

Traffic Operation Analysis

**White Bear Avenue
St. Paul, MN**

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Appendix A: Intersection Delay and LOS

1.0 Introduction

Ramsey County has programmed a project that includes reconstructing White Bear Avenue from the I-94 North Ramp terminal intersection to the Beech Street intersection to begin in 2016. The project location is shown in Figure 1.

This report documents the traffic operation analysis completed for White Bear Avenue. Conclusions of this analysis are being used to help inform design decisions regarding roadway cross-section, turn lanes and signal operation improvements.

1.1 Project Study Area

Figure 2 illustrates the key signalized intersections evaluated as part of the traffic operation analysis. The key study intersections include:

- White Bear Avenue at I-94 North Ramps
- White Bear Avenue at Old Hudson Road
- White Bear Avenue at 3rd Street

As shown, the traffic operation analysis modeling limits extend outside of the reconstruction limits. This is necessary to appropriately evaluate the White Bear Avenue/I-94 North Ramp and White Bear Avenue/3rd Street intersections.

1.2 Existing Conditions

White Bear Avenue is a four lane undivided arterial roadway with a 30 mile per hour (mph) posted speed limit. Key geometric and traffic operation characteristics of the existing conditions include:

- The cross-sectional street width is 40 to 56 feet with a grass boulevard and a 5 to 6 foot sidewalk. White Bear Avenue operates with two travel lanes in each direction.
- The corridor is fully developed, and acquiring additional right-of-way may be disruptive and cost prohibitive.
- Designated left turn lanes are provided on the northbound/southbound approaches at the White Bear Avenue/3rd Street intersection. Designated turn lanes are not provided at the other key intersections, which creates congestion along the corridor during the PM Peak time period.
- On-street parking is provided along much of the length of the corridor and is lightly utilized. There is a no parking zone for northbound traffic north of Old Hudson Road from 4:00 p.m. to 6:00 p.m.
- Metro Transit Routes 63 and 80 serve White Bear Avenue. Bus stops are located at most intersections within the study area.

- Most traffic signals are two phase operation. Protected/permissive left turn phasing for northbound traffic is provided at the White Bear Avenue/I-94 North Ramp intersection and southbound traffic at the 1-94 South Ramp intersection.

Key features of the existing characteristics are illustrated in Figure 3.

1.3 Project Description

The proposed reconstruction project will include full depth reconstruction between the existing face of curbs. A few considerations include:

- To maintain on-street parking, mature boulevard trees, and sidewalk space, the proposed typical section will remain similar to existing with a 40 to 56 foot roadway width, green space boulevard and a six foot sidewalk.
- The County is considering additional widening at Old Hudson Road to provide dedicated left turn lanes. The need for the left turn lanes will be evaluated as part of this study.
- Alternative roadway cross-sections, intersection lane assignments and turn lane considerations at other locations along the corridor will be evaluated as part of this study.

1.4 Study Objective

Minnesota Rule 8820.9936 requires at least four through traffic lanes for all routes with a projected traffic volume greater than 15,000 ADT, unless a capacity analysis demonstrates that an alternative lane configuration achieves a LOS D or better. The objective of this analysis is to document the expected level of service and to identify feasible improvements to achieve a LOS D operation where needed.

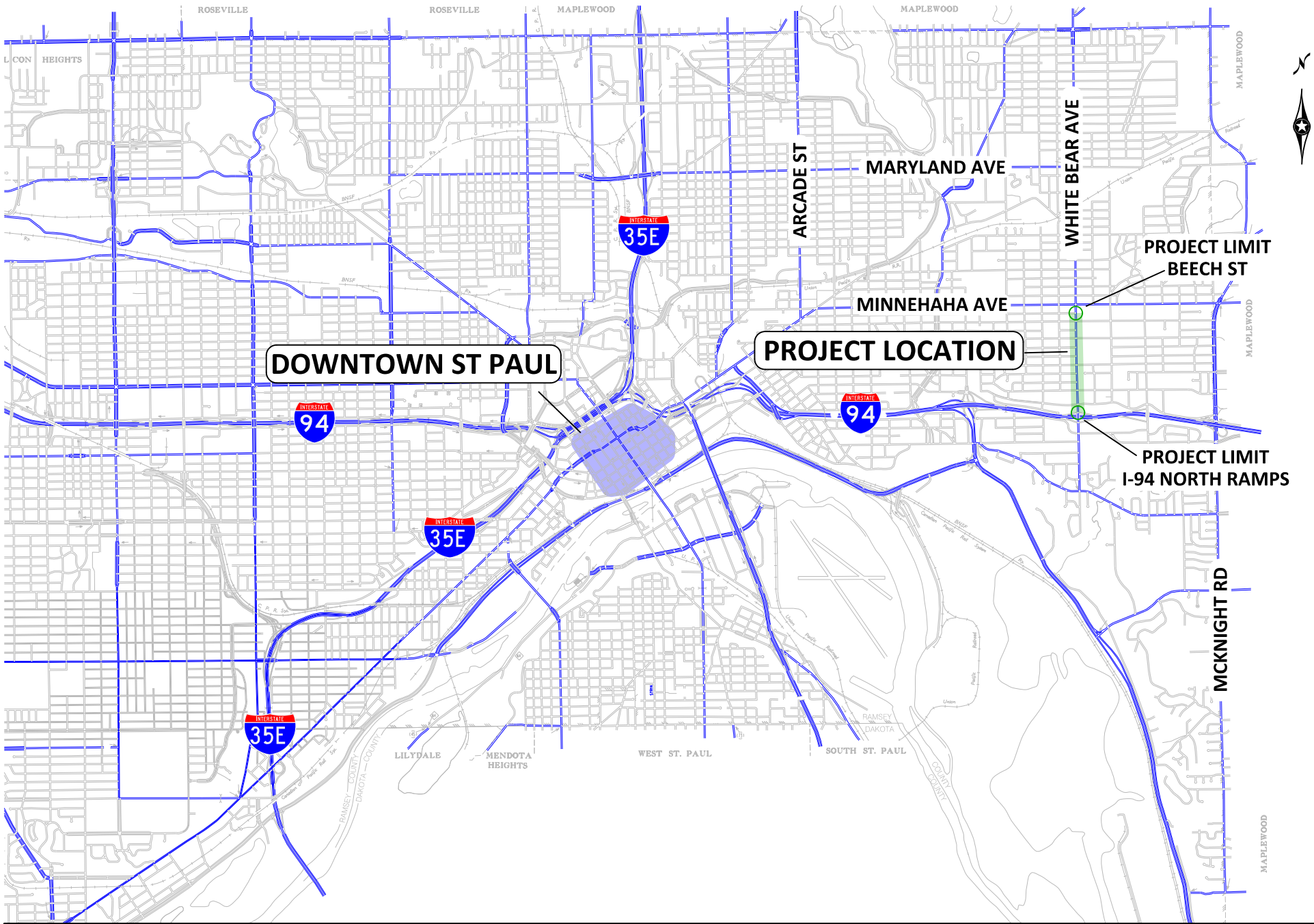
To further support Ramsey County in developing their proposed layout for White Bear Avenue, this traffic operation analysis will:

- Document the existing geometric and traffic operation characteristics.
- Document future year 2036 traffic forecasts.
- Conduct a traffic operation analysis of the proposed alternatives and document the expected intersection and arterial performance of the facility.
- Identify and evaluate any recommended geometric or traffic control changes necessary.

1.5 Elements of Study

The following elements are included in the traffic operation analysis:

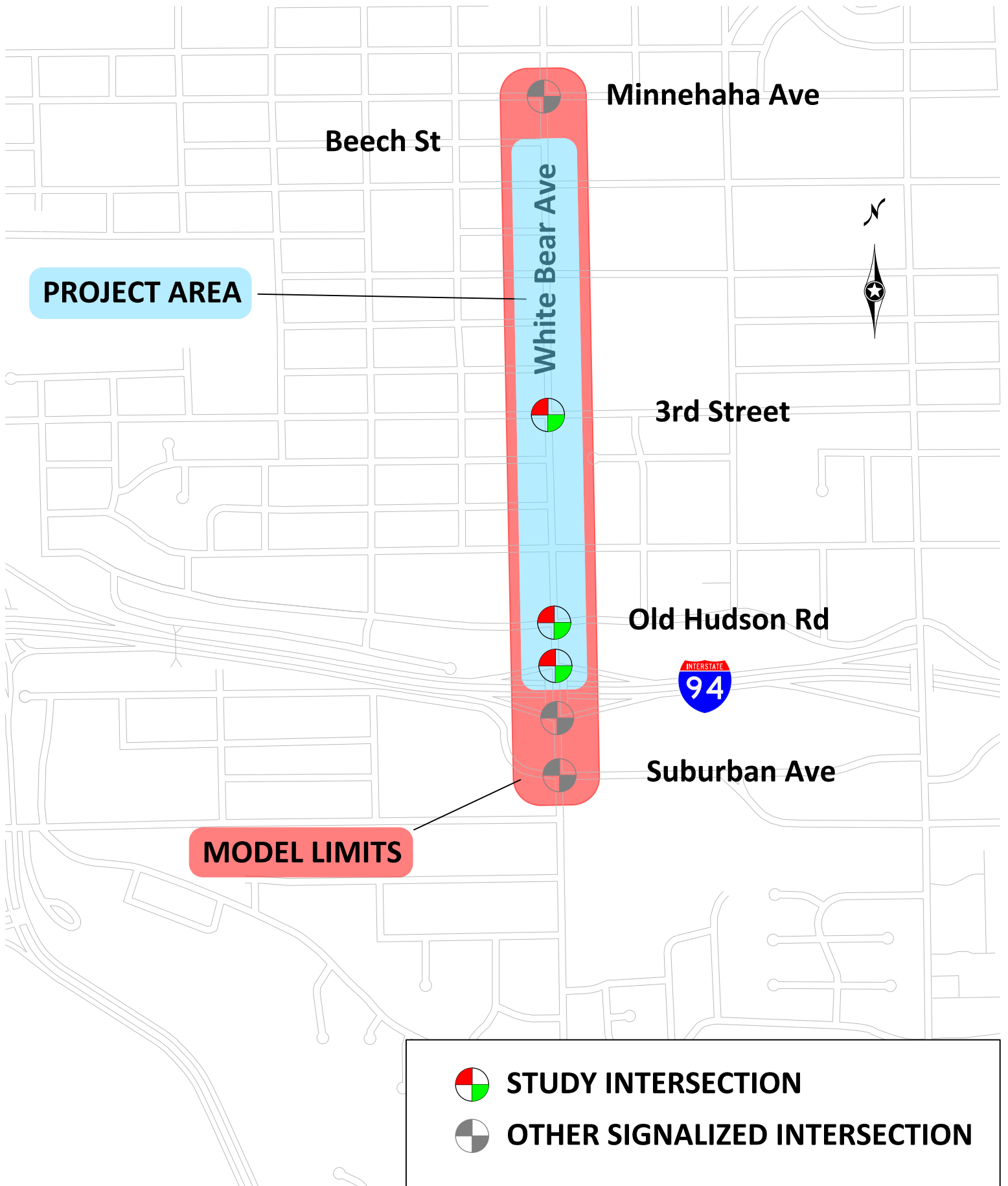
- Traffic Volumes (Section 2.0)
- Safety Analysis (Section 3.0)
- Traffic Operation Analysis (Section 4.0)
- Conclusions and Recommendations (Section 5.0)

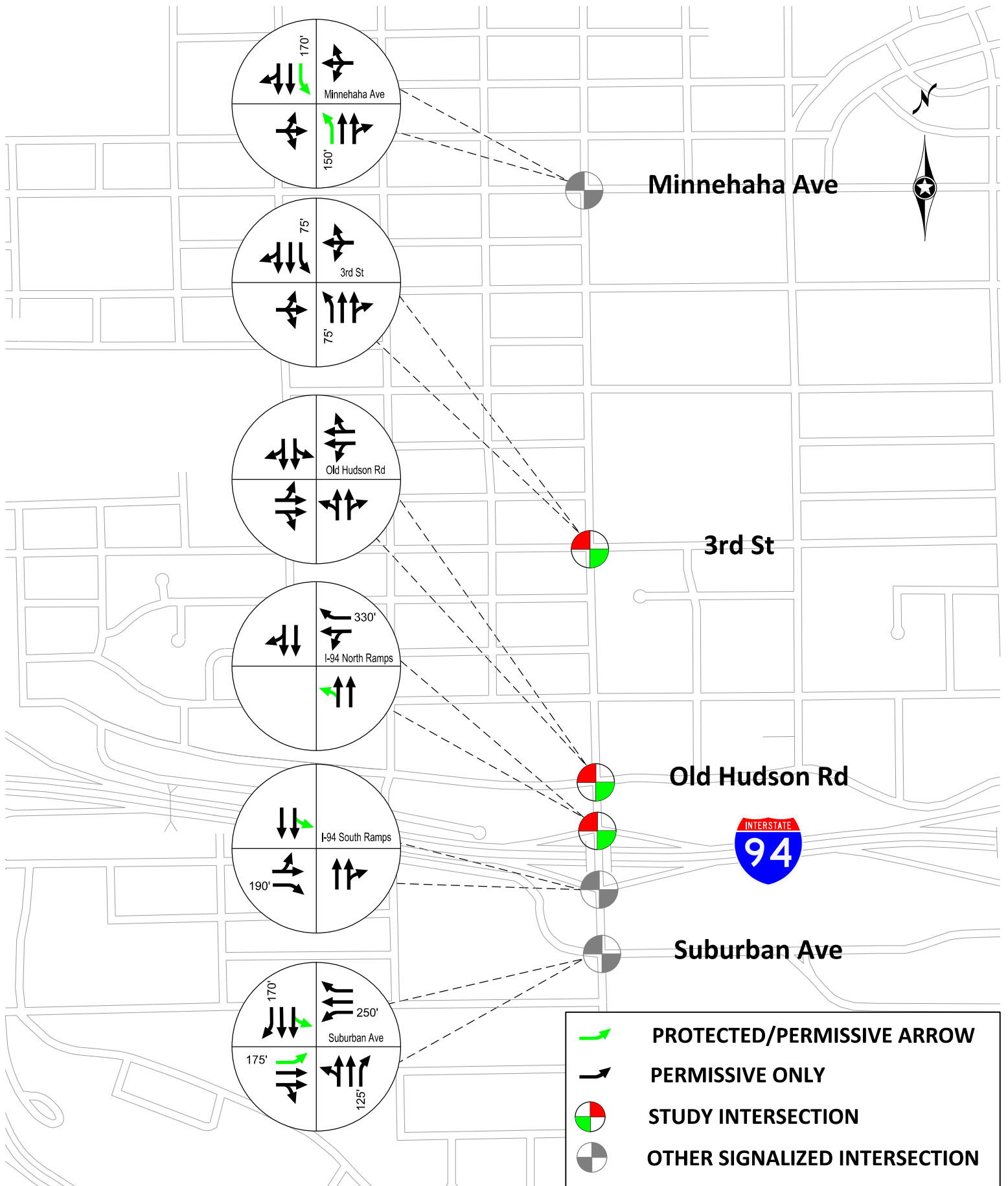


White Bear Avenue Traffic Operations Analysis

*Figure 1
Project Location*







White Bear Avenue Traffic Operations Analysis

Figure 3
Existing Roadway Geometrics

2.0 Traffic Volumes

The following sections document the existing and forecast traffic volumes and characteristics within the project study area.

2.1 Existing Traffic Volumes

Ramsey County provided existing intersection turning movement volumes for each intersection. The turning movement counts were conducted in July and August 2014. The existing a.m. and p.m. peak hour volumes are shown in Figure 4 and the existing annual average daily traffic (AADT) volumes are shown in Table 1.

Table 1. Existing AADT Volumes

Roadway	Segment	Existing AADT ¹
		2014
White Bear Avenue	Suburban Avenue to I-94 South Ramps	17,100
	I-94 North Ramps to Old Hudson Road	22,000
	Old Hudson Road to 3rd Street	18,600
	4th Street to 5th Street	19,800
	Margaret Street to Beech Street	19,800

¹ Derived from year 2014 intersection turning movement and approach volume counts.

2.2 Forecast 2036 Traffic Volumes

White Bear Avenue exists within a fully developed area of St. Paul. Growth in traffic may likely occur in the future as a result of localized redevelopment or changes in area traffic patterns. Although there has been some up and down variation, historically, traffic volumes along White Bear Avenue have remained relatively constant with a slight upward trend from year to year.

To develop the 2036 forecast volumes, the following data sources were evaluated:

- 20 year historical AADT
- State Aid project factor for Ramsey County (1.2)
- City of St. Paul 2030 Comprehensive Plan

Based on a review of the available data sources, an annual growth rate of 0.5 percent per year was derived for White Bear Avenue. A 0.1 percent per year is estimated for the segment of White Bear Avenue south of I-94. The forecast year 2036 AADT along with the existing AADT and 20 year historical average is shown in Table 2.

Table 2. Forecast 2036 AADT

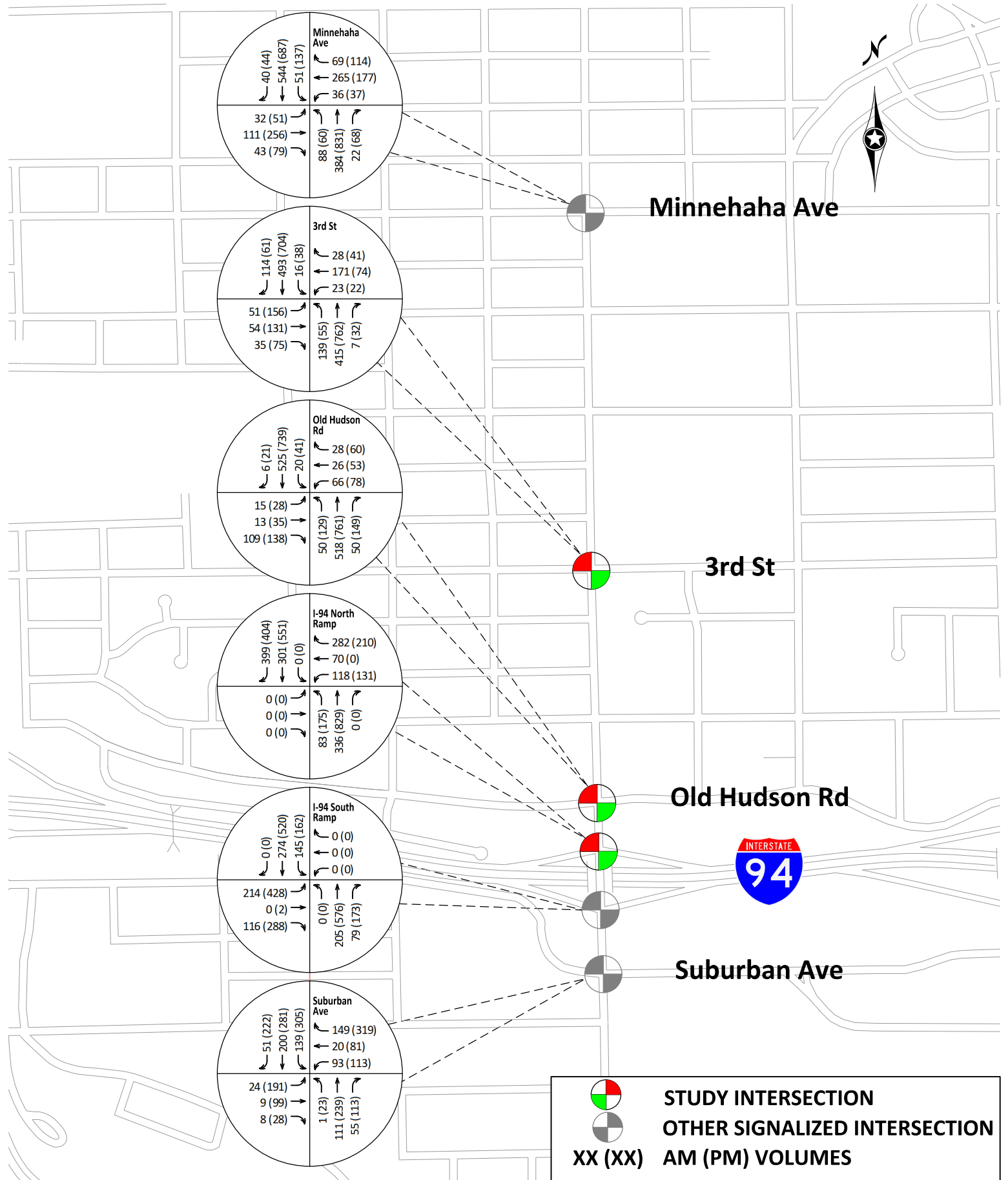
Roadway	Segment	20 Year Average	Existing AADT ¹	Forecast AADT ³	Annual Growth Rate ²
		1994-2014	2014	2036	
White Bear Avenue	Suburban Avenue to I-94 South Ramps	18,000	17,100	17,500	0.1%
	I-94 North Ramps to Old Hudson Road	20,800	22,000	24,600	0.5%
	Old Hudson Road to 3rd Street	18,300	18,600	20,800	0.5%
	4th Street to 5th Street	17,500	19,800	22,100	0.5%
	Margaret Street to Beech Street	17,600	19,800	22,100	0.5%

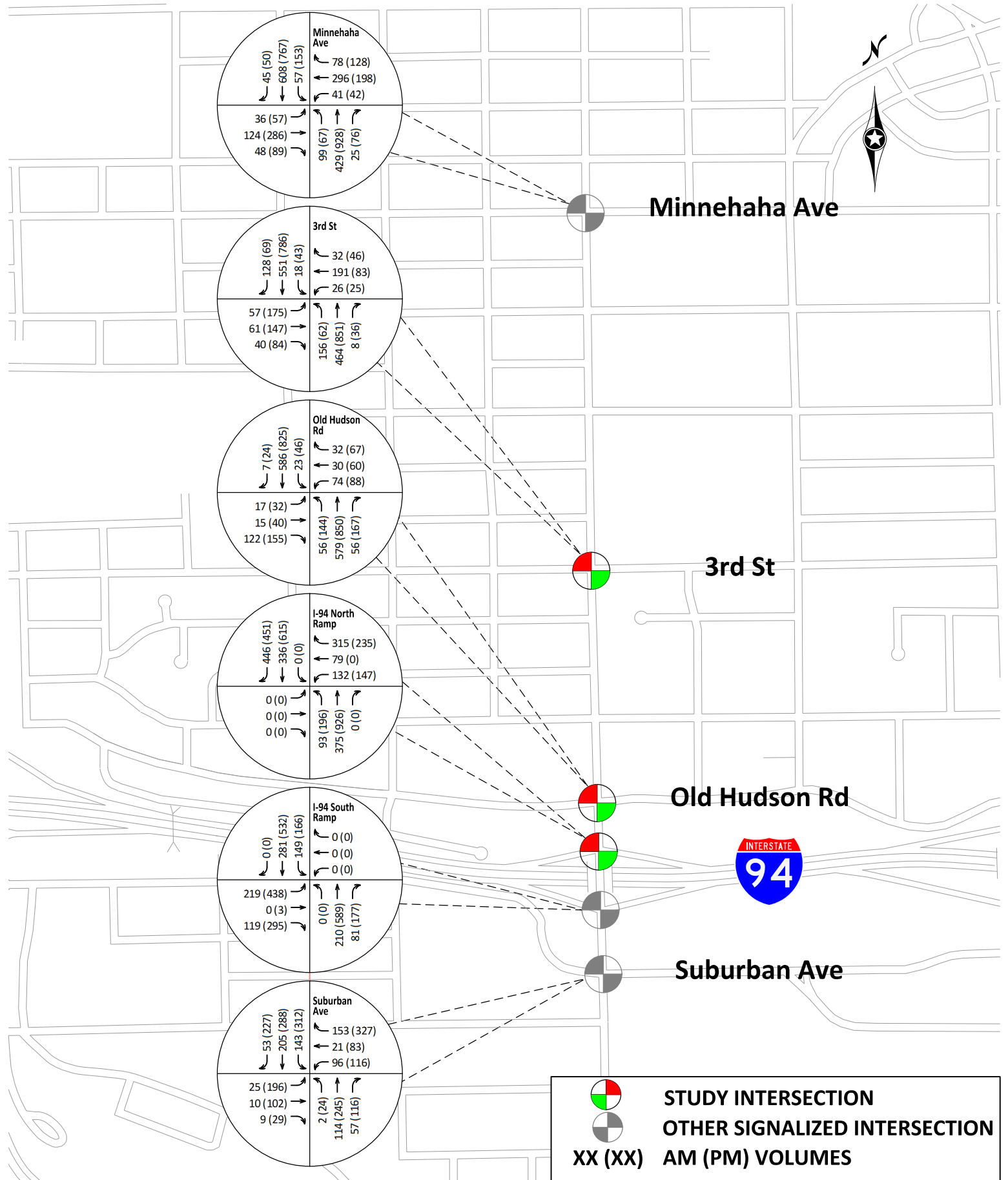
¹ Derived from year 2014 intersection turning movement and approach volume counts.

² Background growth rate derived based upon the forecast 2036 AADT compared to the 2014 existing AADT.

³ Proposed forecast AADT based on evaluation of historical regression analysis, 20 year average, characteristics of the surrounding land use and comparison to other forecast projections (e.g., State Aid Factor and St. Paul Transportation Plan).

Applying the annual growth rate, the year 2036 intersection traffic volumes for the a.m. and p.m. peak hours were developed as illustrated on Figure 5.





3.0 Safety Analysis

Ramsey County provided intersection crash data for the years 2011 to 2013. Evaluation of current crash characteristics may identify certain patterns correctable by signal timing changes, signal phasing changes, or geometry improvements.

3.1 Crash Rate Analysis

A key factor in the safety analysis is the crash rate. The crash rate for any intersection is defined as the number of crashes occurring per million entering vehicles (MEV). Table 3 summarizes the existing crash rate for each intersection compared to the statewide average for similar traffic control types.

Crash occurrence is somewhat random by nature. Identifying every intersection with a crash rate above the statewide average value in an analysis would produce a large amount of data that may not be statistically relevant with respect to safety deficiencies. The critical crash rate identifies those locations that have a crash rate higher than similar facilities by a statistically significant amount. The critical crash rate is calculated by adjusting the system wide average based on the amount of exposure and a statistical constant indicating level of confidence¹. At locations where the actual crash rate exceeds the critical crash rate, it is 99 percent certain that an intersection design deficiency exists, or there are hazardous characteristics present at the location.

Crash severity quantifies how severe the crashes are at a particular location. In the crash information database maintained by MnDOT, crashes are categorized into three major categories of severity; property damage – no injuries occurred, type A, B and C injury crashes and fatal crashes. The purpose for analyzing this statistic is to identify locations that experience a low crash rate but have a high percentage of injury or fatal crashes. Conversely, locations which have high crash rates with a large proportion of property damage crashes may not warrant as much priority when deficiencies are being addressed.

Table 3. Crash Rate Summary

Intersection	Total Crashes ¹	MEV	Crash Rate	Statewide Average Crash Rate ²	Critical Crash Rate	Intersection Severity Rate ³	Statewide Average Severity Rate ²
White Bear Ave. & 3rd St.	19	29,382,713	0.65	0.70	1.11	0.92	0.97
White Bear Ave. & Old Hudson Rd.	39	30,772,925	1.27	0.70	1.10	1.46	0.97
White Bear Ave. & Margaret St.	6	23,894,271	0.25	0.18	0.42	0.42	0.26

MEV - Million Entering Vehicles

¹ Source: Ramsey County 2011- 2013

² Source: MnDOT Intersection Green Sheets 2012

³ Severity Rate Factors: 5 for Fatal Crash, 3 for Injury Crash, and 1 for Property Damage Only Crash.

¹ MnDOT Traffic Safety Fundamentals Handbook, August 2008.

The analysis indicates that the White Bear Avenue/Old Hudson Road and White Bear Avenue/Margaret Street intersections have crash rates higher than the statewide average. However, only Old Hudson Road exceeds the critical crash rate, indicating there is a statistically significant concern that a safety deficiency may exist. It should be noted that the statewide average reflects all high volume, low speed signalized intersections on the trunk highway system. This may not best reflect the urbanized characteristics of signalized intersections within St. Paul. As such, an average crash rate higher than 0.70 may very well be expected. Therefore, the crash rate comparison should be taken in context with the type of crashes and contributing factors occurring.

3.2 Crash Type Distribution

Figure 3 documents the crash type distribution. The crash type distribution was compared to the typical values compiled from data throughout Minnesota.

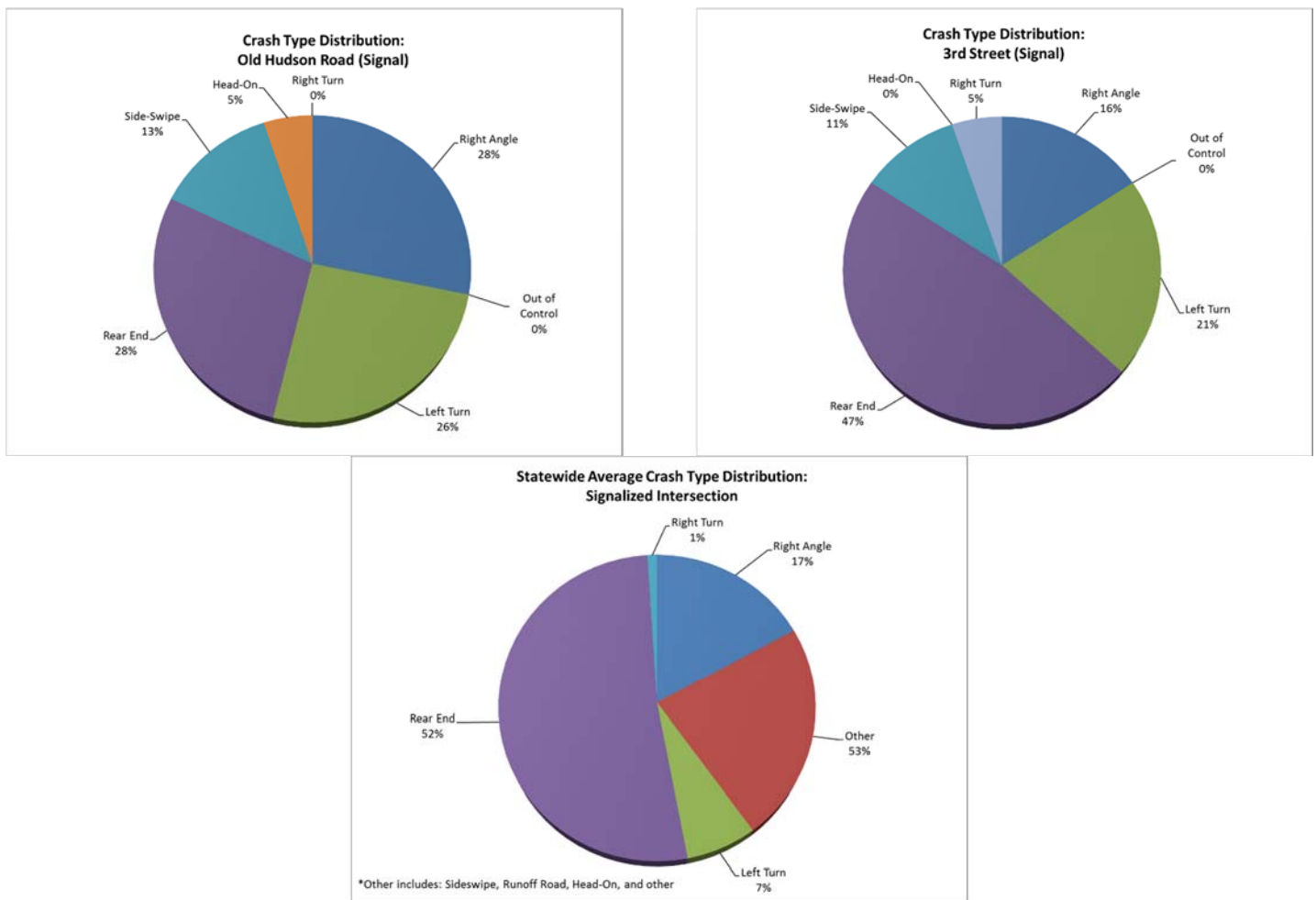


Figure 6. Crash Type Distribution Summary

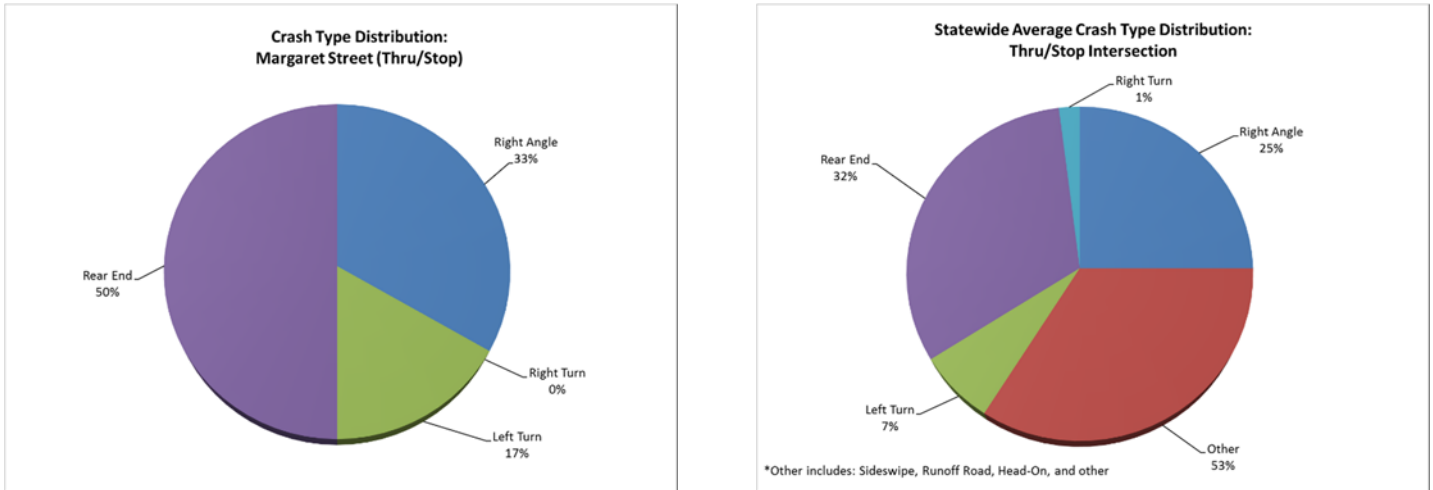


Figure 6. Crash Type Distribution Summary Cont'd

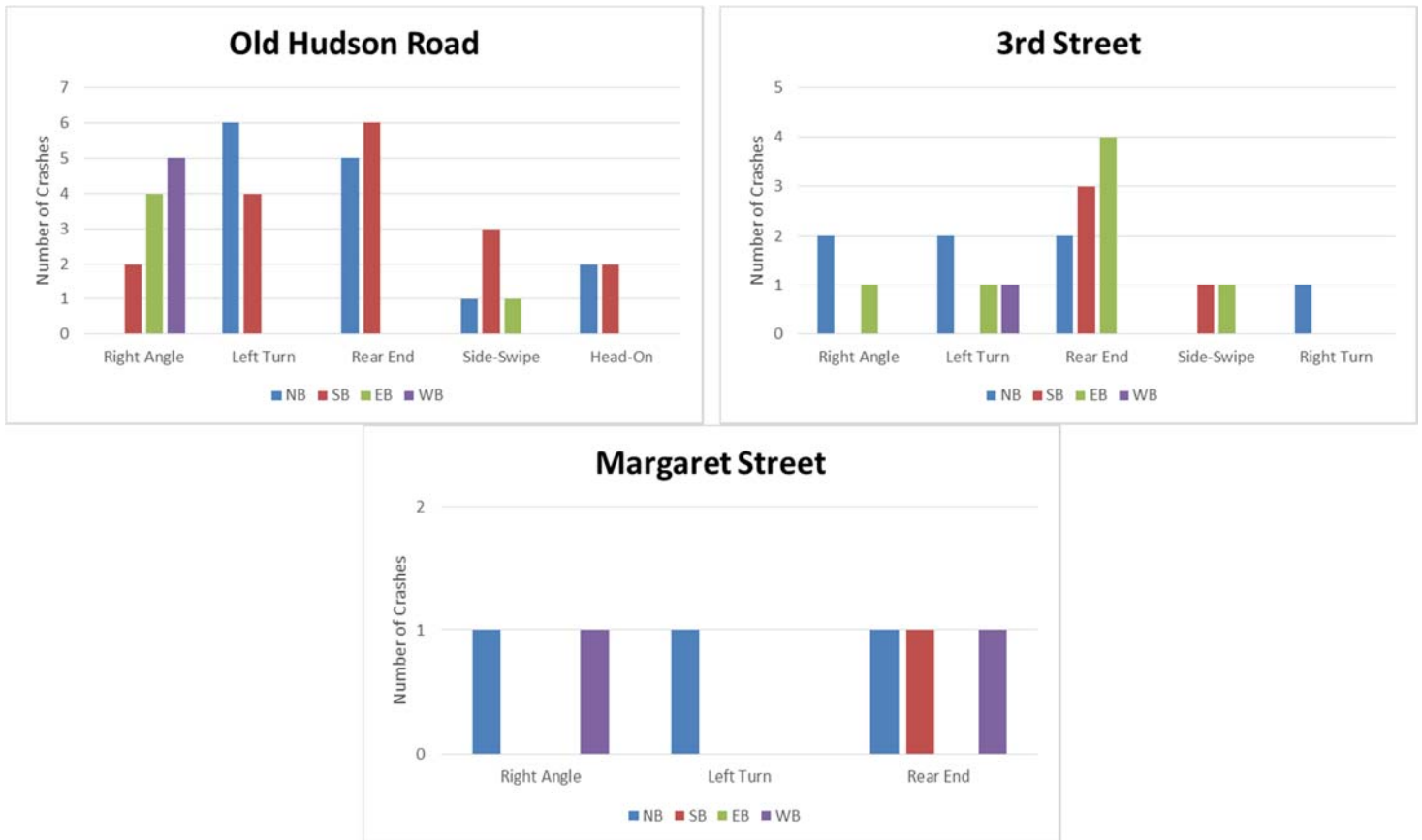


Figure 7. Crash Type Distribution By Approach

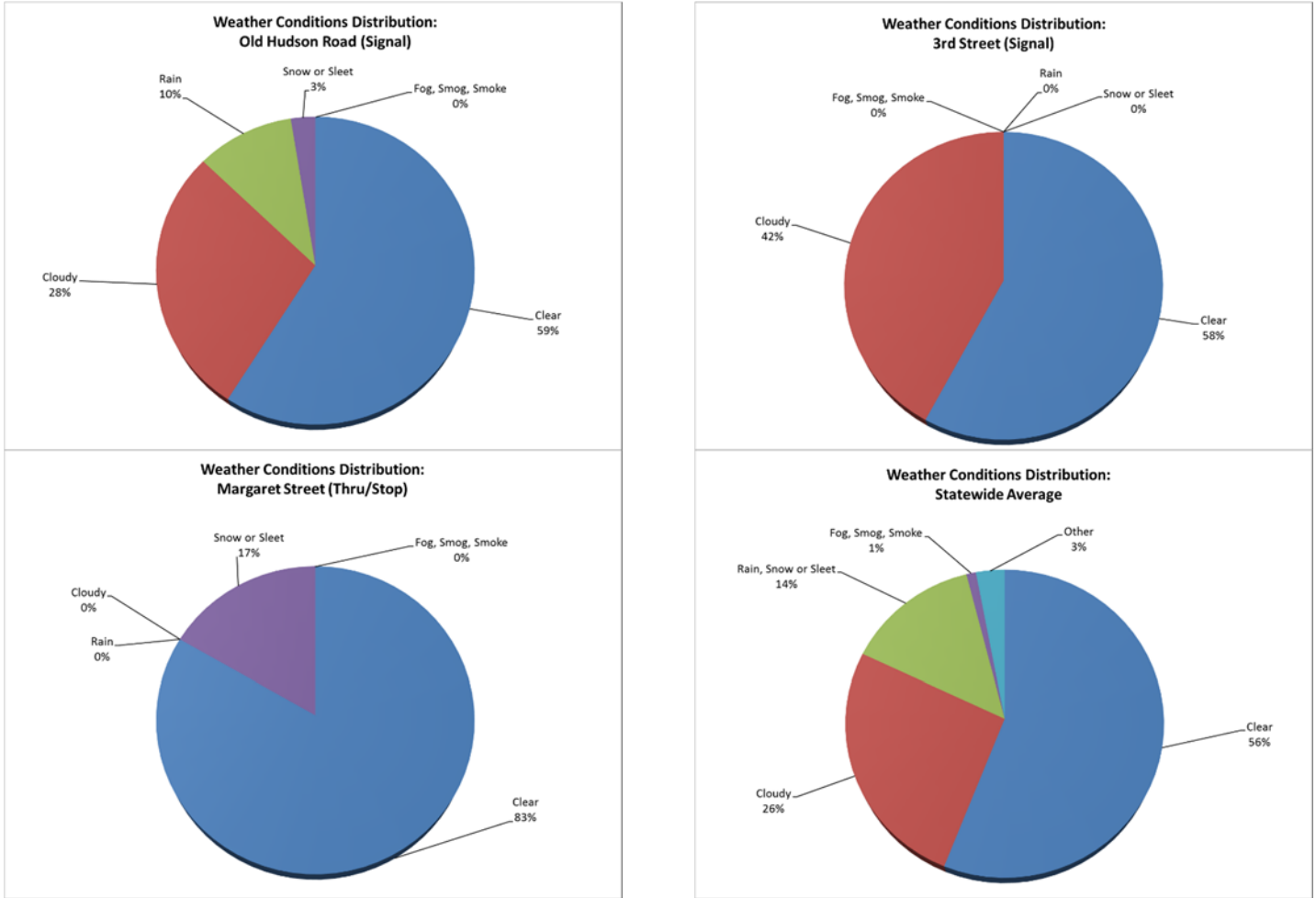


Figure 8. Crash Type Distribution Versus Weather

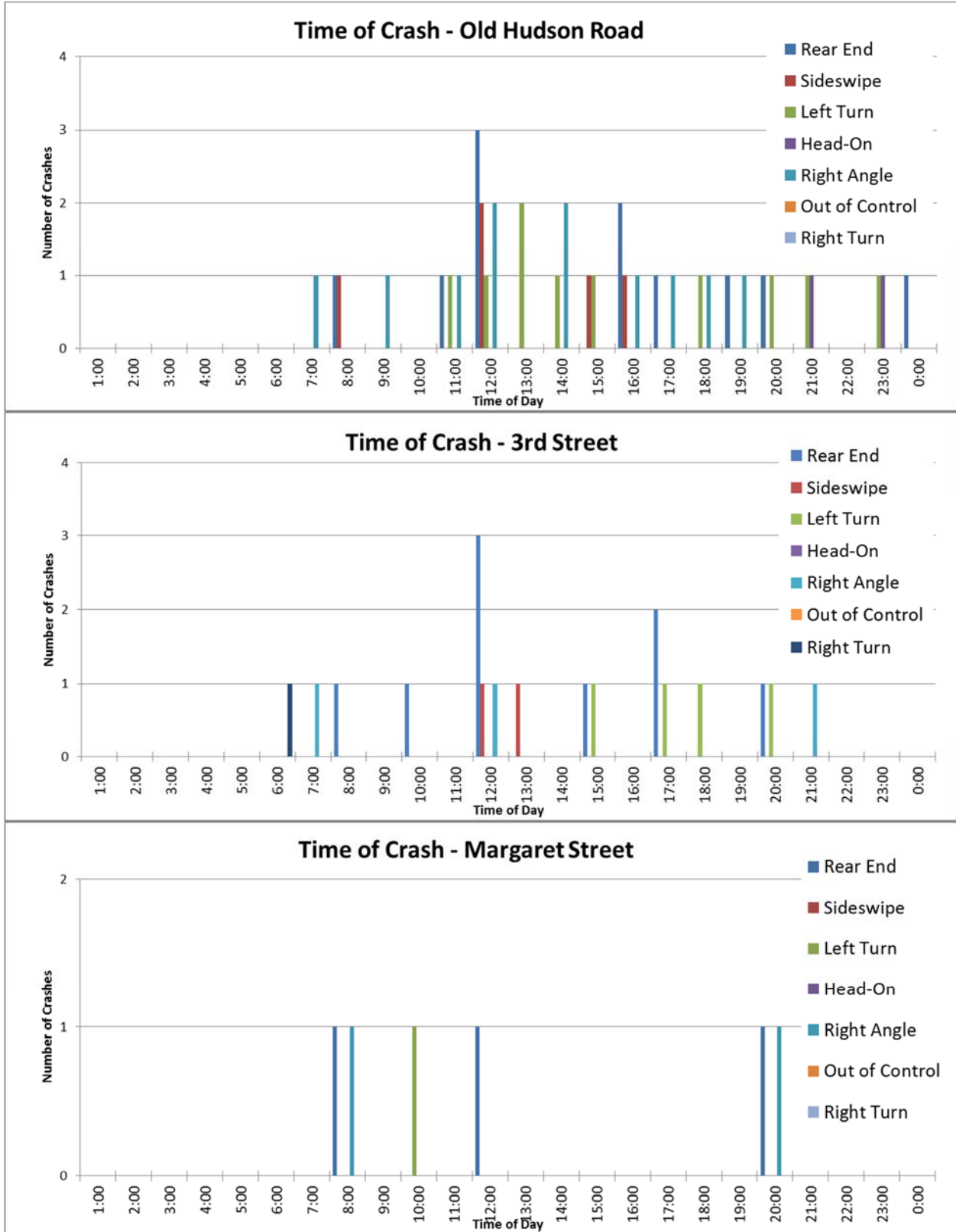


Figure 9. Crash Type Distribution Versus Time of Day

3.3. Safety Analysis Conclusions

Based on a review of the existing intersections crash experience, the following conclusions are made:

- The White Bear Avenue/3rd Street intersection has a crash rate below the statewide average rate. The intersection of White Bear Avenue and Old Hudson Road's crash rate exceeds both the average rate and critical crash rate.
- In addition, the data indicates that the left turn and right angle type crashes at White Bear Avenue/Old Hudson Road are significantly higher than the statewide average.
- Sideswipe type crashes represent a high percentage of the overall crashes occurring at the study intersections, which is consistent with a multi-lane undivided urban arterial without turn lanes.
- The weather conditions and road conditions distribution percentages appeared to be close to the statewide averages and do not appear to be a strong contributing factor.
- A majority of the crashes took place during the middle of the day and afternoon hours, which is consistent with the highest traffic volume periods.
- Rear end type crashes appear to be consistent with expected percentages found at signalized intersections.

Overall the crash experience is indicative of facilities with higher traffic volumes, shared turn lane operation and permissive traffic signal phasing. To most effectively reduce the crash types occurring at these intersections, improvement measures will need to focus on reducing congestion, provide exclusive turn lanes and provide opportunities for protected/permissive left turn phasing.

4.0 Traffic Operation Analysis

A traffic operation analysis was conducted for White Bear Avenue during the a.m. and p.m. peak hours. The analysis evaluates the operational performance of the existing year 2014 conditions, opening year 2016 and the forecast 2036 conditions.

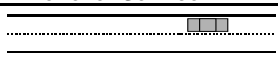
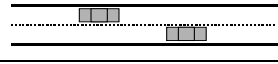

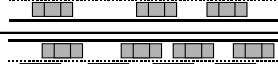

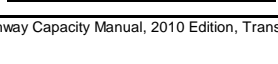
4.1 Analysis Tool

The traffic operation analysis performed for the existing conditions and the forecast year conditions was completed using SimTraffic8.0. SimTraffic8.0 is a microscopic simulation tool and was used to evaluate the operational performance of the traffic signal control options. SimTraffic8.0 was selected based upon its ability to better replicate the traffic peaking behavior and interaction across a corridor and network of traffic signal systems.

4.2 Level of Service

The term level of service (LOS), as taken from the *Highway Capacity Manual (HCM)*², refers to the ability of an intersection to process traffic volumes. It is defined as the delay to vehicles caused by the traffic control at the intersection or average operating speed along an urban arterial. The results of this measure of effectiveness (MOE) are typically presented in the form of a letter grade (A-F) that provides a qualitative indication of the operational efficiency or effectiveness. By definition, LOS A conditions represent high-quality operations and LOS F conditions represent very poor operations. The general relationship between intersection delay, average operating speed and LOS are graphically displayed in Table 4.

Table 4. LOS Definition

Level of Service	Description	Signalized Intersection	Urban Street LOS
		Intersection Delay (s/veh)	Average Travel Speed (mph)
A	 Free Flow. Low volumes and no delays.	0 - 10	>26
B	 Stable Flow. Speeds restricted by travel conditions, minor delays.	>10 - 20	>20 - 26
C	 Stable Flow. Speeds and maneuverability closely controlled due to higher volumes.	>20 - 35	>15 - 20
D	 Stable Flow. Speeds considerably affected by change in operating conditions. High density traffic restricts maneuverability, volume near capacity.	>35 - 55	>12 - 15
E	 Unstable Flow. Low speeds, considerable delay, volume at or slightly over capacity.	>55 - 80	>9 - 12
F	 Forced Flow. Very low speeds, volumes exceed capacity, long delays with stop and go traffic.	> 80	0 - 9

Source: Highway Capacity Manual, 2010 Edition, Transportation Research Board, Exhibit 18-4 for Signalized Intersections and Exhibit 19-1 for Unsignalized Intersection:

² Highway Capacity Manual, 2010 Edition, Transportation Research Board

4.3 Existing and Forecast No-Build Analysis Results

A traffic operation analysis was completed for the existing 2014, opening year 2016 and year 2036 forecast conditions under the existing intersection lane geometrics and signal control. The purpose of this analysis is provide a baseline condition, which the need for future improvement alternatives (if necessary) can be compared. Intersection delays and corridor average operating speeds are reported using SimTraffic8.0 and represent an average of five recorded random number seeds.

The key MOE's evaluated include; overall intersection delay and average speed. The existing year 2014, opening year 2016 and forecast year 2036 overall intersection delay results are summarized in Table 5. The existing year 2014, opening year 2016 and forecast year 2036 average vehicle speeds (urban arterial LOS) are illustrated in Table 6. The detailed approach delay and LOS are attached for reference in Appendix A.

Table 5. Existing and Forecast No-Build Intersection MOE Results

Intersection	MOE	Existing Conditions (Year 2014)		Year 2016 No Build		Year 2036 No Build	
		AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
		Overall	Overall	Overall	Overall	Overall	Overall
White Bear Avenue & Suburban Avenue	Delay (s/v)	8.7	18.8	9.3	18.6	9.4	143.9
	LOS	A	B	A	B	A	F
White Bear Avenue & I-94 South Ramps	Delay (s/v)	12.1	37.2	12.1	37.5	11.9	62.9
	LOS	B	D	B	D	B	E
White Bear Avenue & I-94 North Ramps	Delay (s/v)	10.7	34.8	10.9	36.5	12.4	52.1
	LOS	B	C	B	D	B	D
White Bear Avenue & Old Hudson Road	Delay (s/v)	10.7	48.5	11.1	46.4	11.6	78.4
	LOS	B	D	B	D	B	E
White Bear Avenue & 3rd Street	Delay (s/v)	12.9	15.2	13.3	15.2	16.4	16.2
	LOS	B	B	B	B	B	B
White Bear Avenue & Minnehaha Avenue	Delay (s/v)	14.3	18.7	15.1	22.2	16.3	26.5
	LOS	B	B	B	C	B	C
Total Network	Delay (hr)	28.4	110.8	30.7	113.8	35.8	233.8

1. AM and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table 6. Existing and Forecast No-Build Arterial MOE Results

Direction	Travel Route	MOE	Existing Conditions (Year 2014)		Year 2016 No Build		Year 2036 No Build	
			AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
			Overall	Overall	Overall	Overall	Overall	Overall
NB	White Bear: Suburban Avenue to Minnehaha Avenue	Speed (mph)	21.7	13.9	21.4	14.0	21.0	5.4
		LOS	B	D	B	D	B	F
SB	White Bear: Minnehaha Avenue to Suburban Avenue	Speed (mph)	20.9	13.3	20.8	13.5	20.6	11.6
		LOS	B	D	B	D	B	E

1. AM and PM Peak speeds computed using SimTraffic averaged over 5 random seeds

The following summarizes the results of the intersection traffic operation analysis:

- Overall all intersections are expected to operate at an acceptable LOS C or better during the a.m. peak hour.
- During the existing and forecast 2016 p.m. peak hour, the White Bear Avenue/Old Hudson Road intersection operates at a LOS D. However, periods of northbound congestion currently exists between Suburban Avenue and Old Hudson Road and southbound congestion between Old Hudson Road and I-94.
- Under the forecast 2036 conditions, significant congestion and delay is expected. The primary contributing factors include the shared through/left turn operation at the I-94 interchange and the Old Hudson Road intersections.

4.4 Alternatives Analysis

A traffic operation analysis was completed for several cross-section alternatives and intersection improvement scenarios under the opening year 2016 and year 2036 a.m. and p.m. peak hour forecast conditions. The traffic operation and safety analysis of the existing and future no-build conditions indicated the need for left turn lanes at key intersections including northbound/southbound White Bear Avenue/Old Hudson Road, and southbound White Bear Avenue/I-94 South Ramps. A descriptive summary of each scenario evaluated is provided in Table 7. There are three primary scenarios:

- Scenario 1: Maintain existing lane geometrics and employ improved traffic signal operation strategies.
- Scenario 2: Three-lane cross-section and evaluate alternative lane configurations and need for turn lanes.
- Scenario 3: Maintain four lane cross-section and evaluate alternative lane configurations, signal operations and need for turn lanes.

Each primary scenario evaluates multiple lane configurations and intersection improvement (signal operations and geometrics) sub-scenarios to provide a comparison of operational performance. This comparison analysis will help to identify the most beneficial improvement measures. The intersection lane configurations and traffic control for Scenario 2 and Scenario 3, including sub-scenarios, are illustrated in Figure 10 and Figure 11, respectively.

The traffic operations analysis identified the existing four-lane bridge over I-94 contributes to congestion experienced at Old Hudson Road. In order to effectively assess and compare potential improvement alternatives at Old Hudson Road, each scenario assumes a five-lane wide bridge.

Table 7. Alternatives Analysis Scenario Descriptions

Scenario	Description
No Build	Existing signal timing and existing lane geometry.
1	Optimize traffic signal timing and maintain existing lane geometry.
1a	<ul style="list-style-type: none"> - Optimize traffic signal timing - Add a northbound protected/permissive left turn phase at Old Hudson Road - Maintain existing lane geometry.
2	<ul style="list-style-type: none"> - Three lane cross-section along the entire length of the corridor - Optimize traffic signal timing
2a	<ul style="list-style-type: none"> - Provide a three lane cross-section north of Old Hudson Road. Maintain existing four-lane cross-section south of Old Hudson Road - Optimize traffic signal timing - Provide exclusive left turn lanes at Old Hudson Road
2b	<ul style="list-style-type: none"> - Scenario 2a plus - Add northbound and southbound right turn lanes at 3rd Street.
2c	<ul style="list-style-type: none"> - Provide a three lane cross-section north of 3rd Street. Maintain existing four-lane cross-section south of 3rd Street - Optimize traffic signal timing - Provide exclusive left turn lanes at Old Hudson Road
2d	<ul style="list-style-type: none"> - Scenario 2a plus - add northbound and southbound right turn lanes at 3rd Street and at Minnehaha Avenue.
3	Add northbound and southbound left turn lanes at Old Hudson Road and optimize traffic signal timing.
3a	<ul style="list-style-type: none"> - Scenario 3 plus - Reconfigure the Old Hudson Road eastbound approach to consist of 1-LT lane, 1-TH lane, 1-RT lane and the westbound approach to consist of 1-LT lane, 1-TH/RT lane.
3b	<ul style="list-style-type: none"> - Scenario 3a plus - Add protected/permissive left turn phases for all directions at Old Hudson Road.
3c	<ul style="list-style-type: none"> - Scenario 3 plus - Add northbound and southbound right turn lanes at Old Hudson Road and 3rd Street. - Add a southbound right turn lane at I-94 North Ramp.
3d	<ul style="list-style-type: none"> - Scenario 3a plus - Add a southbound right turn lane at I-94 North Ramp. - Extend the I-94 North Ramp northbound left to I-94 South Ramp. - At I-94 South Ramp reconfigure the southbound approach to consist of 1-LT and 1-TH lane. - At Suburban Avenue reconfigure the southbound approach to consist of 1-LT lane, 1-TH lane, 1-RT lane and the northbound approach to consist of 1-LT lane, 2-TH lanes, 1-RT lane.
3e	<ul style="list-style-type: none"> - Scenario 3b plus - Add northbound and southbound right turn lanes at Old Hudson Road and 3rd Street. - Add a southbound right turn lane at I-94 North Ramp.

White Bear Avenue Scenarios

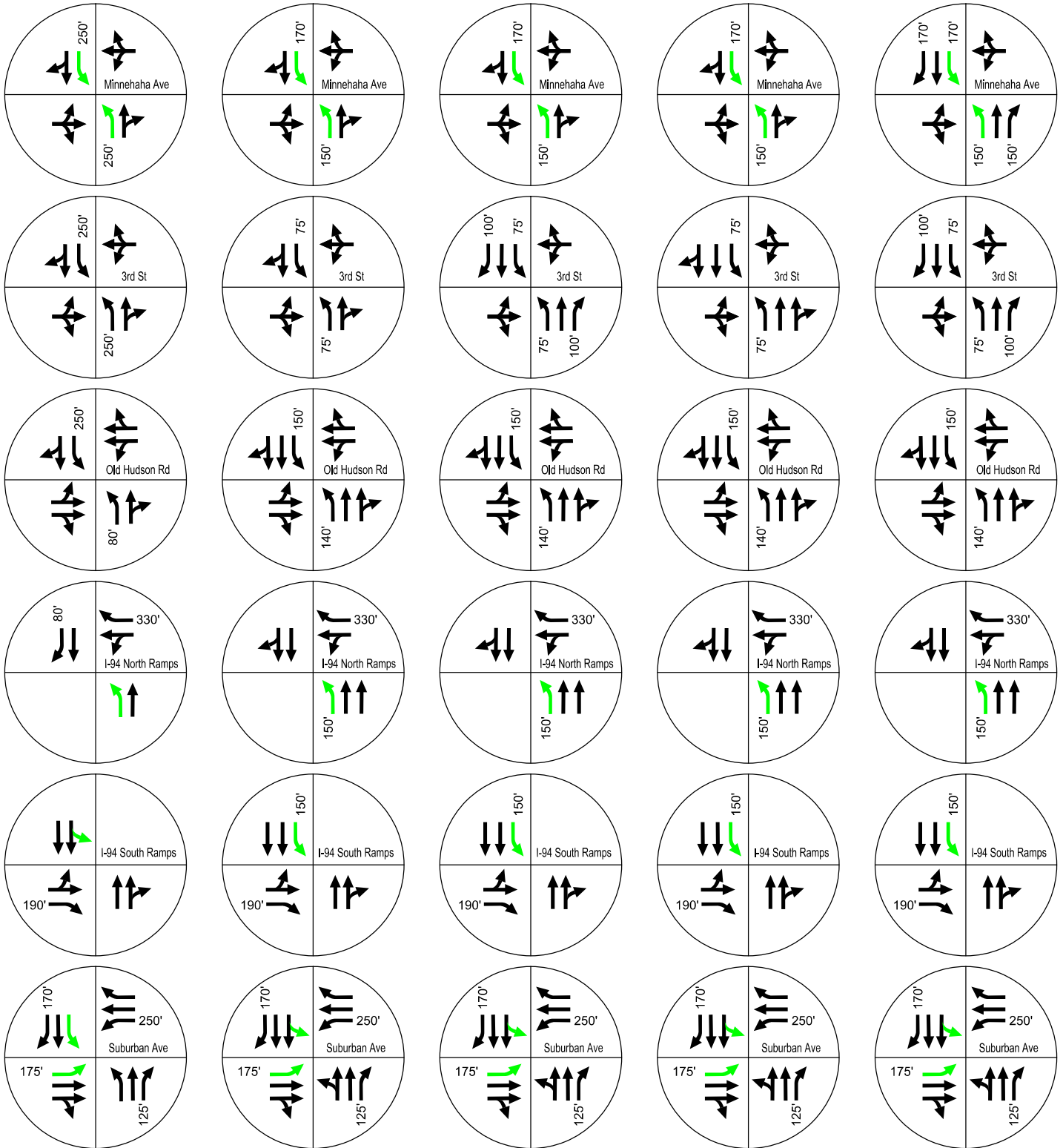
Scenario 2



Scenario 2a

Scenario 2b

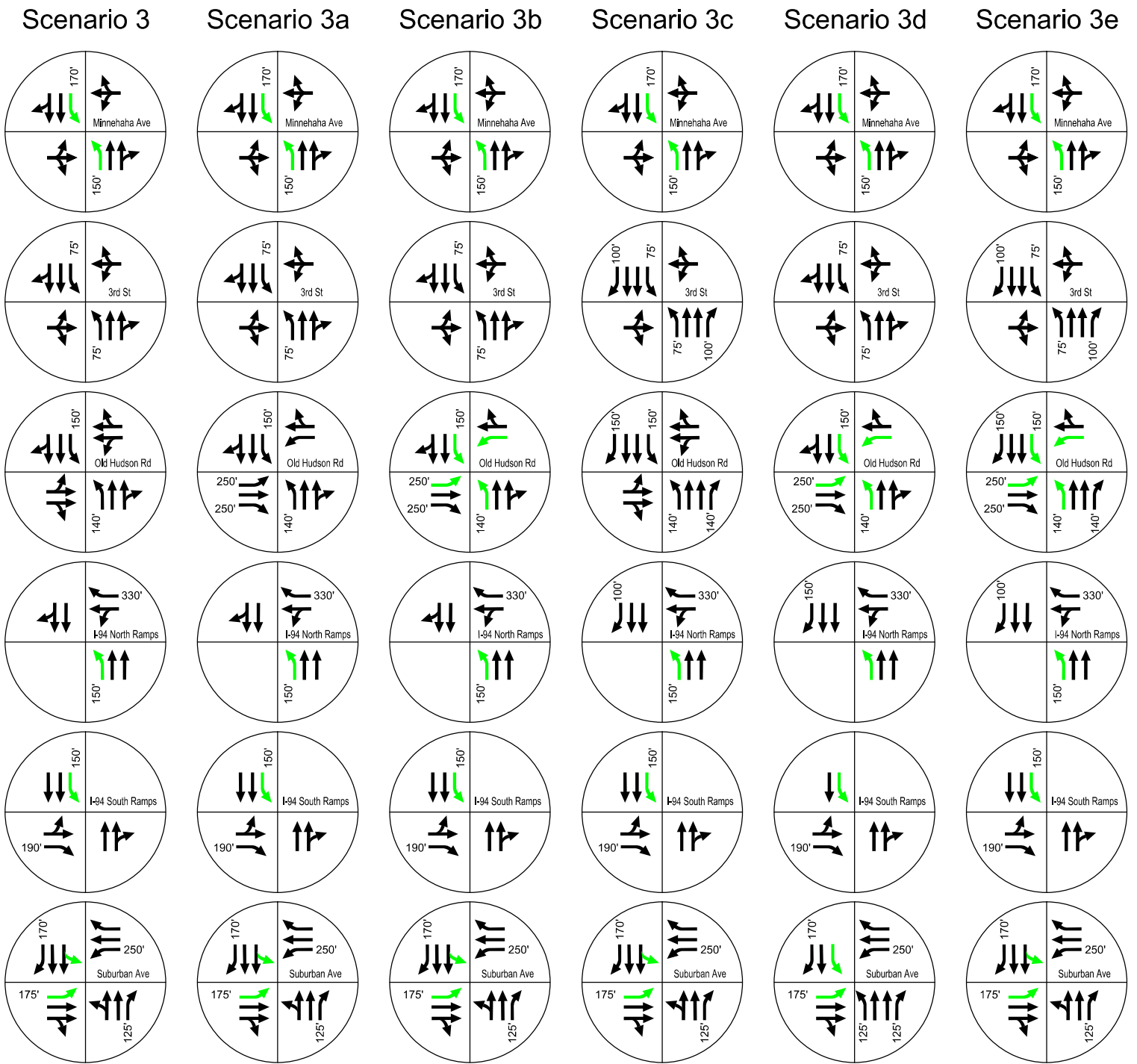
Scenario 2c

Scenario 2d



	PROTECTED/PERMISSIVE ARROW
	PERMISSIVE ONLY

White Bear Avenue Scenarios





 **PROTECTED/PERMISSIVE ARROW**
 **PERMISSIVE ONLY**

Table 8 and Table 9 summarizes the forecast year 2016 and year 2036 overall intersection delay results for each scenario, respectively. Table 10 summarizes the forecast year 2016 and year 2036 average vehicle speeds (urban arterial LOS). The detailed movement delay and LOS are attached for reference in Appendix A. The results of the operation analysis will help identify the most effective improvements and may be used by Ramsey County to help prioritize or secure right of way for future implementation.

The following summarizes the results of the arterial intersection traffic operation analysis:

- The implementation of optimized signal timing (Scenario 1) along White Bear Avenue is expected to provide considerable improvement over the forecast 2036 no build scenario. Overall, the total network delay is reduced in half and a LOS D or better is expected at each intersection.
- Overall most intersections are expected to operate at an acceptable LOS C or better during the a.m. peak hour for all scenarios. The White Bear Avenue/3rd Street intersection operates at LOS D in 2036 for Scenario 2a. The White Bear Avenue/Minnehaha Avenue intersection operates at LOS D in 2036 for Scenarios 2b, 2c, and 2d.
- During the p.m. peak period, a three lane cross-section is not expected to provide acceptable level of traffic operations and will not satisfy Minnesota Rule 8820.9936. All of the three-lane section scenarios (Scenarios 2, 2a, 2b, 2c, and 2d) operate at a LOS F for many of the intersections. The scenarios evaluated multiple locations for transitioning between a four-lane and three-lane cross-section; and also evaluated the benefit of adding exclusive right turn lanes. The analysis concludes that a single travel lane in the northbound cannot accommodate the forecast traffic volume demand without excessive delays and queuing or traffic volume diversion.
- The implementation of northbound and southbound left turn lanes at Old Hudson Road (Scenarios 3, 3a, 3b, 3c, 3d, and 3e), results in an estimated additional 35 percent reduction in network delay over providing optimized signal timing (Scenario 1). For each of these scenarios, most intersections are expected to operate at an acceptable LOS C or better during the a.m. and p.m. peak hours.
- Reconfiguring the Old Hudson Road to a 3-lane cross-section (Scenario 3a, lane configurations shown in Figure 11) results in a neutral traffic operation improvement; however, is expected to provide improved safety characteristics by segregating turning movements into exclusive lanes. The addition of protected/permissive signal phasing (Scenario 3b) increases intersection delay; however, additional safety benefit is expected.
- The addition of right turn lanes at the White Bear Avenue/3rd Street, Old Hudson Road and I-94 North Ramp intersections is expected to provide improved intersections operations (approximately 8 percent additional reduction in delay). With exception to the right turn lane at the I-94 North Ramp, the overall delay reduction is fairly minimal and may not be the cost-beneficial improvement.

Table 8. Forecast Year 2016 Alternatives Analysis Results – Intersection LOS

AM Peak Hour

Intersection	MOE	Year 2016 AM Peak Hour													
		No Build	S1	S1a	S2	S2a	S2b	S2c	S2d	S3	S3a	S3b	S3c	S3d	S3e
		Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall
White Bear Avenue & Suburban Avenue	Delay (s/v)	9.3	9.3	10.0	9.8	9.2	9.0	9.3	9.7	9.2	9.6	8.8	9.5	9.4	9.1
	LOS	A	A	B	A	A	A	A	A	A	A	A	A	A	A
White Bear Avenue & I-94 South Ramps	Delay (s/v)	12.1	11.8	11.8	13.0	12.0	11.6	11.4	12.1	11.3	11.4	11.1	11.6	11.8	11.4
	LOS	B	B	B	B	B	B	B	B	B	B	B	B	B	B
White Bear Avenue & I-94 North Ramps	Delay (s/v)	10.9	11.6	12.8	12.5	10.6	11.3	11.4	10.4	11.4	11.2	10.5	10.2	10.1	9.9
	LOS	B	B	B	B	B	B	B	B	B	B	B	B	B	A
White Bear Avenue & Old Hudson Road	Delay (s/v)	11.1	9.7	11.3	11.4	9.3	9.1	9.5	10.6	9.1	9.4	9.8	8.7	9.7	9.3
	LOS	B	A	B	B	A	A	A	B	A	A	A	A	A	A
White Bear Avenue & 3rd Street	Delay (s/v)	13.3	13.8	13.2	18.1	20.1	16.2	15.4	17.4	12.9	12.6	13.8	12.4	14.8	12.8
	LOS	B	B	B	B	C	B	B	B	B	B	B	B	B	B
White Bear Avenue & Minnehaha Avenue	Delay (s/v)	15.1	15.5	16.6	22.1	24.8	28.6	26.9	31.3	16.1	16.5	16.0	16.1	15.5	16.1
	LOS	B	B	B	C	C	C	C	C	B	B	B	B	B	B
Total Network	Delay (hr)	30.7	30.1	32.0	37.2	36.6	37.6	35.7	39.9	29.7	29.8	29.5	28.6	30.3	28.9

PM Peak Hour

Intersection	MOE	Year 2016 PM Peak Hour													
		No Build	S1	S1a	S2	S2a	S2b	S2c	S2d	S3	S3a	S3b	S3c	S3d	S3e
		Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall
White Bear Avenue & Suburban Avenue	Delay (s/v)	18.6	16.0	15.5	238.9	14.5	14.3	14.3	14.2	14.0	14.0	13.3	14.3	20.5	14.3
	LOS	B	B	B	F	B	B	B	B	B	B	B	B	C	B
White Bear Avenue & I-94 South Ramps	Delay (s/v)	37.5	26.7	24.2	47.6	19.0	19.1	19.6	20.3	19.5	19.6	19.8	19.6	29.1	20.6
	LOS	D	C	C	D	B	B	B	C	B	B	B	B	C	C
White Bear Avenue & I-94 North Ramps	Delay (s/v)	36.5	18.3	18.4	21.9	13.0	13.3	12.6	10.9	13.5	13.0	11.7	10.3	10.1	9.6
	LOS	D	B	B	C	B	B	B	B	B	B	B	B	B	A
White Bear Avenue & Old Hudson Road	Delay (s/v)	46.4	24.5	23.4	92.2	11.0	11.9	11.4	12.4	13.3	14.5	14.2	9.9	17.4	12.0
	LOS	D	C	C	F	B	B	B	B	B	B	B	A	B	B
White Bear Avenue & 3rd Street	Delay (s/v)	15.2	13.5	13.5	35.7	26.1	19.7	16.7	19.7	13.1	13.0	13.3	12.6	13.4	12.5
	LOS	B	B	B	D	C	B	B	B	B	B	B	B	B	B
White Bear Avenue & Minnehaha Avenue	Delay (s/v)	22.2	18.7	18.3	105.9	84.9	95.4	84.4	75.1	17.6	18.0	18.1	18.6	18.1	19.3
	LOS	C	B	B	F	F	F	F	E	B	B	B	B	B	B
Total Network	Delay (hr)	113.8	78.0	73.8	305.3	114.9	120.7	108.6	104.6	60.6	61.4	60.3	57.4	71.4	59.6

1. AM and PM Peak delays computed using SimTraffic averaged over 5 random seeds



Table 9. Forecast Year 2036 Alternatives Analysis Results – Intersection LOS

AM Peak Hour

Intersection	MOE	Year 2036 AM Peak Hour													
		No Build	S1	S1a	S2	S2a	S2b	S2c	S2d	S3	S3a	S3b	S3c	S3d	S3e
		Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall
White Bear Avenue & Suburban Avenue	Delay (s/v)	9.4	10.2	9.5	9.4	9.4	8.8	8.9	9.2	9.2	9.6	9.2	9.4	9.8	8.9
	LOS	A	B	A	A	A	A	A	A	A	A	A	A	A	A
White Bear Avenue & I-94 South Ramps	Delay (s/v)	11.9	11.5	11.2	12.9	11.5	11.5	11.3	11.5	11.0	11.2	11.3	11.0	11.3	11.1
	LOS	B	B	B	B	B	B	B	B	B	B	B	B	B	B
White Bear Avenue & I-94 North Ramps	Delay (s/v)	12.4	13.2	13.9	18.3	13.4	12.4	11.7	11.7	11.9	12.2	11.1	11.1	10.4	10.3
	LOS	B	B	B	B	B	B	B	B	B	B	B	B	B	B
White Bear Avenue & Old Hudson Road	Delay (s/v)	11.6	10.5	11.7	14.6	11.5	10.0	9.5	10.9	9.4	9.4	9.8	9.4	9.3	9.6
	LOS	B	B	B	B	B	A	A	B	A	A	A	A	A	A
White Bear Avenue & 3rd Street	Delay (s/v)	16.4	15.8	15.0	29.8	39.4	19.5	16.3	18.1	14.5	15.3	14.3	14.2	15.2	13.7
	LOS	B	B	B	C	D	B	B	B	B	B	B	B	B	B
White Bear Avenue & Minnehaha Avenue	Delay (s/v)	16.3	17.6	19.6	25.2	33.3	52.9	45.0	46.9	17.0	17.8	17.1	18.0	17.0	16.5
	LOS	B	B	B	C	C	D	D	D	B	B	B	B	B	B
Total Network	Delay (hr)	35.8	36.0	37.9	52.6	56.7	56.2	49.1	52.4	33.4	35.2	33.2	33.7	33.1	32.1

PM Peak Hour

Intersection	MOE	Year 2036 PM Peak Hour													
		No Build	S1	S1a	S2	S2a	S2b	S2c	S2d	S3	S3a	S3b	S3c	S3d	S3e
		Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall
White Bear Avenue & Suburban Avenue	Delay (s/v)	143.9	16.8	16.0	348.2	22.1	15.7	14.5	14.2	13.8	14.5	14.2	14.1	39.4	14.9
	LOS	F	B	B	F	C	B	B	B	B	B	B	B	D	B
White Bear Avenue & I-94 South Ramps	Delay (s/v)	62.9	26.1	26.0	66.3	27.2	23.2	20.7	20.9	18.6	20.7	19.6	19.2	29.7	20.1
	LOS	E	C	C	E	C	C	C	C	B	C	B	B	C	C
White Bear Avenue & I-94 North Ramps	Delay (s/v)	52.1	25.7	23.8	44.0	32.1	35.0	18.8	13.2	14.4	14.7	13.6	11.8	11.6	10.3
	LOS	D	C	C	D	C	D	B	B	B	B	B	B	B	B
White Bear Avenue & Old Hudson Road	Delay (s/v)	78.4	46.0	68.7	130.1	25.9	26.0	20.4	16.1	14.8	14.5	18.0	10.5	18.0	13.0
	LOS	E	D	E	F	C	C	C	B	B	B	B	B	B	B
White Bear Avenue & 3rd Street	Delay (s/v)	16.2	14.9	14.8	58.3	74.5	62.8	74.6	40.3	14.1	13.9	14.5	13.9	14.5	13.5
	LOS	B	B	B	E	E	E	E	D	B	B	B	B	B	B
White Bear Avenue & Minnehaha Avenue	Delay (s/v)	26.5	21.8	22.2	122.4	154.9	164.1	182.3	134.4	20.6	20.5	22.4	21.0	20.8	21.0
	LOS	C	C	C	F	F	F	F	F	C	C	C	C	C	C
Total Network	Delay (hr)	233.8	107.0	122.2	410.4	236.8	235.5	233.7	177.5	69.4	71.5	74.3	65.5	92.4	67.0

1. AM and PM Peak delays computed using SimTraffic averaged over 5 random seeds



Table 10. Forecast Year 2016 and 2036 Alternatives Analysis Results – Urban Arterial LOS

Year 2016 AM Peak Hour

Direction	Travel Route	MOE	Year 2016 AM Peak Hour													
			No Build	S1	S1a	S2	S2a	S2b	S2c	S2d	S3	S3a	S3b	S3c	S3d	S3e
			Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall
NB	White Bear: Suburban Avenue to Minnehaha Avenue	Speed (mph)	21.4	24.1	24.5	23.3	23.1	24.0	23.9	24.5	24.8	24.6	24.9	24.9	25.1	24.9
		LOS	B	B	B	B	B	B	B	B	B	B	B	B	B	B
SB	White Bear: Minnehaha Avenue to Suburban Avenue	Speed (mph)	20.8	23.6	22.6	20.7	22.5	22.7	22.9	23.1	23.6	23.9	24.3	24.2	24.1	24.5
		LOS	B	B	B	B	B	B	B	B	B	B	B	B	B	B

Year 2016 PM Peak Hour

Direction	Travel Route	MOE	Year 2016 PM Peak Hour													
			No Build	S1	S1a	S2	S2a	S2b	S2c	S2d	S3	S3a	S3b	S3c	S3d	S3e
			Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall
NB	White Bear: Suburban Avenue to Minnehaha Avenue	Speed (mph)	14.0	18.7	19.1	7.2	14.8	13.8	13.7	17.9	20.2	20.5	20.3	20.9	18.3	20.0
		LOS	D	C	C	F	D	D	D	C	B	B	B	B	C	C
SB	White Bear: Minnehaha Avenue to Suburban Avenue	Speed (mph)	13.5	18.0	17.8	13.0	20.2	20.1	20.7	21.4	21.8	21.9	22.4	22.6	21.0	23.3
		LOS	D	C	C	D	B	B	B	B	B	B	B	B	B	B

Year 2036 AM Peak Hour

Direction	Travel Route	MOE	Year 2036 AM Peak Hour													
			No Build	S1	S1a	S2	S2a	S2b	S2c	S2d	S3	S3a	S3b	S3c	S3d	S3e
			Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall
NB	White Bear: Suburban Avenue to Minnehaha Avenue	Speed (mph)	21.0	23.3	23.9	20.3	17.9	22.5	23.6	23.8	24.7	24.6	24.4	24.6	24.7	24.6
		LOS	B	B	B	B	C	B	B	B	B	B	B	B	B	B
SB	White Bear: Minnehaha Avenue to Suburban Avenue	Speed (mph)	20.6	22.9	22.2	19.6	21.7	22.2	22.3	22.9	23.7	23.3	24.2	24.0	24.2	24.7
		LOS	B	B	B	C	B	B	B	B	B	B	B	B	B	B

Year 2036 PM Peak Hour

Direction	Travel Route	MOE	Year 2036 PM Peak Hour													
			No Build	S1	S1a	S2	S2a	S2b	S2c	S2d	S3	S3a	S3b	S3c	S3d	S3e
			Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall	Overall
NB	White Bear: Suburban Avenue to Minnehaha Avenue	Speed (mph)	5.4	16.4	17.7	4.0	7.5	7.7	7.5	11.3	20.2	19.7	19.3	20.1	17.5	19.7
		LOS	F	C	C	F	F	F	F	E	B	C	C	C	C	C
SB	White Bear: Minnehaha Avenue to Suburban Avenue	Speed (mph)	11.6	16.7	13.5	12.8	16.9	18.1	19.4	20.3	21.4	21.5	21.4	22.2	20.8	22.7
		LOS	E	C	D	D	C	C	C	B	B	B	B	B	B	B

1. AM and PM Peak speeds computed using SimTraffic averaged over 5 random seeds



5.0 Conclusions and Recommendations

The safety and traffic operation analysis draws the following key conclusions:

- The intersection of White Bear Avenue and Old Hudson Road's crash rate exceeds both the average rate and critical crash rate.
- In addition, the data indicates that the left turn and right angle type crashes at White Bear Avenue/Old Hudson Road are significantly higher than the statewide average.
- Overall the crash experience is indicative of facilities with higher traffic volumes, shared turn lane operation and permissive traffic signal phasing. To most effectively reduce the crash types occurring at these intersections, improvement measures will need to focus on reducing congestion, provide exclusive turn lanes and provide opportunities for protected/permissive left turn phasing.
- The implementation of optimized signal timing (Scenario 1) along White Bear Avenue is expected to provide considerable improvement over the forecast 2036 no build scenario. Overall, the total network delay is reduced in half and a LOS D or better is expected at each intersection.
- Overall most intersections are expected to operate at an acceptable LOS C or better during the a.m. peak hour for all scenarios. The White Bear Avenue/3rd Street intersection operates at LOS D in 2036 for Scenario 2a. The White Bear Avenue/Minnehaha Avenue intersection operates at LOS D in 2036 for Scenarios 2b, 2c, and 2d.
- During the p.m. peak period, a three lane cross-section is not expected to provide acceptable level of traffic operations and will not satisfy Minnesota Rule 8820.9936. All of the three-lane section scenarios (Scenarios 2, 2a, 2b, 2c, and 2d) operate at a LOS F for many of the intersections. The scenarios evaluated multiple locations for transitioning between a four-lane and three-lane cross-section; and also evaluated the benefit of adding exclusive right turn lanes. The analysis concludes that a single travel lane in the northbound cannot accommodate the forecast traffic volume demand without excessive delays and queuing or traffic volume diversion.
- The implementation of northbound and southbound left turn lanes at Old Hudson Road (Scenarios 3, 3a, 3b, 3c, 3d, and 3e), results in an estimated additional 35 percent reduction in network delay over providing optimized signal timing (Scenario 1). For each of these scenarios, most intersections are expected to operate at an acceptable LOS C or better during the a.m. and p.m. peak hours.
- Reconfiguring the Old Hudson Road to a 3-lane cross-section (Scenario 3a, lane configurations shown in Figure 11) results in a neutral traffic operation improvement; however, is expected to provide improved safety characteristics by segregating turning movements into exclusive lanes. The addition of protected/permissive signal phasing (Scenario 3b) increases intersection delay; however, additional safety benefit is expected.
- The addition of right turn lanes at the White Bear Avenue/3rd Street, Old Hudson Road and I-94 North Ramp intersections is expected to provide improved

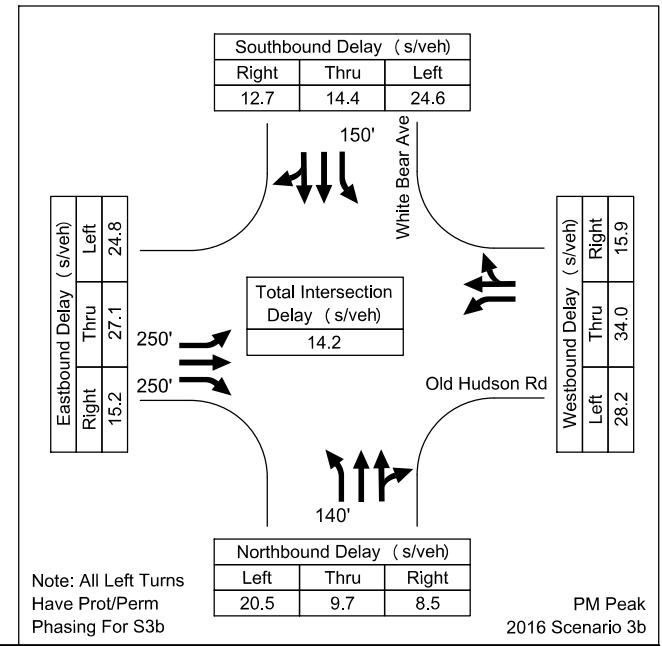
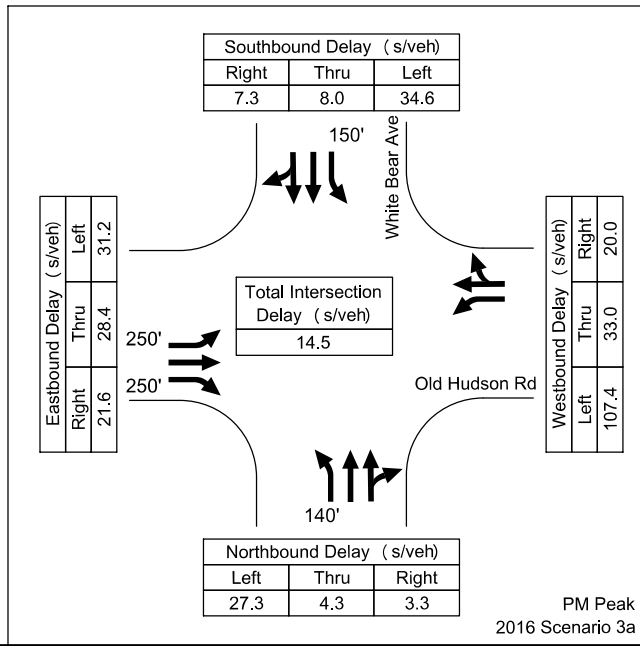
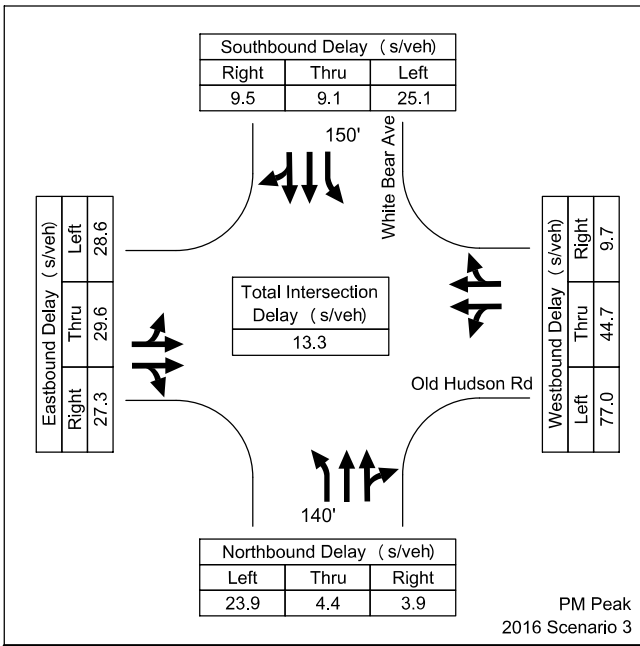
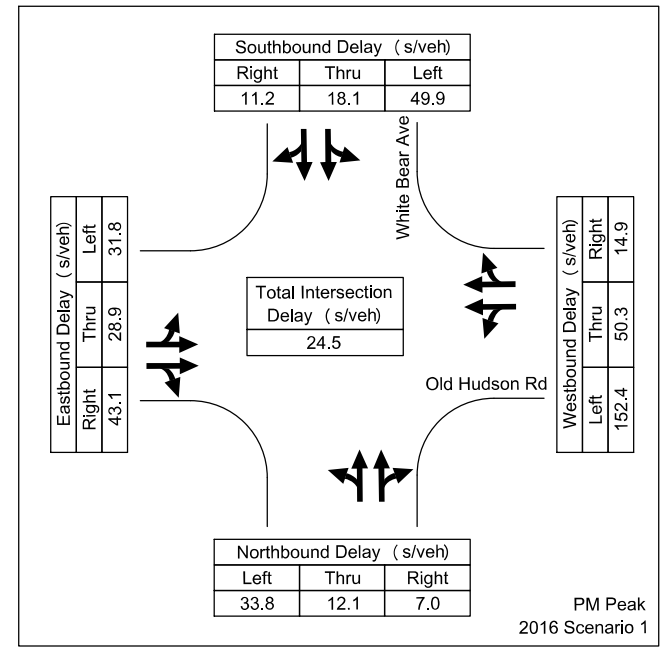
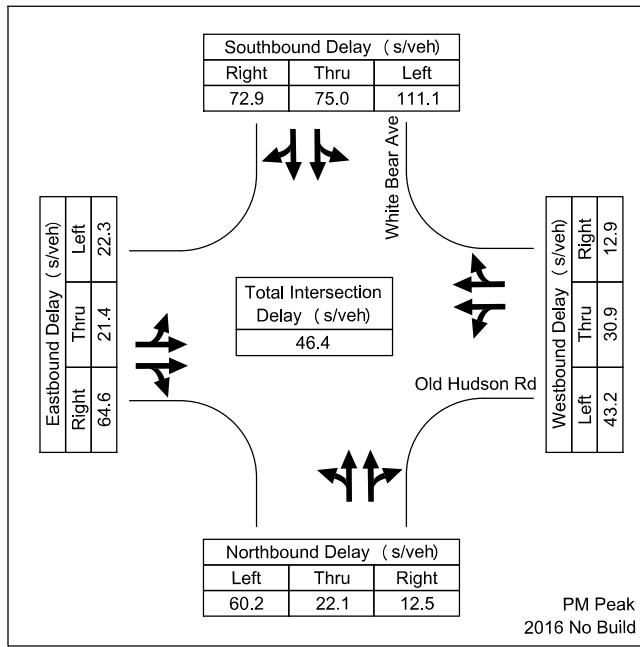
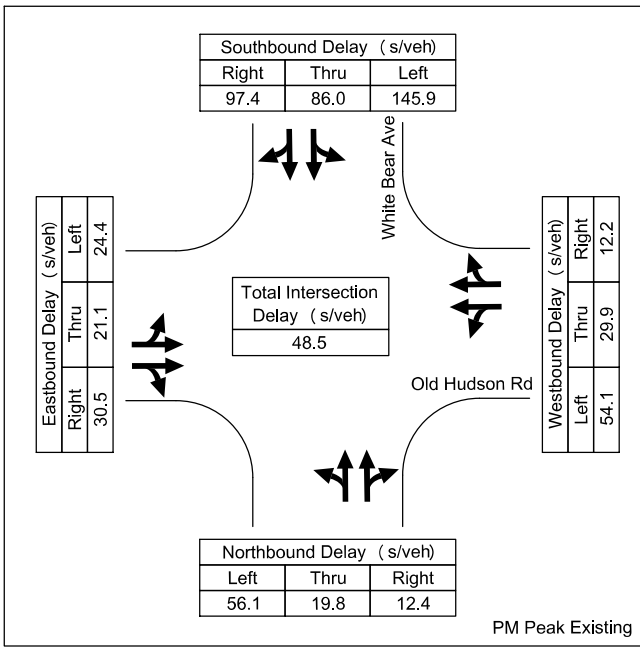
intersections operations (approximately 8 percent additional reduction in delay). With exception to the right turn lane at the I-94 North Ramp, the overall delay reduction is fairly minimal and may not be the cost-beneficial improvement.

5.1 Recommendations

Based on the safety and traffic operation analysis, field observations and alternatives analysis, the following considerations should be made:

- Within the project limits of White Bear Avenue evaluated, a four lane roadway is recommended.
- The implementation of optimized signal timing along White Bear Avenue is expected to result in an estimated 54 percent reduction in total network delay. An overall LOS D or better is expected under existing and forecast traffic volumes. Optimized signal timing plans should be developed and implemented. In addition, the White Bear Avenue/3rd Street intersection should be included in the signal coordination patterns. (Scenario 1).
- The provision of exclusive left turn lanes along White Bear Avenue at Old Hudson Road is expected to result in an additional 35 percent improvement. (Scenario 3).
- Consideration should be made to reconfigure Old Hudson Road to a three lane cross-section (Scenario 3a).
- Protected/permissive left turn operation (flashing yellow arrow) should be considered at the White Bear Avenue/Old Hudson Road intersection. The safety characteristics of the intersection are expected to be improved, with minimal increase in motorist delay (additional signal phases and lost time). Overall, a LOS B is expected. (Scenario 3b)
- The preliminary evaluation completed for the I-94/White Bear Avenue interchange indicates that a 5-lane bridge (if diamond operation is maintained) and an exclusive southbound right turn lane at the north ramp terminal are necessary into the future. Detailed evaluation of the I-94/White Bear Avenue interchange, or interchange configurations was not included as part of this study but should be completed in the future.

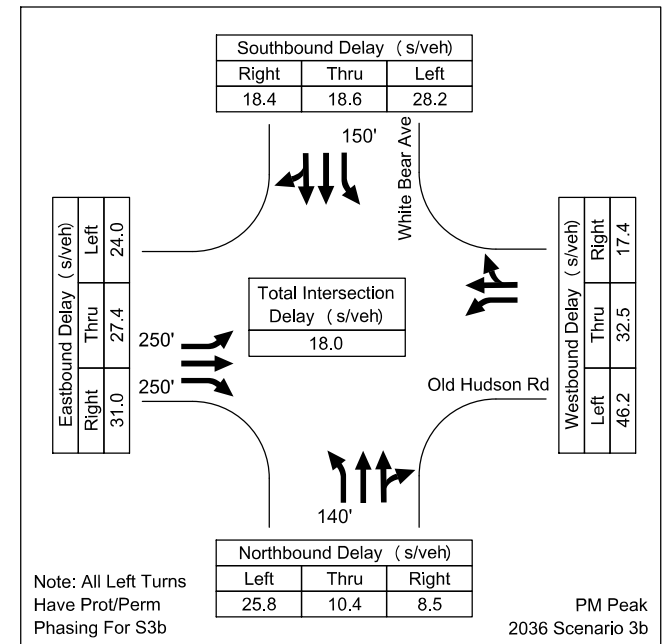
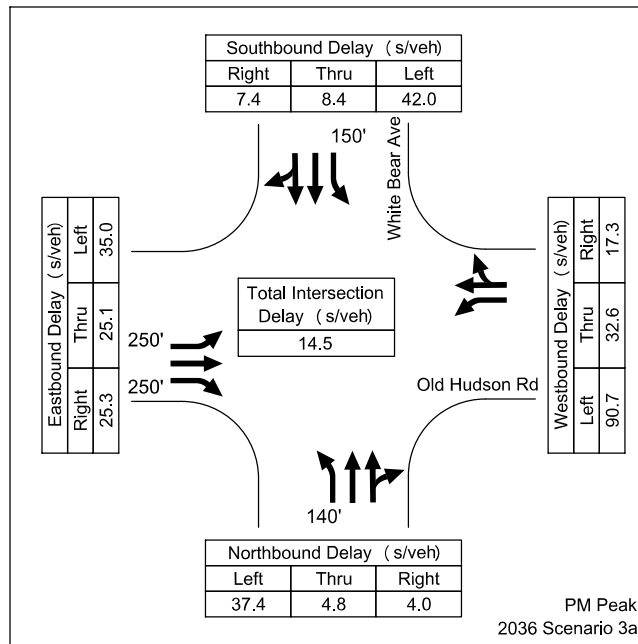
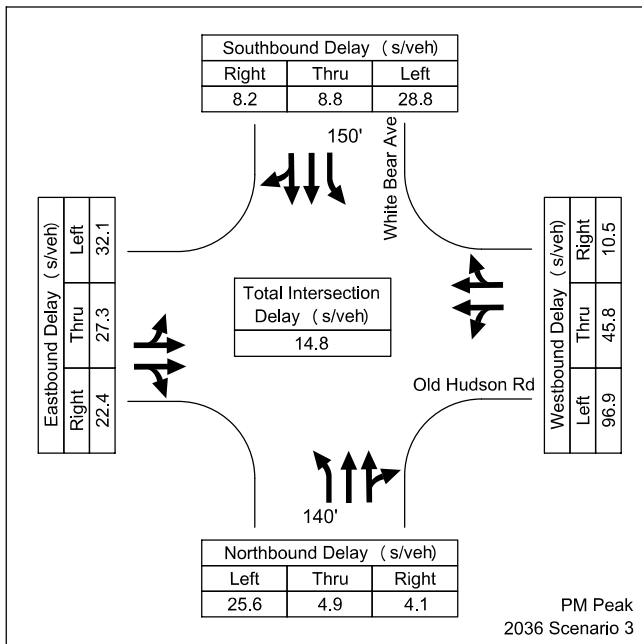
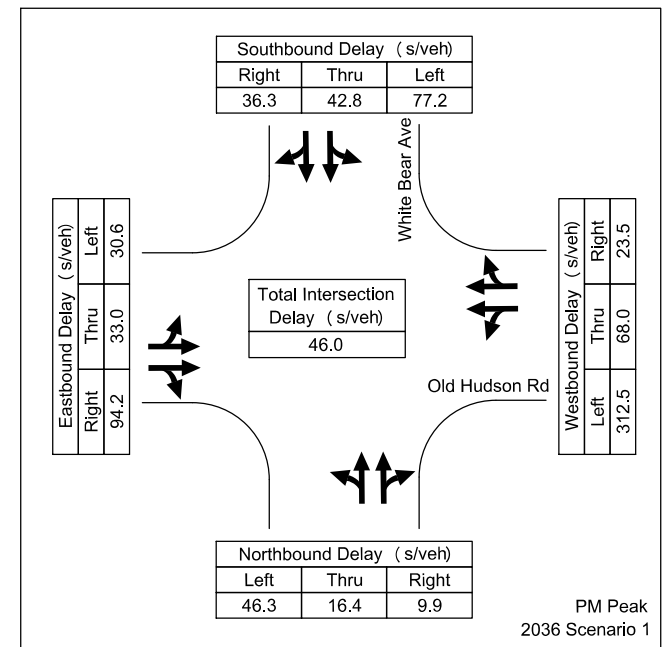
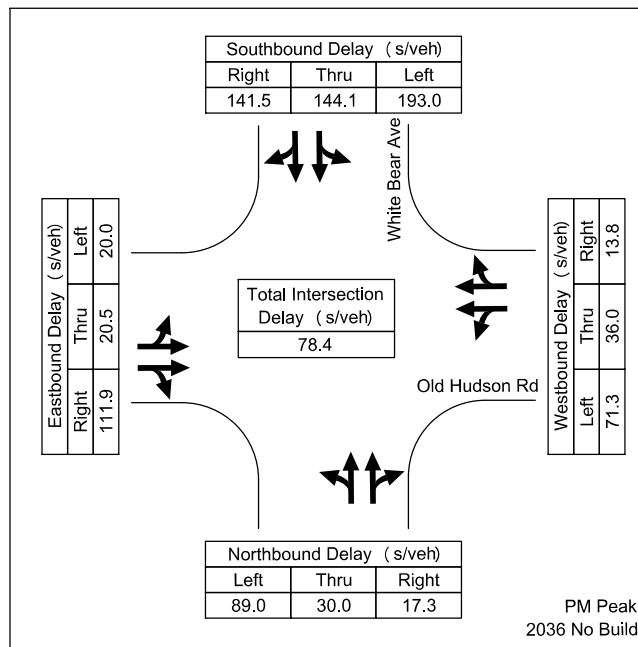
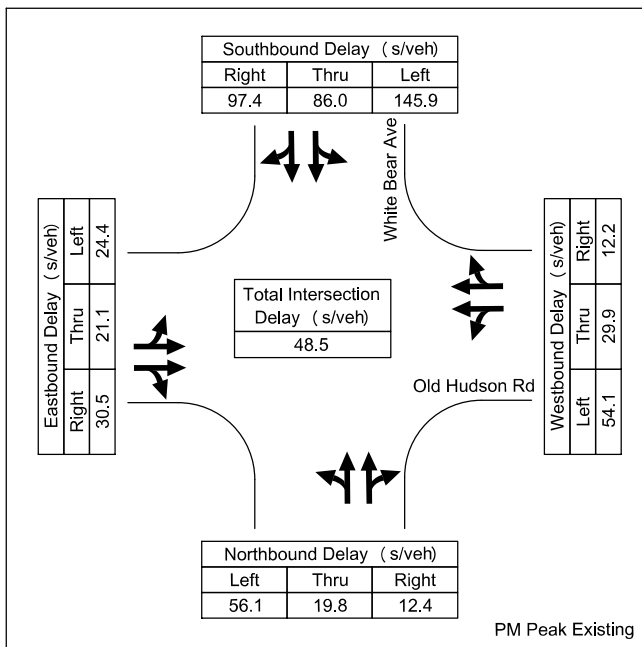
Based on the conclusions and recommendations listed above, a detailed summary comparison of the key preferred scenarios for the White Bear Avenue/Old Hudson Road intersection under 2016 and 2036 volumes is illustrated in Figure 12 and Figure 13, respectively.



White Bear Avenue Traffic Operations Analysis

Figure 12
White Bear Avenue and Old Hudson Road
Intersection Delay Summary Forecast 2016





White Bear Avenue Traffic Operations Analysis

Figure 13
White Bear Avenue and Old Hudson Road
Intersection Delay Summary Forecast 2036



Appendix A:
Traffic Operation Analysis Results – Intersections

Traffic parameters used in Synchro/Simtraffic models

1. Peak Hour Factor (PHF) of 1.00 used in Synchro model. Volumes used were peak 15 minute volume times four.
2. Five 15 minute volumes were used in the Simtraffic model for the AM Peak and PM Peak time periods.
3. AM Peak intervals included 7:00, 7:15, 7:30, 7:45, and 8:00 a.m. 7:00 was the seeding interval while the remaining intervals were recorded.
4. PM Peak intervals included 4:45, 5:00, 5:15, 5:30, and 5:45 p.m. 4:45 was the seeding interval while the remaining intervals were recorded.
5. Heavy vehicle percentage of 2% was used in the Synchro model.
6. Ideal Saturated Flow of 1800 vphpl used in models.
7. Turning speeds adjusted at select locations to calibrate models.
8. Mandatory distance adjusted for southbound White Bear Ave at I-94 North Ramp to calibrate models.

Table A-1. 2014 Existing Conditions

Node	Intersection	MOE	Peak Hours									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	20.2	12.4	6.9	6.1	8.8	24.2	16.7	18.8	13.5	17
		LOS	C	B	A	A	A	C	B	B	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	17.9	0	6	11.7	12.1	18.4	0	45.4	48.4	37.2
		LOS	B	A	A	B	B	B	A	D	D	D
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	12.3	11.6	9.1	10.7	0	18.6	52.2	22.3	34.8
		LOS	A	B	B	A	B	A	B	D	C	C
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	11.3	17.3	9.6	10.4	10.7	27.9	34	23.5	89	48.5
		LOS	B	B	A	B	B	C	C	C	F	D
105	White Bear Avenue & 3rd Street	Delays (s/v)	18.7	18.1	11.1	11.4	12.9	19.9	16.3	13.2	15.1	15.2
		LOS	B	B	B	B	B	B	B	B	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	19.2	23.1	10.7	10.5	14.3	41.1	28.4	14.5	9.7	18.7
		LOS	B	C	B	B	B	D	C	B	A	B

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-2. 2016 No Build Conditions

Node	Intersection	MOE	2016 No Build Conditions									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	16.6	13.5	7.2	6.8	9.5	25.2	16.7	17.3	12.8	16.7
		LOS	B	B	A	A	A	C	B	B	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	18.5	0	5.9	11.5	12.1	18.9	0	44.2	49.6	37.5
		LOS	B	A	A	B	B	B	A	D	D	D
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	12.5	12.2	9.1	10.9	0	19.7	53.5	24.6	36.5
		LOS	A	B	B	A	B	A	B	D	C	D
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	11.3	17.7	9.8	10.9	11.1	50.2	29.6	25.4	76.9	46.4
		LOS	B	B	A	B	B	D	C	C	E	D
105	White Bear Avenue & 3rd Street	Delays (s/v)	18.7	17.8	12.2	11.4	13.3	20.5	17	13.5	14	15.2
		LOS	B	B	B	B	B	C	B	B	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	19.6	24.3	12.1	10.6	15.1	54.4	35.4	14.6	9.7	22.2
		LOS	B	C	B	B	B	D	D	B	A	C

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-3. 2036 No Build Conditions

Node	Intersection	MOE	2036 No Build Conditions									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	20	13.1	6.9	6.3	9.3	308.4	60.3	93.7	18.2	88.7
		LOS	C	B	A	A	A	F	E	F	B	F
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	18.5	0	6.2	10.9	11.9	40.5	0	119.8	36.4	62.9
		LOS	B	A	A	B	B	D	A	F	D	E
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	13.1	14.5	10.8	12.4	0	28.8	91.3	25.5	52.1
		LOS	A	B	B	B	B	A	C	F	C	D
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	11.6	16.4	10.6	11.6	11.6	82.3	43.5	35.4	134.9	78.4
		LOS	B	B	B	B	B	F	D	D	F	E
105	White Bear Avenue & 3rd Street	Delays (s/v)	17.6	18.5	19.4	12.7	16.4	20.2	17.3	14.3	15.9	16.2
		LOS	B	B	B	B	B	C	B	B	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	19.6	27.4	12.1	12	16.3	64.5	54.9	15.4	10.3	26.5
		LOS	B	C	B	B	B	E	D	B	B	C

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-4. 2016 Scenario 1 Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	21.7	17.2	6.5	3.4	9.4	22.7	15	14.1	13.9	15.6
		LOS	C	B	A	A	A	C	B	B	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.9	0	7	5.5	11.8	21.9	0	26.9	31.6	26.7
		LOS	C	A	A	A	B	C	A	C	C	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.1	11.3	8.1	11.6	0	20.9	14	21.8	18.3
		LOS	A	B	B	A	B	A	C	B	C	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.1	27.3	7.3	7	9.7	38.7	81.1	14.1	19.4	24.5
		LOS	B	C	A	A	A	D	F	B	B	C
105	White Bear Avenue & 3rd Street	Delays (s/v)	30.7	31.4	8.5	8.1	13.8	31.6	26.3	7.4	9.4	13.5
		LOS	C	C	A	A	B	C	C	A	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	25.7	30.4	7.9	9.7	15.5	31.2	28.1	15.7	12.9	18.7
		LOS	C	C	A	A	B	C	C	B	B	B

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-5. 2036 Scenario 1 Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	25.5	18.1	7.2	3.8	10.1	23.5	16	15.2	14	16.3
		LOS	C	B	A	A	B	C	B	B	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	22.7	0	8.8	5	11.5	23.2	0	33.9	21	26.1
		LOS	C	A	A	A	B	C	A	C	C	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.7	12.7	10.5	13.2	0	28.3	27.4	23	25.7
		LOS	A	B	B	B	B	A	C	C	C	C
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.6	33.3	7.8	7.3	10.5	82.3	152	18.9	45.2	46
		LOS	B	C	A	A	B	F	F	B	D	D
105	White Bear Avenue & 3rd Street	Delays (s/v)	32.5	30.9	12.6	9.6	15.8	32.4	25.7	9.5	11	14.9
		LOS	C	C	B	A	B	C	C	A	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	26.3	35	9.3	11.2	17.6	38.5	30.4	18	14.9	21.8
		LOS	C	D	A	B	B	D	C	B	B	C

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-6. 2016 Scenario 1a Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	24.3	17.7	6.3	4	9.8	23.4	14.6	14.5	12.4	15.2
		LOS	C	B	A	A	A	C	B	B	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.2	0	6.8	6.1	11.8	22.5	0	26	24.1	24.2
		LOS	C	A	A	A	B	C	A	C	C	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.9	14.6	8.1	12.8	0	20.4	15.6	20.7	18.4
		LOS	A	B	B	A	B	A	C	B	C	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.4	30.8	5.6	12.2	11.3	30.7	58	10.5	29.6	23.4
		LOS	B	C	A	B	B	C	E	B	C	C
105	White Bear Avenue & 3rd Street	Delays (s/v)	30.1	31.1	7.6	7.9	13.2	30.3	24.5	7.7	9.9	13.5
		LOS	C	C	A	A	B	C	C	A	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	25.4	33.6	8.3	10.5	16.6	32.1	26.9	15.2	12.6	18.3
		LOS	C	C	A	B	B	C	C	B	B	B

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-7. 2036 Scenario 1a Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	23.1	17.3	6	4.3	9.6	23	14.9	15.2	13.3	15.7
		LOS	C	B	A	A	A	C	B	B	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	22.9	0	7.2	5.3	11.2	24.7	0	29.3	23.6	26
		LOS	C	A	A	A	B	C	A	C	C	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.6	15.7	10.5	13.9	0	23.8	21.8	25.9	23.8
		LOS	A	B	B	B	B	A	C	C	C	C
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	16.6	32.1	6.4	11.8	11.7	94.4	211.3	14.4	99.1	68.7
		LOS	B	C	A	B	B	F	F	B	F	E
105	White Bear Avenue & 3rd Street	Delays (s/v)	30.2	30.3	11.6	9.3	15	32.9	26	9.4	10.7	14.8
		LOS	C	C	B	A	B	C	C	A	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	28.4	40.8	9.4	11.9	19.6	41.1	29.9	18.6	14.7	22.2
		LOS	C	D	A	B	B	D	C	B	B	C

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-8. 2016 Scenario 2 Conditions

Node	Intersection	MOE										
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	22.5	17.5	6.7	4	9.8	1032.6	83.6	59.8	20.2	145.6
		LOS	C	B	A	A	A	F	F	E	C	F
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.2	0	9.6	7.2	13	28.9	0	89.2	34	47.6
		LOS	C	A	A	A	B	C	A	F	C	D
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	19.2	12.7	7.7	12.5	0	30	20.5	20	21.9
		LOS	A	B	B	A	B	A	C	C	C	C
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	18.4	29.4	8	9.5	11.4	235.1	478.9	15.9	56	92.2
		LOS	B	C	A	A	B	F	F	B	E	F
105	White Bear Avenue & 3rd Street	Delays (s/v)	32.2	30.4	12.8	15.3	18.1	32.3	24.9	38.4	36.6	35.7
		LOS	C	C	B	B	B	C	C	D	D	D
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	34.4	32.1	12.6	19.7	22.1	34	32.5	238.6	32.8	105.9
		LOS	C	C	B	B	C	C	C	F	C	F

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-9. 2036 Scenario 2 Conditions

Node	Intersection	MOE										
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	24.5	16.4	6.4	3.6	9.2	1143.3	128.6	264.6	16.8	218.5
		LOS	C	B	A	A	A	F	F	F	B	F
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.5	0	11.6	6	12.9	77.6	0	128.3	16.1	66.3
		LOS	C	A	B	A	B	E	A	F	B	E
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	31.3	16.7	10.5	18.3	0	112.7	42.9	19.4	44
		LOS	A	C	B	B	B	A	F	D	B	D
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	19.9	45.2	10.5	10.4	14.6	290.1	1285.7	27.1	39.6	130.1
		LOS	B	D	B	B	B	F	F	C	D	F
105	White Bear Avenue & 3rd Street	Delays (s/v)	30.9	30.5	41.3	19.1	29.8	36.9	24.7	116.1	29.5	58.3
		LOS	C	C	D	B	C	D	C	F	C	E
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	31.5	37.6	15.6	23.6	25.2	61.5	49.8	242.6	72.8	122.4
		LOS	C	D	B	C	C	E	D	F	E	F

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-10. 2016 Scenario 2a Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	22.7	17.6	6.4	3.3	9.3	21.7	15.4	14.6	9.9	14.1
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.9	0	7.6	4.7	12	22.1	0	26.4	7.7	19
		LOS	C	A	A	A	B	C	A	C	A	B
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	15.8	9.9	7.6	10.6	0	18.4	8	16.4	13
		LOS	A	B	A	A	B	A	B	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	13.4	31.4	6	4.4	8.5	20.6	31.6	6.6	5.4	9.9
		LOS	B	C	A	A	A	C	C	A	A	A
105	White Bear Avenue & 3rd Street	Delays (s/v)	28.3	30.6	17.3	13.6	18.8	34.2	26	22.3	21.2	24.2
		LOS	C	C	B	B	B	C	C	C	C	C
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	46	54	10.1	12.5	24.8	185.6	174.5	71.5	19.8	84.9
		LOS	D	D	B	B	C	F	F	E	B	F

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-11. 2036 Scenario 2a Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	24.4	16.4	6.8	3.6	9.4	36.7	21.1	19	9.7	19
		LOS	C	B	A	A	A	D	C	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	24.2	0	7.9	4.5	11.5	28.8	0	45.2	7.6	27.2
		LOS	C	A	A	A	B	C	A	D	A	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	23.3	11.2	8.1	13.4	0	66.2	34.9	17.4	32.1
		LOS	A	C	B	A	B	A	E	C	B	C
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	16.8	36.1	9	4.1	10.4	37.9	80.7	23.6	6.7	24.4
		LOS	B	D	A	A	B	D	F	C	A	C
105	White Bear Avenue & 3rd Street	Delays (s/v)	31.2	29.7	62.4	17.9	36.6	32.6	26	104.5	50.5	66.1
		LOS	C	C	E	B	D	C	C	F	D	E
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	58.6	76.2	13.4	15.6	33.3	298.7	267.2	178.2	30.9	154.9
		LOS	E	E	B	B	C	F	F	F	C	F

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-12. 2016 Scenario 2b Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	23.5	16.8	6	3.4	9.1	23.4	14.2	14.6	10	14
		LOS	C	B	A	A	A	C	B	B	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	22.9	0	8.4	4.8	11.6	23.1	0	25.5	8	19.1
		LOS	C	A	A	A	B	C	A	C	A	B
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.1	9.6	8.3	11.3	0	18.8	8	16.7	13.3
		LOS	A	B	A	A	B	A	B	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	13.5	28	5.8	4.5	8	21.3	38.7	7	5.5	10.8
		LOS	B	C	A	A	A	C	D	A	A	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	29.8	30.6	9.1	11.2	15	32.9	26.8	12.5	15.9	18.2
		LOS	C	C	A	B	B	C	C	B	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	69.5	58.3	9.8	13.4	28.6	133.7	227.7	99.8	23.9	95.4
		LOS	E	E	A	B	C	F	F	F	C	F

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-13. 2036 Scenario 2b Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	23.8	16	6.1	3.1	8.8	25.1	16.6	14.9	9.3	14.8
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.1	0	9.6	4.3	11.5	26.5	0	35.4	7.3	23.2
		LOS	C	A	A	A	B	C	A	D	A	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	18.1	10.4	9.7	12.4	0	97.9	29.5	18.8	35
		LOS	A	B	B	A	B	A	F	C	B	D
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	14.6	34.6	6.3	4.6	8.9	44	88.4	21.5	7.1	24.6
		LOS	B	C	A	A	A	D	F	C	A	C
105	White Bear Avenue & 3rd Street	Delays (s/v)	29.3	29.4	16.8	12.8	18.2	33.9	26.9	95.5	30.9	55.5
		LOS	C	C	B	B	B	C	C	F	C	E
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	116.7	136.6	11.2	14.9	52.9	283.5	303.4	198.4	30.9	164.1
		LOS	F	F	B	B	D	F	F	F	C	F

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-14. 2016 Scenario 2c Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	23.8	17.3	5.9	3.3	9.2	22.9	14.7	14.5	9.7	14
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	22.8	0	8.2	4.4	11.4	21.6	0	28	7.9	19.6
		LOS	C	A	A	A	B	C	A	C	A	B
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	16.7	9.7	8.8	11.4	0	18.2	7.5	16.1	12.6
		LOS	A	B	A	A	B	A	B	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.3	31.5	5.8	6.6	9.5	21.6	37.7	6.3	8.5	11.4
		LOS	B	C	A	A	A	C	D	A	A	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	32.3	31.2	10.8	5	13.5	30.6	26.3	12.2	7.7	14.7
		LOS	C	C	B	A	B	C	C	B	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	37.5	64.8	8.8	12.7	26.4	136.5	116	100.9	23.9	81.9
		LOS	D	E	A	B	C	F	F	F	C	F

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-15. 2036 Scenario 2c Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	23.5	16.4	6	3.4	9	23.8	14.8	14.6	9.3	14
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.4	0	8.6	4.4	11.3	23.9	0	30.3	7.5	20.7
		LOS	C	A	A	A	B	C	A	C	A	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.9	9.4	8.9	11.7	0	38.3	12.9	17.8	18.8
		LOS	A	B	A	A	B	A	D	B	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.2	30.6	6	7	9.5	35.5	73.2	14.3	10.4	20.4
		LOS	B	C	A	A	A	D	E	B	B	C
105	White Bear Avenue & 3rd Street	Delays (s/v)	29.9	30.1	12.6	6	14.1	35	24.3	152.7	11.2	71.8
		LOS	C	C	B	A	B	D	C	F	B	E
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	115.8	96.8	10	16.5	44.1	300.4	389.2	185.4	31.1	170.3
		LOS	F	F	B	B	D	F	F	F	C	F

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-16. 2016 Scenario 2d Conditions

Node	Intersection	MOE										
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	24.9	18.9	5.7	3.1	9.5	26.8	16.1	12.9	8.2	14
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	26.2	0	7.1	4.4	12.1	27.8	0	23	9.1	20.3
		LOS	C	A	A	A	B	C	A	C	A	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	18.8	9.7	5.3	10.4	0	20.2	8.2	10.3	10.9
		LOS	A	B	A	A	B	A	C	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.9	32.8	4.8	8.1	9.6	22.2	33.1	5.1	10.6	11.1
		LOS	B	C	A	A	A	C	C	A	B	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	36.4	35.2	11.9	9.6	16.7	39.9	29	12.1	13.4	18.7
		LOS	D	D	B	A	B	D	C	B	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	89.6	59.6	10.3	12.9	31.3	140.8	249.5	44.1	18.8	75.1
		LOS	F	E	B	B	C	F	F	D	B	E

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-17. 2036 Scenario 2d Conditions

Node	Intersection	MOE										
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	25.4	18.4	6.2	2.8	9.3	25.9	15.6	12.7	8.7	13.9
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	25.4	0	6.9	4.2	11.5	27.8	0	25.3	9.3	20.9
		LOS	C	A	A	A	B	C	A	C	A	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	20	11.1	6.5	11.7	0	26.6	10.5	11.1	13.2
		LOS	A	C	B	A	B	A	C	B	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.7	32.8	5.1	8	9.7	27.6	40.1	9.2	11.8	14.6
		LOS	B	C	A	A	A	C	D	A	B	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	35	33.9	14.1	10.5	17.4	40.3	28	52.1	21	37
		LOS	D	C	B	B	B	D	C	D	C	D
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	163.4	90.4	11.3	14.7	46.9	295.9	285.7	130.9	24.3	134.4
		LOS	F	F	B	B	D	F	F	F	C	F

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-18. 2016 Scenario 3 Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	25.3	16.6	6.1	3.4	9.1	22.3	14.4	15.1	9	13.7
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	22.4	0	8.1	4.5	11.3	22.4	0	27.3	7.6	19.5
		LOS	C	A	A	A	B	C	A	C	A	B
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.9	9.7	8	11.4	0	18.6	7.8	17.7	13.5
		LOS	A	B	A	A	B	A	B	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.7	28.6	5.7	6.6	9.1	28.1	45.3	6.6	10	13.3
		LOS	B	C	A	A	A	C	D	A	B	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	31.1	29.9	7.7	7.7	12.9	31.2	26.3	6.9	9	13.1
		LOS	C	C	A	A	B	C	C	A	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	25.6	31	8.1	10.8	16.1	31.3	27.3	13.5	12.2	17.6
		LOS	C	C	A	B	B	C	C	B	B	B

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-19. 2036 Scenario 3 Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	22.9	17.3	6.3	3.3	9.3	21.4	14.3	14.1	9.7	13.6
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	22.6	0	8.2	4	11	21.5	0	26.8	7.4	18.6
		LOS	C	A	A	A	B	C	A	C	A	B
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.8	9.7	9.2	11.9	0	19.3	8.3	19	14.4
		LOS	A	B	A	A	B	A	B	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.2	30.4	5.8	7.1	9.4	27.7	57.3	7.5	10	14.8
		LOS	B	C	A	A	A	C	E	A	B	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	31.4	31.1	10.3	8.5	14.5	32.9	25.3	7.5	10.7	14.1
		LOS	C	C	B	A	B	C	C	A	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	28.7	33.4	8.7	10.4	17	37.7	30.4	15.6	14.2	20.6
		LOS	C	C	A	B	B	D	C	B	B	C

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-20. 2016 Scenario 3a Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	25.8	17.8	6.2	3.5	9.8	22.3	14.2	13.7	9.8	13.7
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	22.8	0	8.2	4.5	11.4	22.7	0	27.1	8.3	19.6
		LOS	C	A	A	A	B	C	A	C	A	B
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.4	10	7.7	11.2	0	18.1	7.8	16.4	13
		LOS	A	B	B	A	B	A	B	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	14.4	29.8	5.6	7.2	9.4	24.4	61.8	7.1	9.3	14.5
		LOS	B	C	A	A	A	C	E	A	A	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	30.7	29.2	7.4	7.5	12.6	29.5	24.6	7.1	9.6	13
		LOS	C	C	A	A	B	C	C	A	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	26.1	32	8.4	10.1	16.5	30.2	31	13.7	12.2	18
		LOS	C	C	A	B	B	C	C	B	B	B

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-21. 2036 Scenario 3a Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	27.3	16.8	6.1	3.7	9.5	24.2	14.5	14.2	9.9	14.3
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	22.9	0	8.3	4.2	11.2	22.2	0	31.4	7.5	20.7
		LOS	C	A	A	A	B	C	A	C	A	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	18.1	9.9	9.8	12.2	0	21.1	8.9	18.5	14.7
		LOS	A	B	A	A	B	A	C	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	18	31.4	5.6	6.7	9.4	26.8	52	8.7	9.9	14.5
		LOS	B	C	A	A	A	C	D	A	A	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	29.6	30.4	12.8	9	15.3	32.7	25.5	7.6	10.3	13.9
		LOS	C	C	B	A	B	C	C	A	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	26.8	36.4	9	11.6	17.8	35.4	31.6	15.6	14.8	20.5
		LOS	C	D	A	B	B	D	C	B	B	C

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-22. 2016 Scenario 3b Conditions

Node	Intersection	MOE										
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	23.3	15.9	6.6	2.9	8.8	23.6	13.6	13	8.1	13
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.3	0	7.4	4.2	11.1	23.4	0	26.6	8.2	19.8
		LOS	C	A	A	A	B	C	A	C	A	B
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.2	9.6	6.4	10.5	0	19	7.5	13.4	11.7
		LOS	A	B	A	A	B	A	B	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	14.3	22.3	6.8	9.1	9.8	19	25.1	10.8	14.9	14.2
		LOS	B	C	A	A	A	B	C	B	B	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	32.4	31.1	8.1	8	13.8	31.5	27.4	7.3	9.1	13.3
		LOS	C	C	A	A	B	C	C	A	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	24.9	32.9	7.1	9.8	16	33.1	27.9	13.9	12.4	18.1
		LOS	C	C	A	A	B	C	C	B	B	B

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-23. 2036 Scenario 3b Conditions

Node	Intersection	MOE										
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	20.9	17.3	6.2	3.2	9.1	22.8	13.9	15.4	9.3	13.9
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23	0	8.6	4	11.3	21.9	0	29.3	6.9	19.6
		LOS	C	A	A	A	B	C	A	C	A	B
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.9	9.7	7.3	11.1	0	20.3	8.4	16.7	13.6
		LOS	A	B	A	A	B	A	C	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	14.8	24.1	6.9	8.6	9.8	29.4	32.9	12.2	19	18
		LOS	B	C	A	A	A	C	C	B	B	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	30.4	29.4	10.4	8.5	14.3	32.9	24.2	8.3	10.8	14.5
		LOS	C	C	B	A	B	C	C	A	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	27.2	35.1	7.8	10.7	17.1	39	43	15.2	14.7	22.4
		LOS	C	D	A	B	B	D	D	B	B	C

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-24. 2016 Scenario 3c Conditions

Node	Intersection	MOE										
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	21.7	17.1	6.4	3.6	9.5	23.2	14.6	13.7	9.8	13.9
		LOS	C	B	A	A	A	C	B	B	A	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.1	0	8.1	4.2	11.6	23.7	0	26.3	7.7	19.6
		LOS	C	A	A	A	B	C	A	C	A	B
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	16.3	9.2	6.6	10.2	0	18.7	7	10.8	10.3
		LOS	A	B	A	A	B	A	B	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	14.8	29.5	5.1	6.4	8.7	18.6	30.1	5.4	8.5	9.9
		LOS	B	C	A	A	A	B	C	A	A	A
105	White Bear Avenue & 3rd Street	Delays (s/v)	30.9	29.7	7	6.7	12.4	30.8	25.4	6.4	8.9	12.6
		LOS	C	C	A	A	B	C	C	A	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	25.4	31.9	7.7	10.1	16.1	31.5	30.7	14	13.1	18.6
		LOS	C	C	A	B	B	C	C	B	B	B

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-25. 2036 Scenario 3c Conditions

Node	Intersection	MOE										
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	22.1	17.8	6.7	3.3	9.5	21.8	14.3	14	10	13.9
		LOS	C	B	A	A	A	C	B	B	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.6	0	7.9	3.9	11	22.1	0	27.6	7.3	19.2
		LOS	C	A	A	A	B	C	A	C	A	B
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	18	10	7.1	11.1	0	20	8.2	12.7	11.8
		LOS	A	B	B	A	B	A	C	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.2	34.4	5.4	6.7	9.4	18	34	5.8	8.7	10.5
		LOS	B	C	A	A	A	B	C	A	A	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	29.5	30.8	10.2	8.1	14.2	32.8	25.4	7.7	9.8	13.9
		LOS	C	C	B	A	B	C	C	A	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	27.6	36	9	11	18	34.5	35.4	16.1	14.8	21
		LOS	C	D	A	B	B	C	D	B	B	C

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-26. 2016 Scenario 3d Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	24.2	17.4	5.9	4	9.4	25.2	26.4	21	12.5	19.7
		LOS	C	B	A	A	A	C	C	C	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.8	0	7.8	4.5	11.8	30.3	0	46.3	9.1	29.1
		LOS	C	A	A	A	B	C	A	D	A	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.8	9.3	5.3	10.1	0	17.4	7.8	9.9	10.1
		LOS	A	B	A	A	B	A	B	A	A	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	14	23	6.3	9.3	9.7	21.8	27.3	11.5	21.2	17.4
		LOS	B	C	A	A	A	C	C	B	C	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	28.9	30.3	11.4	8.9	14.8	31.9	25.9	7	9.5	13.4
		LOS	C	C	B	A	B	C	C	A	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	26	30.7	7.3	10.1	15.5	33.4	29.5	12.8	12.8	18.1
		LOS	C	C	A	B	B	C	C	B	B	B

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-27. 2036 Scenario 3d Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	20.7	16.8	7.4	4.2	9.7	32.1	44.6	24.7	12.8	26.2
		LOS	C	B	A	A	A	C	D	C	B	C
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.5	0	8.2	3.9	11.3	29.8	0	51.1	8.5	29.7
		LOS	C	A	A	A	B	C	A	D	A	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.3	9.8	5.8	10.4	0	20.4	8.4	11.7	11.6
		LOS	A	B	A	A	B	A	C	A	B	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	14.2	21.2	6.9	8.2	9.3	24.7	26.9	12.4	21.1	18
		LOS	B	C	A	A	A	C	C	B	C	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	33	29.2	12.2	9	15.2	31.1	24.2	8.6	11.2	14.5
		LOS	C	C	B	A	B	C	C	A	B	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	28.9	34.5	7.6	10.6	17	35.9	35.1	15.1	14.7	20.8
		LOS	C	C	A	B	B	D	D	B	B	C

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-28. 2016 Scenario 3e Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	23.5	17.2	6.1	3.1	9	24	13.4	14.7	10.1	14
		LOS	C	B	A	A	A	C	B	B	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	23.2	0	7.8	4.3	11.4	24	0	28.3	8.4	20.6
		LOS	C	A	A	A	B	C	A	C	A	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	16.8	9.4	5.4	9.9	0	20	7	8.6	9.6
		LOS	A	B	A	A	A	A	C	A	A	A
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	13.5	22.9	6.3	8.7	9.3	18.5	24.1	8.3	12.1	12
		LOS	B	C	A	A	A	B	C	A	B	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	30.6	30.6	7.4	7.1	12.8	28.4	24.7	7.1	8.8	12.5
		LOS	C	C	A	A	B	C	C	A	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	26.7	32.5	6.7	10.4	16.1	36.7	32.4	13.6	12.8	19.3
		LOS	C	C	A	B	B	D	C	B	B	B

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds

Table A-29. 2036 Scenario 3e Conditions

Node	Intersection	MOE	Peak Hour									
			AM Peak Hour					PM Peak Hour				
			EB	WB	NB	SB	Int.	EB	WB	NB	SB	Int.
101	White Bear Avenue & Suburban Avenue	Delays (s/v)	23.6	16.7	5.8	3.2	8.9	23.8	14.2	14	11.2	14.6
		LOS	C	B	A	A	A	C	B	B	B	B
102	White Bear Avenue & I-94 South Ramps	Delays (s/v)	22.8	0	8.5	3.9	11.1	23.9	0	28.6	7.6	20.1
		LOS	C	A	A	A	B	C	A	C	A	C
103	White Bear Avenue & I-94 North Ramps	Delays (s/v)	0	17.2	9.8	6	10.3	0	19.9	7.9	9.3	10.3
		LOS	A	B	A	A	B	A	B	A	A	B
104	White Bear Avenue & Old Hudson Road	Delays (s/v)	15.8	23	6.6	8.1	9.6	19	26.2	9.3	13.1	13
		LOS	B	C	A	A	A	B	C	A	B	B
105	White Bear Avenue & 3rd Street	Delays (s/v)	31.3	29.6	9.1	7.9	13.7	30.1	25.8	7.6	9.9	13.5
		LOS	C	C	A	A	B	C	C	A	A	B
106	White Bear Avenue & Minnehaha Avenue	Delays (s/v)	25.2	33.8	7.8	10.6	16.5	39.8	31.7	15.4	14.7	21
		LOS	C	C	A	B	B	D	C	B	B	C

1. AM Peak and PM Peak delays computed using SimTraffic averaged over 5 random seeds