav	/ (sec/v	eh)	4.4

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

	EB	Approa	ich	WE	3 Appro	ach	NB Approach			SB Approach		
	EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Volume	0	1001	208	0	1925	127	220	0	227			
Delay Time/Veh. (s)	0	2.8	0.5	0	4.5	6.3	43.4	0	7.0			
Max Queue (ft)	0	217	196	0	407	407	204	0	185			
Avg. Queue (ft)	0	8	1	0	34	34	41	0	12			
							Int	ersectio	n Delay	/ (sec/v	eh)	6.3

EB Approach   EBL   EBT   EBR   WBL   WBT   WBR   NBL   NBT   NBR   SBL   S		Node L	ocation	1:	I-29 &	38th St							
Volume		EB	Approa	ach	WB Approach			NB	Approa	ach	SB	ach	
Delay Time/Veh. (s)		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Max Queue (ft)	Volume				865	0	137	0	217	526	446	194	0
Node Location:	Delay Time/Veh. (s)				15.1	0	5.9	0	7.7	7.7	18.5	7.4	0
Node Location:	Max Queue (ft)				273	0	202	0	190	250	348	348	0
Node   Location   L	Avg. Queue (ft)				52	0	10	0	8	2	55	55	0
EB Appro≥								Int	ersectio	on Delay	/ (sec/v	eh)	12.3
EBL   EBT   EBR   WBL   WBT   WBR   NBL   NBT   NBR   SBL   SBT		Node L	ocation	:	I-29 &	13th Av	e S (E. S	Side)					
Volume   51   1209   268   0   1521   255   371   177   240		EB	Approa	ach	WE	3 Appro	ach	NB	Appro	ach	SB	Approa	ach
Delay Time/Veh. (s)   55.2   8.6   0.3   0   16.0   5.9   37.8   52.7   8.0		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Max Queue (ft)   151   332   218   0   524   0   297   296   300	Volume	51	1209	268	0	1521	255	371	177	240			
Avg. Queue (ft)   17   33   1   0   79   0   71   65   50	Delay Time/Veh. (s)	55.2	8.6	0.3	0	16.0	5.9	37.8	52.7	8.0			
Node   Location   FB   Approach   EBL   EBT   EBR   WBL   WBT   WBR   NBL   NBT   NBR   SBL   SBT   NBR   Queue (ft)   O   540   O   202   286   O   O   Intersection Delay (sec/veh)   Delay Time/Veh. (s)   O   17.8   1.3   47.7   9.1   O   Intersection Delay (sec/veh)   I-29 & 32nd Ave   S (E. Side)   SBApproach   SBApproach	Max Queue (ft)	151	332	218	0	524	0	297	296	300			
Node Location	Avg. Queue (ft)	17	33	1	0	79	0	71	65	50			
EB   Approach   EB   EBR   EBR   WBL   WBT   WBR   NBL   NBT   NBR   SBL   SBT								Int	ersectio	on Delay	/ (sec/v	eh)	15.7
EBL   EBT   EBR   WBL   WBT   WBR   NBL   NBT   NBR   SBL   SBT		Node L	ocation	:	I-29 &	32nd Av	ve S (W	Side)					
Volume		EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	ach	
Delay Time/Veh. (s)   0		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Max Queue (ft)         0         540         0         202         286         0         Image: Legislation of the property of the prop	Volume	0	1148	49	98	750	0				801	0	375
Avg. Queue (ft)       0       92       0       30       27       0       Intersection Delay (sec/veh)         Node Location:       I-29 & 32nd Ave S (E. Side)         EB Approach       WB Approach       NB Approach       SB Approach         EBL EBT EBR WBL WBT WBR NBL NBT NBR SBL SBT         Volume       0       1660       282       0       803       820       48       0       75       75       75       75       75       76 <td>Delay Time/Veh. (s)</td> <td>0</td> <td>17.8</td> <td>1.3</td> <td>47.7</td> <td>9.1</td> <td>0</td> <td></td> <td></td> <td></td> <td>36.7</td> <td>0</td> <td>8.4</td>	Delay Time/Veh. (s)	0	17.8	1.3	47.7	9.1	0				36.7	0	8.4
Node   Location   Node   Location   I-29 & 32nd   Ave   S (E.   Side)   Side	Max Queue (ft)	0	540	0	202	286	0				470	0	481
Node   Series   Node   Series   Side   Si	Avg. Queue (ft)	0	92	0	30	27	0				121	0	83
BB   BB   BB   BB   BB   BB   BB   B								Intersection Delay (sec/veh) 20.0					
EBL   EBT   EBR   WBL   WBT   WBR   NBL   NBT   NBR   SBL   SBT		Node L	ocation	:	I-29 &	32nd Av	ve S (E.	Side)					
Volume		EB Approach			WB Approach			NB	Approa	ach	SB	Approa	ach
Delay Time/Veh. (s)         0         2.4         1.5         0         2.3         2.4         36.6         0         9.4         Image: colspan="8">Image: colspan="8">Ima		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Max Queue (ft)         0         344         295         0         184         0         133         0         121         Image: control of the product of the pr	Volume	0	1660	282	0	803	820	48	0	75			
Avg. Queue (ft)       0       10       41       0       4       0       11       0       4       Image: Location of the process	Delay Time/Veh. (s)	0	2.4	1.5	0	2.3	2.4	36.6	0	9.4			
Avg. Queue (ft)       0       10       41       0       4       0       11       0       4       Image: Location of the process	Max Queue (ft)	0	344	295	0	184	0	133	0	121			
Node Location:   I-29 & 52nd Ave S (W. Side)			10	41	0	4	0	11	0	4			
EB									eh)	2.9			
EBL   EBT   EBR   WBL   WBT   WBR   NBL   NBT   NBR   SBL   SBT		Node L	ocation	:	I-29 &	52nd Av	ve S (W	Side)					
Volume         0         95         22         6         70         0           221         0           Delay Time/Veh. (s)         0         5.1         2.2         4.1         4.3         0          37.1         0           Max Queue (ft)         0         123         0         103         103         0           323         0           Avg. Queue (ft)         0         2         0         1         1         0          59         0           Intersection Delay (sec/veh)           Node Location:         I-29 & 52nd Ave S (E. Side)           EB Approach         WB Approach         NB Approach         SB Approach           EBL         EBT         EBR         WBL         WBT         WBR         NBL         NBR         SBL         SBT           Volume         84         232         0         0         60         129         16         0         29            Delay Time/Veh. (s)         2.2         4.3         0         0         2.1         2.4         27.0         0 <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>ach</td>		EB	Approa	ach	WE	3 Appro	ach	NB	Approa	ach	SB	Approa	ach
Delay Time/Veh. (s)         0         5.1         2.2         4.1         4.3         0          37.1         0           Max Queue (ft)         0         123         0         103         103         0          323         0           Avg. Queue (ft)         0         2         0         1         1         0          Intersection Delay (sec/veh)           Node Location:         I-29 & 52nd Ave S (E. Side)           EB Approach         WB Approach         NB Approach         SB Approach           EBL         EBT         EBR         WBL         WBR         NBL         NBT         NBR         SBL         SBT           Volume         84         232         0         0         60         129         16         0         29            Delay Time/Veh. (s)         2.2         4.3         0         0         2.1         2.4         27.0         0         1.4            Max Queue (ft)         283         283         0         0         88         106         84         0         47		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Max Queue (ft)         0         123         0         103         103         0         Image: control of the property	Volume	0	95	22	6	70	0				221	0	110
Avg. Queue (ft)       0       2       0       1       1       0       Intersection Delay (sec/veh)       0         Node Location:       I-29 & 52nd Ave S (E. Side)         EB Approach       WB Approach       NB Approach       SB Approach         EBL       EBT       EBR       WBL       WBR       NBL       NBT       NBR       SBL       SBT         Volume       84       232       0       0       60       129       16       0       29       Image: Color of the color o	Delay Time/Veh. (s)	0	5.1	2.2	4.1	4.3	0				37.1	0	2.1
Node Location: I-29 & 52nd Ave S (E. Side)   SB Approach	Max Queue (ft)	0	123	0	103	103	0				323	0	112
Node Location:       I-29 & 52nd Ave S (E. Side)         EB Approach       WB Approach       NB Approach       SB Approach         EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL       SBT         Volume       84       232       0       0       60       129       16       0       29       □       □         Delay Time/Veh. (s)       2.2       4.3       0       0       2.1       2.4       27.0       0       1.4       □       □         Max Queue (ft)       283       283       0       0       88       106       84       0       47       □       □	Avg. Queue (ft)	0	2	0	1	1	0				59	0	1
EB Approach       WB Approach       NB Approach       SB Approach         EBL       EBT       EBR       WBL       WBT       WBR       NBL       NBT       NBR       SBL       SBT         Volume       84       232       0       0       60       129       16       0       29       □       □         Delay Time/Veh. (s)       2.2       4.3       0       0       2.1       2.4       27.0       0       1.4       □         Max Queue (ft)       283       283       0       0       88       106       84       0       47       □								Int	ersectio	on Delay	/ (sec/v	eh)	17.7
EBL         EBT         EBR         WBL         WBT         WBR         NBL         NBT         NBR         SBL         SBT           Volume         84         232         0         0         60         129         16         0         29         0         0         10		Node L	ocation	ı <b>:</b>	I-29 &	52nd Av	ve S (E.	Side)					
Volume         84         232         0         0         60         129         16         0         29           Delay Time/Veh. (s)         2.2         4.3         0         0         2.1         2.4         27.0         0         1.4           Max Queue (ft)         283         283         0         0         88         106         84         0         47		EB Approach WB Approach				NB	Approa	ach	SB	Approa	ach		
Delay Time/Veh. (s)       2.2       4.3       0       0       2.1       2.4       27.0       0       1.4       1.4         Max Queue (ft)       283       283       0       0       88       106       84       0       47       47		EDI	FBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR
Max Queue (ft) 283 283 0 0 88 106 84 0 47		EBL				60	129	16	0	29			
Max Queue (ft) 283 283 0 0 88 106 84 0 47	Volume			0	0	00			_				
Avg. Queue (ft) 6 6 0 0 1 1 3 0 0		84	232										
	Delay Time/Veh. (s)	84 2.2	232 4.3	0	0	2.1	2.4	27.0	0	1.4			
Intersection Delay (sec/veh)	Delay Time/Veh. (s) Max Queue (ft)	84 2.2 283	232 4.3 283	0	0	2.1 88	2.4 106	27.0 84	0	1.4 47			