Intersection Control Evaluation

US Highway 14 Ramps at CSAH 5

Blue Earth County, Minnesota

Blue Earth County

September 2023

SRF No. 15202

Intersection Control Evaluation (ICE)

US 14 Ramps at CSAH 5

Report Certification:

I hereby certify that this report was prepared by me or under my direct supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Minnesota.

Adrian S. Potter	42785
Print Name	Reg. No.
	
Signature	8/6/2023 Date

Approved By:

Lisa Bigham Digitally signed by Lisa Bigham
Date: 2023.10.16 16:32:23 -05'00'

MnDOT District 7
State Aid Engineer — Date


Scott Thompson
2023.10.09 21:12:20 -05'00'

MnDOT District 7
Traffic Engineer — Date

Ryan Thilges Digitally signed by Ryan Thilges
Date: 2023.10.18 14:19:53 -05'00'

Blue Earth County
County Engineer — Date

Table of Contents

Introduction

The Minnesota Department of Transportation (MnDOT), Blue Earth County, Lime Township, and the City of Mankato have partnered to improve safety, mobility, and connectivity along the CSAH 5 (Third Avenue) corridor. The primary objective of the Study is to complete a technical analysis of current and future traffic along the corridor, with a special emphasis on the corridor's regional importance to freight movement and identify short- and long-term improvements to reduce congestion, improve safety, and enhance accessibility for those traveling by all modes. The corridor study area is approximately 4.8 miles long and includes the section of CSAH 5 (Third Avenue) from North Riverfront Drive (southern terminus) to the Blue Earth County Line (northern terminus).

The purpose of the study is to address safety concerns, mobility along CSAH 5, and operational issues impacting the intersections to maintain their functionality for years to come. The MnDOT Intersection Control Evaluation (ICE) is a process that identifies the most appropriate intersection control type through a comprehensive analysis and documentation of the technical (safety, operational, other) and political issues of viable alternatives. The goal of an ICE is to select the optimal control for an intersection based on an objective analysis of existing conditions and future needs. The needs of the project include:

- Safety Concerns (Vehicle)
- Vehicle Mobility
- Operational Issues and Queuing.

This report comprises the intersection control evaluation (ICE) results for the CSAH 5 at US 14 Eastbound ramps and CSAH 5 at US 14 Westbound ramps in Blue Earth County, Minnesota (see Figure 1).

These intersections are located in an urban area in the City of Mankato, with the eastbound and westbound US Highway 14 off-ramp approaches being side-street stop controlled. The goal of this report is to investigate safety and operations concerns at these intersections. The following alternatives were considered applicable:

- Side-Street Stop Control (existing)
- All-Way Stop Control
- Traffic Signal Control
- Single Lane Roundabout Control

There's no planned construction year for any corridor or intersection modifications and therefore the years of analysis completed are existing (year 2022), forecast year 2035 (roundabout only), and forecast year 2045. This evaluation was completed to analyze potential alternatives to address safety concerns at these intersections.

SRF

Study Intersection Locations

CSAH 5 (Third Ave) Corridor Study
City of Mankato

Figure 1

02315202
January 2023

Existing Conditions

Intersection Characteristics

The CSAH 5 and US Highway 14 ramp intersections are located in an urban area in the City of Mankato, MN. CSAH 5 is classified as a minor arterial roadway and US 14 is classified as a principal arterial – other freeway or expressway. Within the vicinity of the intersections, CSAH 5 is a 4-Lane divided roadway with a posted speed limit of 40 miles per hour (mph) to the north of the CSAH 5 and US 14 westbound ramp and a posted speed limit of 30 mph south of the US 14 westbound ramp. The intersections are currently side-street stop-controlled for the eastbound and westbound minor approaches at the US 14 ramps. Current intersection geometrics are listed in Table 1 and Table 2, respectively. The existing geometry is shown in Figure 2.

Table 1. Existing CSAH 5 & US 14 Eastbound Ramps Lane Geometry

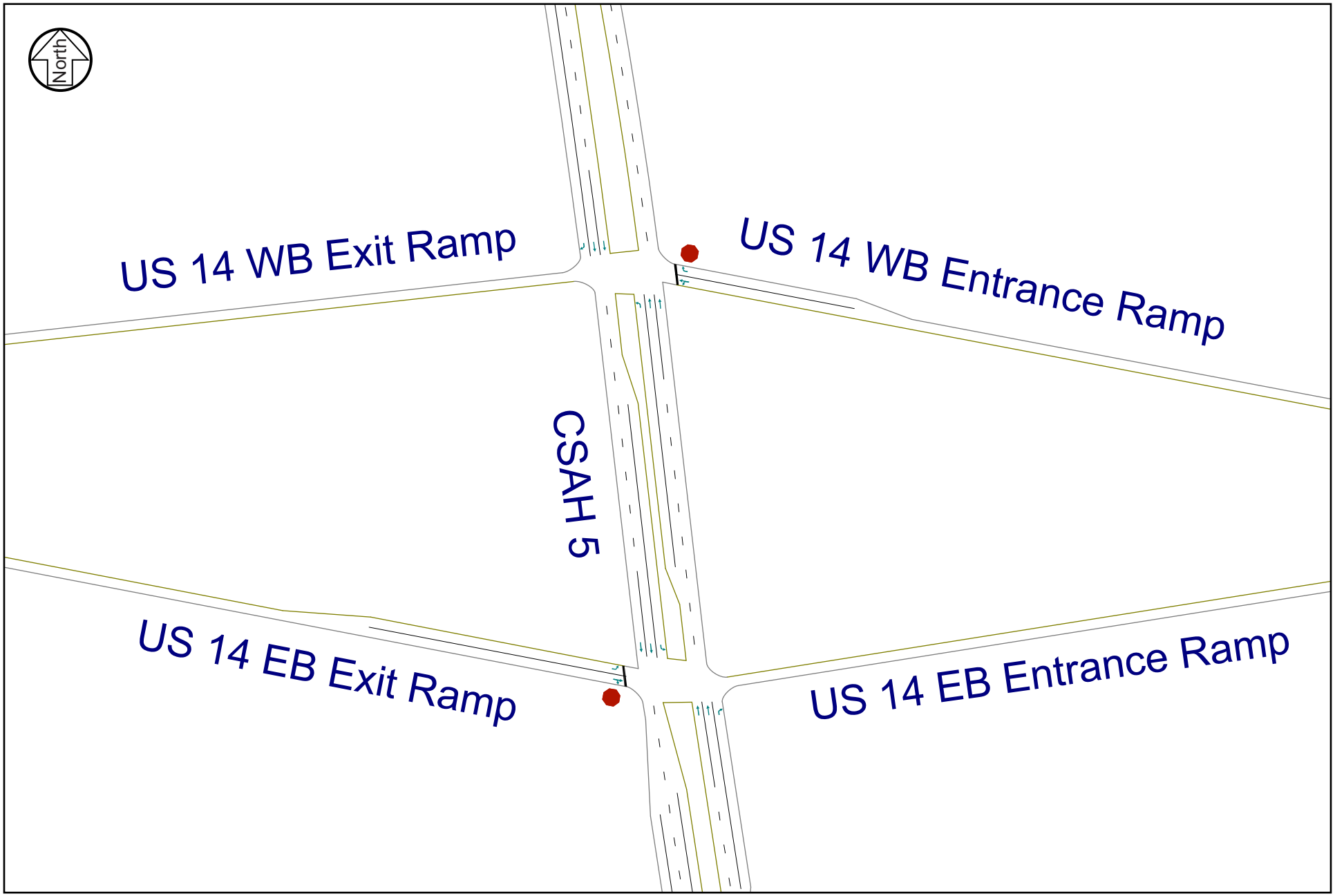
Approach	Geometry
Northbound CSAH 5	Two thru lanes and one right-turn lane
Southbound CSAH 5	Two thru lanes and one left-turn lane
Eastbound US 14 Ramp	One shared thru/right-turn lane and one left-turn lane

Table 2. Existing CSAH 5 & US 14 Westbound Ramps Lane Geometry

Approach	Geometry
Northbound CSAH 5	Two thru lanes and one left-turn lane
Southbound CSAH 5	Two thru lanes and one right-turn lane
Westbound US 14 Ramp	One shared left-turn/thru lane and one right-turn lane

Crash History

The most recent crash data available (from 2017 through 2021) for the existing intersections were obtained from the MnDOT Crash Mapping Analysis Tool (MnCMAT2) crash database. When measuring crash data, the critical crash rate determined by MnDOT is defined using the statewide average rate and the specific volume of the subject intersection to determine a point at which a high crash rate is considered statistically significant. If a crash rate exceeds the critical rate, an indication that a potential safety need exists. For this analysis, the latest available (2016 to 2020 MnDOT ToolKit) statewide averages were utilized. A summary of the crash statistics is shown in Table 3, Table 4, Table 5.



Existing Lane Geometry

CSAH 5 (Third Ave) Corridor Study

City of Mankato

Figure 2

02315202
January 2023

Table 3. Existing Intersection Crash Severity Summary

Intersection	K	A	B	C	PDO	Total
CSAH 5 and US 14 Eastbound Ramp	1[1]	0	1	1	8	11
CSAH 5 and US 14 Westbound Ramp	0	0	1	1	6	8

(1) Fatal crash was an angle crash due to failure to yield right-of-way/vision obstruction by a side-street vehicle.

Table 4. Existing Intersection Crash Rate Summary

Intersection	Total Crashes	Total Crash Rate [1]			Fatal and Serious Injury Crash Rate [2]		
		Calculated	Average	Critical	Calculated	Average	Critical
US 14 Eastbound Ramp	11	**0.57**	0.13	0.36	**5.19**	0.31	4.53
US 14 Westbound Ramp	8	**0.34**	0.13	0.34	0.00	0.31	3.94

(1) Intersection Crash Rates are expressed in crashes per million entering vehicles.

(2) Intersection crash rates are expressed in crashes per 100 million entering vehicles.

Table 5. Existing Intersection Crash Type Summary

Intersection	Angle	Left Turn	Rear End	Other / Unknown	Total
CSAH 5 and US 14 Eastbound Ramp	8	0	2	1	11
CSAH 5 and US 14 Westbound Ramp	2	2	4	0	8

Eleven (11) crashes were reported at CSAH 5 and US 14 Eastbound ramp during the analysis period resulting in a crash rate of 0.57 crashes per million entering vehicles (MEV). Eight (8) of the crashes were angle crashes, two (2) were rear end, and one (1) other undefined crash was identified. The observed crash rate is above the critical crash rate and the statewide average crash rate, which indicates the possibility of a potential safety need. Based on these factors, it is desired that the proposed traffic control alternative at the intersection addresses observed crash trends.

Eight (8) crashes were reported at CSAH 5 and US 14 Westbound ramp during the analysis period resulting in a crash rate of 0.34 crashes per million entering vehicles (MEV). Four (4) of the crashes were rear end crashes, two (2) were angle crashes and two (2) were left-turn crashes. The observed crash rate is at the critical crash rate and above the statewide average crash rate, which indicates the possibility of a potential safety need at this intersection. Based on these factors, it is desired that the proposed traffic control alternative at the intersection addresses observed crash trends. No fatal or severe injury crashes occurred at this intersection in the analysis period.

Existing Volumes

Existing 15-minute traffic volumes by movement were collected at the study intersections from 6:00 a.m. to 7:00 p.m. on Tuesday, May 10, 2022, resulting in a 13-hour period. Based on the data, 7:30-8:30 a.m. and 3:45-4:45 p.m. are the a.m. and p.m. peak hours, respectively. Turning movement counts are shown in Figure 3. The existing 13-hour turning movement counts can be found in the Appendix.

CSAH 5 is an important freight corridor servicing the region, notably, interconnecting with US 14 which is a critical freight corridor on the National Truck Network. A percentage of heavy commercial (e.g., semi) traffic of 20 and 15 (based on collected turning movement counts) during the a.m. and p.m. peak hours, respectively, were used in the existing and forecast year 2035 and 2045 analysis. Due to the high heavy commercial traffic volume at these intersections, it was considered conservative to assume the percentage of heavy commercial traffic volume would not change. This assumption is viewed as conservative as decreased heavy commercial traffic is anticipated because of the forthcoming cessation of mining operations immediately adjacent to CSAH 5, prior to the forecast year.

Intersection Alternatives

As previously noted, there is not a planned build year yet for any potential alternative. Therefore, the existing year 2022 will be used as the initial analysis year. The analysis is expected to be completed for the following traffic control types:

- Side-Street Stop Control (existing)
- All-Way Stop Control
- Traffic Signal Control
- Single Lane Roundabout Control

The all-way stop and traffic signal control alternatives are expected to have the same geometry as the existing side-street stop control. The assumed layout for the roundabout alternative is shown in Figure 4. A multilane roundabout was not considered as an alternative as a single-lane roundabout is expected to provide sufficient capacity for both intersections. Studies have shown that multilane roundabouts can increase crashes at intersections if the volumes are not high enough to justify the added capacity.

SRF

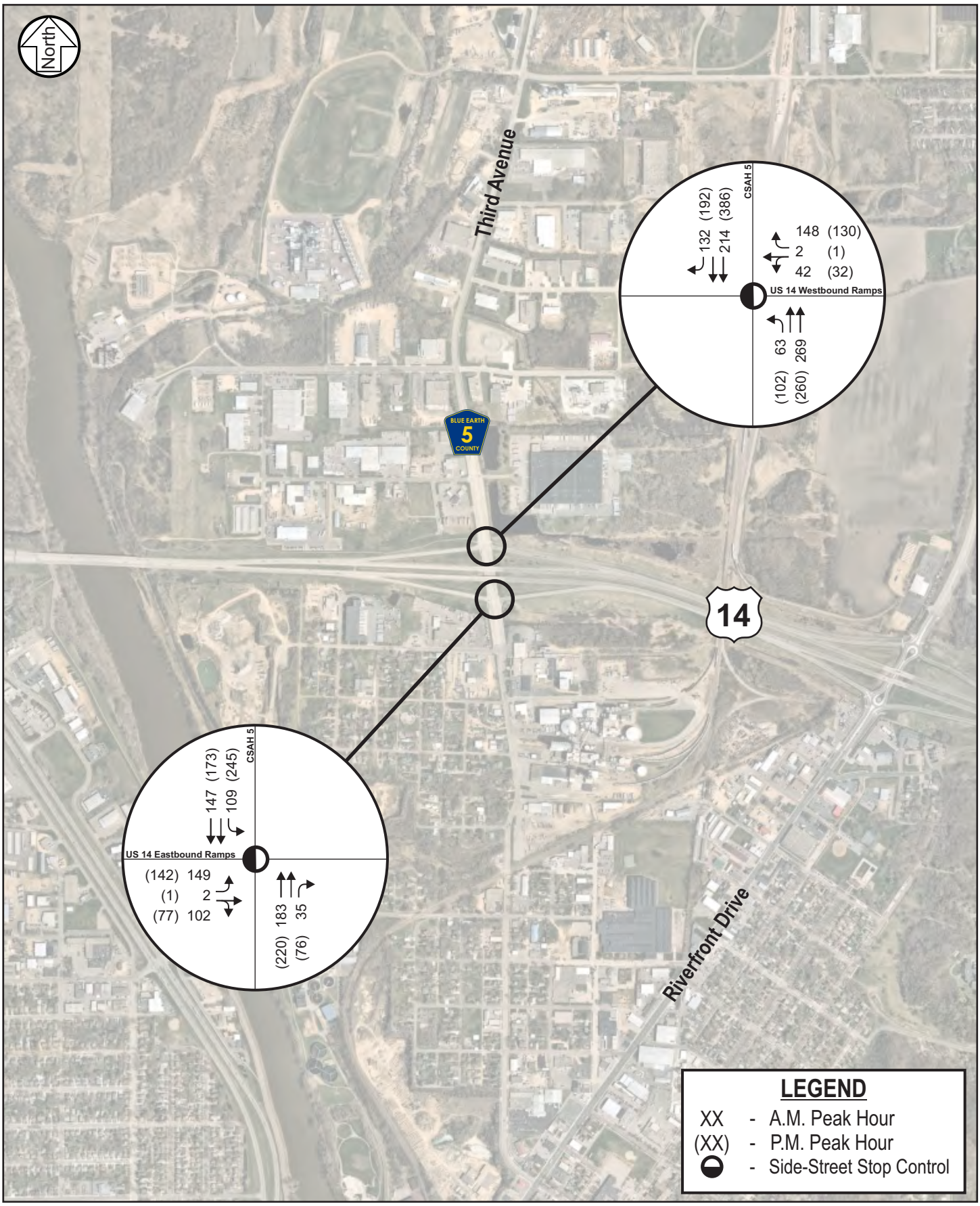
Single Lane Roundabout Layout

CSAH 5 (Third Ave) Corridor Study

City of Mankato

Figure 3

02315202
January 2023



SRF

Existing Turn Movement Counts

CSAH 5 (Third Ave) Corridor Study
City of Mankato

Figure 4

02315202
January 2023

Operations Analysis

An existing intersection capacity analysis was completed for the weekday a.m. and p.m. peak hours to establish a baseline condition to which future traffic operations can be compared. The study intersections were analyzed using Synchro/SimTraffic (Version 11).

Capacity analysis results identify a Level of Service (LOS), which indicates the quality of traffic flow through an intersection. Intersections are given a ranking from LOS A through LOS F. The LOS results are based on the average delay per vehicle, which correspond to the delay threshold values shown in Table 6. LOS A indicates the best traffic operation, with vehicles experiencing minimal delays. LOS F indicates an intersection where demand exceeds capacity, or a breakdown of traffic flow. Overall intersection LOS A through LOS D is generally considered acceptable in Blue Earth County.

Table 6. Level of Service Criteria for Signalized and Unsignalized Intersections

LOS	Signalized Intersection Average Delay/Vehicle (seconds)	Unsignalized Intersection Average Delay/Vehicle (seconds)
A	≤ 10	≤ 10
B	> 10 - 20	> 10 - 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50
F	> 80	> 50

For side-street stop-controlled intersections, special emphasis is given to providing an estimate for the level of service of the side-street approach. Traffic operations at an unsignalized intersection with side-street stop control can be described in two ways. First, consideration is given to the overall intersection level of service. This considers the total number of vehicles entering the intersection and the capability of the intersection to support these volumes. Second, it is important to consider the delay on the minor approach. Since the mainline does not have to stop, most of the delay is attributed to the side-street approaches. It is typical of intersections with higher mainline traffic volumes to experience high levels of delay (i.e., poor levels of service) on the side-street approaches, but an acceptable overall intersection level of service during peak hour conditions.

Existing Year 2022 Operations Analysis

A summary of the operational analysis under Existing volume conditions can be seen in Table 7 and Table 8, while detailed results are included in the Appendix. Note the signal control alternative assumed coordinated traffic signal timing at the interchange ramps.

Table 7 . Year 2022 Existing Operations Analysis Results – CSAH 5 & US 14 Eastbound Ramp

Alternative	Analysis Tool	AM Peak Hour		PM Peak Hour	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Side-Street Stop Control (1)	Synchro	4/9	A/A	6/18	A/C
All-Way Stop Control	Synchro	1	A	2	A
Signal Control(2)	Synchro	11	B	12	B
Single Lane Roundabout (1)	RODEL	5/5	A/A	5/6	A/A

(1) Note: Overall results are followed by the worst approach results.

Table 8 . Year 2022 Existing Operations Analysis Results – CSAH 5 & US 14 Westbound Ramp

Alternative	Analysis Tool	AM Peak Hour		PM Peak Hour	
		Delay (sec/veh)	LOS	Delay (sec/veh)	LOS
Side-Street Stop Control (1)	Synchro	2/6	A/A	3/6	A/A
All-Way Stop Control	Synchro	2	A	2	A
Signal Control(2)	Synchro	5	A	7	A
Single Lane Roundabout (1)	RODEL	5/5	A/A	6/7	A/A

(1) Note: Overall results are followed by the worst approach results.

Operational analysis of Year 2022 Existing Geometry conditions indicates the existing side-street stop control performs acceptably under the existing volumes. The overall intersection LOS for both peaks is LOS A with the worst approach being a LOS C on the eastbound approach of the CSAH 5 and US 14 Eastbound Ramp intersection during the p.m. peak hour. Eastbound left-turns account for most of the delay at this approach. No significant delay or queuing issues were identified. Additionally, all other alternatives operate at an acceptable overall LOS B or better during the weekday a.m. and p.m. peak hours.

Future Forecast Year 2035 and 2045 Volumes

Forecasted volumes from the MAPO Long Range Transportation Plan were utilized to develop future 2035 and 2045 peak hour turning movement counts at the study intersections. Additionally, there is no expected planned year for construction therefore the existing analysis is expected to serve as the potential year of opening analysis at this time. Forecast Year 2035 and 2045 a.m. and p.m. peak hour turning movement volumes used in the analysis were based on the existing hourly counts. Note, historic trends have shown that traffic volumes have been trending down (see Table 9 and Table 10); however, for purposes of this study, the growth rates from the most current Long Ronge Transportation Plan were utilized and represent a conservative estimate.

Table 9. Historic Traffic Volumes

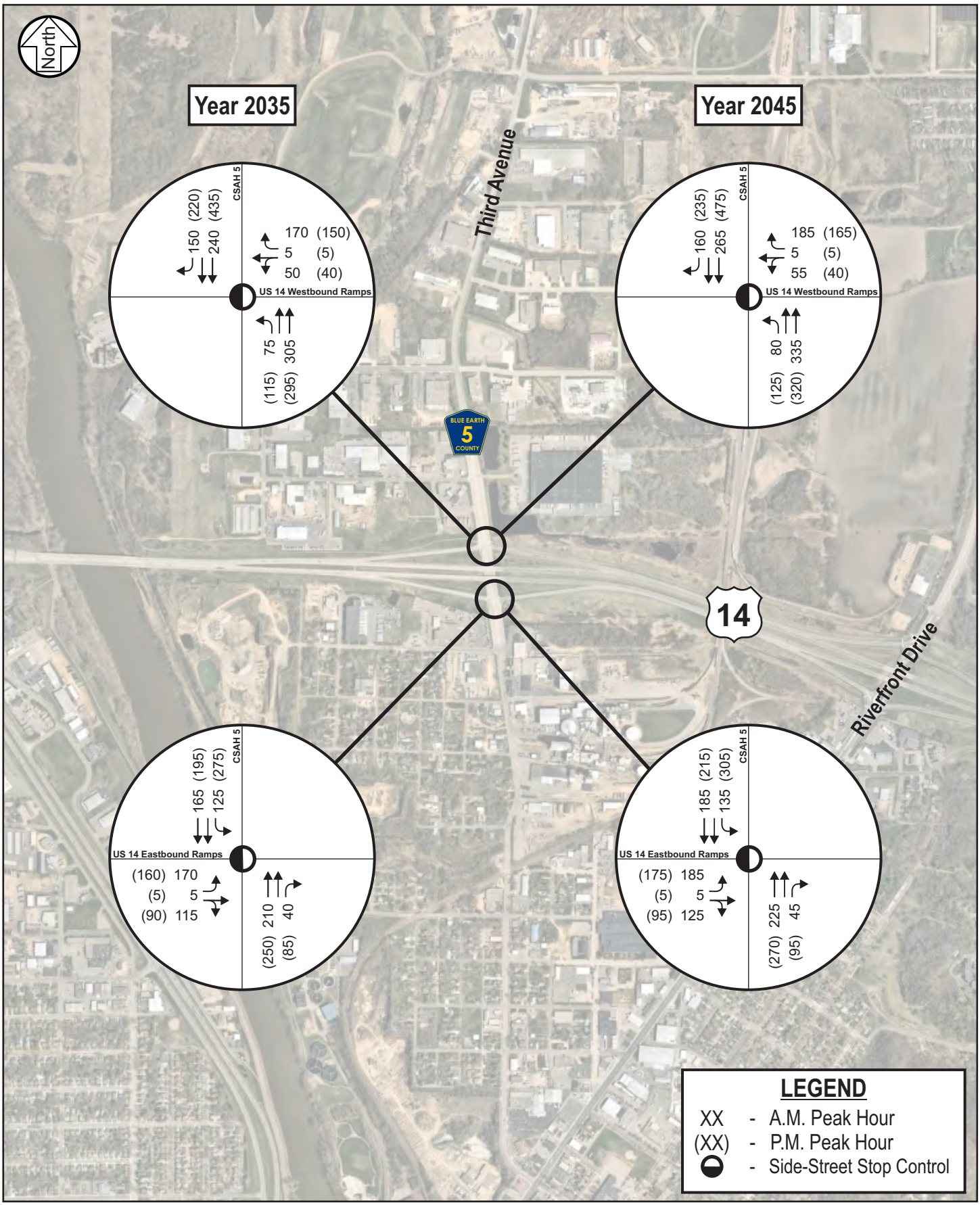
Location	1997	2001	2005	2009	2013	2018	2022(1)
North of US 14 WB Ramps	11,800	14,900	14,000	13,300	12,000	12,200	11,100

(1) Estimated AADT volumes based on traffic count data collected in May 2022.

Table 10. Forecasted Traffic Volumes

Location	Current 2018 Volume(1)	Estimated 2022 AADT (Counts)(2)	2023 AADT (Counts)(4)	Year 2045 Forecast(3)	Forecasted 2045 Based on Counts
North of US 14 WB Ramps	12,200	11,100	9,341	15,800	11,700

(1) From MnDOT Traffic Mapping Application.
(2) Estimated AADT volumes based on traffic count data collected in May 2022.
(3) From the MAPO LRTP
(4) Data collected on April 25, 2023.



Forecast Year 2035 and 2045 Peak Hour Turning Movement Counts

CSAH 5 (Third Ave) Corridor Study
City of Mankato

Figure 5

02315202
January 2023

Year 2035 Operations Analysis

Year 2035 operational analysis for the existing side-street stop control was performed using Synchro/SimTraffic (Version 11) and the roundabout control alternative was performed using RODEL. Note, the other traffic control alternatives were not reviewed under year 2035 conditions as they are not required to be reviewed based on MnDOT guidance at this time.

Year 2035 Operations Analysis

A summary of the operational analysis under Forecast Year 2035 volume conditions for the existing side-street stop control and roundabout alternative can be seen in Table 11 and Table 12Table 12, respectively. Detailed results are included in the Appendix. Note the signal control alternative assumed coordinated traffic signal timing.

Table 11. Year 2035 Operations Analysis Results – Existing Side-Street Stop Control

Existing Side-Street Stop Control	Analysis Tool	AM Peak Hour LOS/Delay (sec/veh)			PM Peak Hour LOS/Delay (sec/veh)		
		Overall	Worst Approach	Worst Movement	Overall	Worst Approach	Worst Movement
US 14 Eastbound Ramp	Synchro	A (5)	EB – B (11)	EBL – C (16)	B (13)	EB – E (48)	EBL – F (72)
US 14 Westbound Ramp	Synchro	A (2)	WB – A (6)	WBT – B (15)	A (3)	WB – A (8)	WBL – C (23)

The results of the analysis indicate that both interchange ramps are expected to perform with acceptable overall levels of service with the existing geometry, however the level of service for the worst approach for the side-street stop control is expected to be LOS E at the US 14 Eastbound Ramps during the p.m. peak hour. This delay is expected to reach 48 seconds per vehicle, with most of the delay attributed to the left-turn movements. The eastbound left-turn 95th percentile queue for the side-street stop control alternative is expected to extend to approximately 300 feet which is anticipated to occupy the full eastbound left-turn storage.

Table 12. Year 2035 Operations Analysis Results – Roundabout Alternative

Single Lane Roundabout Alternative	Analysis Tool	AM Peak Hour LOS/Delay (sec/veh)		PM Peak Hour LOS/Delay (sec/veh)	
		Overall	Worst Approach	Overall	Worst Approach
US 14 Eastbound Ramp	RODEL	A (5)	EB – A (5)	A (6)	NB – A (6)
US 14 Westbound Ramp	RODEL	A (5)	WB – A (6)	A (7)	SB – A (8)

The results of the analysis indicate that both interchange ramps are expected to operate at an acceptable overall LOS A, with no approaches worse than a LOS A during the a.m. and p.m. peak hours with a single lane roundabout control. Average and 95th percentile queuing for both ramps is expected to not exceed 100 feet on any approach during the a.m. and p.m. peak hours.

Year 2045 Operations Analysis

Year 2045 operational analysis for the side-street stop control, all-way stop control, and traffic signal alternatives were performed using Synchro/SimTraffic (Version 11) while the roundabout control was performed using RODEL.

Year 2045 Operations Analysis

A summary of the operational analysis under Forecast Year 2045 volume conditions can be seen in Table 13 and Table 14, while detailed results are included in the Appendix. Note the signal control alternative assumed coordinated traffic signal timing.

Table 13. Year 2045 Operations Analysis Results – CSAH 5 & US 14 Eastbound Ramp

Alternative	Analysis Tool	AM Peak Hour LOS/Delay (sec/veh)			PM Peak Hour LOS/Delay (sec/veh)		
		Overall	Worst Approach	Worst Movement	Over-all	Worst Approach	Worst Movement
Side-Street Stop Control	Synchro	A (5)	EB - B (12)	EBL – C (18)	C (21)	**EB – F (78)**	**EBL – F (111)**
All-Way Stop Control	Synchro	A (8)	SB - A (9)	SBL – A (10)	B (11)	SB – B (14)	SBL – C (16)
Signal Control	Synchro	B (11)	EB – B (18)	EBL – C (28)	B (12)	EB – B (19)	EBL – C (27)
Single Lane Roundabout	RODEL	A (5)	EB – A (6)	-	A (6)	NB – A (7)	-

Table 14 . Year 2045 Operations Analysis Results – CSAH 5 & US 14 Westbound Ramp

Alternative	Analysis Tool	AM Peak Hour LOS/Delay (sec/veh)			PM Peak Hour LOS/Delay (sec/veh)		
		Overall	Worst Approach	Worst Movement	Overall	Worst Approach	Worst Movement
Side-Street Stop Control	Synchro	A (3)	WB - A (7)	WBT - C (18)	A (3)	WB – A (9)	WBT – D (34)
All-Way Stop Control	Synchro	A (7)	NB - A (8)	SBT – A (9)	A (8)	SB – A (10)	SBT – B (11)
Signal Control	Synchro	A (6)	WB – B (11)	WBT – C (31)	A (7)	WB – B (11)	WBL – C (28)
Single Lane Roundabout	RODEL	A (6)	SB – A (6)	-	A (8)	SB – A (10)	-

The results of the analysis indicate that all alternatives are expected to perform with acceptable overall levels of service with the existing geometry, however the level of service for the worst approach for the side-street stop control is expected to be LOS F at the US 14 Eastbound Ramps during the p.m. peak hour. The eastbound approach delay is expected to reach 78 seconds per vehicle, with most of the delay attributed to the left-turn movements. The eastbound left-turn 95th percentile queue for the side-street stop control alternative is expected to extend to approximately 500 feet which exceeds the eastbound turn lane storage and enters into the eastbound shared through/right-turn lane. Note average and 95th percentile queues are not expected to impact mainline US 14 or any entrances and/or

side streets along CSAH 5. All average and 95th percentile queues are expected to be 200 feet or less for the remaining alternatives and no queuing issues are expected.

Warrants Analysis

A warrants analysis was performed for the traffic signal control alternative as outlined in the January 2023 *Minnesota Manual on Uniform Traffic Control Devices* (MnMUTCD). Analysis of signal warrants 1-3 was performed for Existing Conditions and Forecast Year 2045 volumes. Signal warrants 4-9 were investigated and determined to be not applicable to the study.

The mainline approaches were assumed to have two or more approach lanes with a 40-mph speed limit on the north leg of CSAH 5 and US 14 Westbound ramp and a 30-mph speed limit south of the US 14 Westbound ramp. The minor ramp approaches were assumed to have one approach lane and a 30-mph speed limit.

Note that the proposed conditions did not meet the necessary criteria (i.e., mainline roadway speed limits exceed 40 mph and/or the intersection is located in an isolated community having a population of less than 10,000), therefore, a 70 percent factor was not used in the warrants analysis. Table 15 and Table 16 provide a summary of the warrants analysis results for Existing and Year 2045 volume conditions, while the detailed volume-based warrants analysis is included in the Appendix. The results of the warrants analysis indicate that the intersection does not meet signal warrants 1-3 under the Existing or Forecasted Year 2045 conditions. It should be noted that the multi-way stop warrant was not met under either condition. Since signal warrants were not met for either existing or year 2045 traffic volumes no other signal alternatives were explored (e.g., diverging diamond).

Table 15. Warrant Analysis Summary – CSAH 5 at US 14 Eastbound Ramps

MnMUTCD Warrant	Hours Req'd	Existing Volumes		Year 2045 Volumes	
		Hours Met	Warrant Met?	Hours Met	Warrant Met?
MWSA (C): Multiway Stop Applications Condition C	8	0	**No**	1	**No**
Warrant 1A: Minimum Vehicular Volume	8	0	**No**	4	**No**
Warrant 1B: Interruption of Continuous Traffic	8	0	**No**	1	**No**
Warrant 1C: Combination of Warrants	8	1	**No**	2	**No**
Warrant 2: Four-Hour Volume	4	0	**No**	0	**No**
Warrant 3B: Peak Hour Volume	1	0	**No**	0	**No**
Warrants 4-9	Not Applicable				

Table 16. Warrant Analysis Summary – CSAH 5 at US 14 Westbound Ramps

MnMUTCD Warrant	Hours Req'd	Existing Volumes		Year 2045 Volumes	
		Hours Met	Warrant Met?	Hours Met	Warrant Met?
MWSA (C): Multiway Stop Applications Condition C	8	0	**No**	0	**No**
Warrant 1A: Minimum Vehicular Volume	8	0	**No**	0	**No**
Warrant 1B: Interruption of Continuous Traffic	8	0	**No**	0	**No**
Warrant 1C: Combination of Warrants	8	0	**No**	0	**No**
Warrant 2: Four-Hour Volume	4	0	**No**	0	**No**
Warrant 3B: Peak Hour Volume	1	0	**No**	0	**No**
Warrants 4-9	Not Applicable				

Safety Analysis

A safety analysis was performed to estimate the number of crashes per year for each alternative under Year 2022 Existing and Forecast Year 2045 conditions for the study intersections. For the safety analysis, Crash Modification Factors (CMFs) were used to estimate future crashes for the alternatives, along with a detailed review of the Fatal and Serious Crash rate for the Eastbound Ramps. The results of the analysis are shown in Table 17 and

Table 18, respectively, for the US 14 Eastbound Ramps, along with Table 19 and Table 20 for the Westbound Ramps.

Table 17. Projected Crashes per Intersection Alternative - CSAH 5 at US 14 Eastbound Ramp

Alternative	Intersection Entering ADT		Crash Modification Factor(1)	Projected Crash Rate (2)	Projected Crashes/Year	
	Year 2022	Year 2045			Year 2022	Year 2045
Side-Street Stop Control	10,550	13,000	N/A	0.571	2.2	2.7
All-Way Stop Control			0.52(3)	0.297	1.1	1.4
Traffic Signal Control			0.56(4)	0.320	1.2	1.5
Roundabout Control			0.73(5)	0.420	1.6	2.0

(1) CMF applied to 4-Lane divided roadway.
(2) Per million entering vehicles (2017-2021 intersection crash data).
(3) Using CMF ID 315 "Convert Minor-Road Stop Control to All-Way Stop Control" from FHWA CMF Clearinghouse.
(4) Using CMF ID 325 "Install a Traffic Signal" from FHWA CMF Clearinghouse.
(5) Using Crash Reductions from A study of the Traffic Safety at Roundabouts in Minnesota, Revised September 15, 2021

Table 18. Projected Fatal and Serious Injury Crashes per Intersection Alternative - CSAH 5 at US 14 Eastbound Ramp

Alternative	Intersection Entering ADT		Crash Modification Factor(1)	Projected K&A Crash Rate (2)	Projected K&A Crashes/Year	
	Year 2022	Year 2045			Year 2022	Year 2045
Side-Street Stop Control	10,550	13,000	N/A	5.19	0.20	0.25
All-Way Stop Control			0.23(3)	1.19	0.05	0.06
Traffic Signal Control			0.86(4)	4.46	0.17	0.21
Roundabout Control			0.14(5)	0.73(5)	0.03	0.03

(1) CMF applied to 4-Lane divided roadway.
(2) Per 100 million entering vehicles (2017-2021 data).
(3) Using CMF ID 3128 "Convert Minor-Road Stop Control to All-Way Stop Control" from FHWA CMF Clearinghouse.
(4) Using CMF ID 316 "Install a Traffic Signal" from FHWA CMF Clearinghouse.
(5) Using Crash Reductions from A Study of the Traffic Safety at Roundabouts in Minnesota, Revised September 15, 2021

Table 19. Projected Crashes per Intersection Alternative - CSAH 5 at US 14 Westbound Ramp

Alternative	Intersection Entering ADT		Crash Modification Factor(1)	Projected Crash Rate(2)	Projected Crashes/Year	
	Year 2022	Year 2045			Year 2022	Year 2045
Side-Street Stop Control	12,750	15,700	N/A	0.343	1.6	2.0
All-Way Stop Control			0.52(3)	0.178	0.8	1.0
Traffic Signal Control			0.56(4)	0.192	0.9	1.1
Roundabout Control			0.73(5)	0.250	1.2	1.4

(1) CMF applied to 4-Lane divided roadway.
(2) Per million entering vehicles (2017-2021 data).
(3) Using CMF ID 315 "Convert Minor-Road Stop Control to All-Way Stop Control" from FHWA CMF Clearinghouse.
(4) Using CMF ID 325 "Install a Traffic Signal" from FHWA CMF Clearinghouse.
(5) Using Crash Reductions from A Study of the Traffic Safety at Roundabouts in Minnesota, Revised September 15, 2021

Table 20. Projected Fatal and Serious Injury Crashes per Intersection Alternative - CSAH 5 at US 14 Westbound Ramp

Alternative	Intersection Entering ADT		Crash Modification Factor(1)	Projected K&A Crash Rate (2)	Projected K&A Crashes/Year	
	Year 2022	Year 2045			Year 2022	Year 2045
Side-Street Stop Control	12,750	15,700	N/A(3)	0.31	0.014	0.018
All-Way Stop Control			0.23(4)	0.07	0.003	0.004
Traffic Signal Control			0.86(5)	0.27	0.012	0.015
Roundabout Control			0.14(6)	0.40(6)	0.002	0.003

(1) CMF applied to 4-Lane divided roadway.
(2) Per 100 million entering vehicles (2017-2021 data).
(3) The MnDOT statewide average crash rate for fatal and serious injury crashes was used for the side-street stop control as there were no documented fatal or serious injury crashes for the existing year analysis.
(4) Using CMF ID 3128 "Convert Minor-Road Stop Control to All-Way Stop Control" from FHWA CMF Clearinghouse.
(5) Using CMF ID 316 "Install a Traffic Signal" from FHWA CMF Clearinghouse.
(6) Using Crash Reductions from A Study of the Traffic Safety at Roundabouts in Minnesota, Revised September 15, 2021

Based on the crash analysis, the side-street stop control alternative is expected to have the highest crash rate, while the alternatives that have traffic control on all approaches have lower crash rates. The all-way stop control is expected to have the lowest projected number of crashes.

In addition to calculating the crash rates, benefit-cost analyses were completed. Due to the intersection not meeting traffic signal warrants, this control type was not reviewed from a benefit-cost perspective. Although also not meeting warrants, all-way stop control was reviewed from a benefit cost perspective because the delay values are expected to be similar to potential roundabout control. Both all-way stop control and roundabout control were reviewed from a benefit cost perspective.

The benefit-cost analysis included both a consideration of the benefits from a crash reduction, using the expected reduction parameters from the 2021 MnDOT publication of *A Study of the Traffic Safety at Roundabouts in Minnesota*, and the potential reduction in vehicle hours traveled (VHT). Note, the vehicle miles traveled (VMT) was not included as it is expected that vehicles along the corridor will travel essentially the same distance at the existing versus proposed interchanges. A planning level concept estimate for the projected cost of the roundabout interchange was used to help determine the cost of the project. Note, right-of-way costs were not included in the cost estimates given unknown sizing and project needs.

For all-way strop control, it was determined that the Eastbound Ramp intersection will have a benefit-cost ratio of 153.81, while the Westbound Ramp intersection is expected to have a benefit-cost ratio of 1.74, yielding a total benefit-cost ratio for the interchange as a whole of 155.55. This indicates that the all-way stop control improvement would be expected to have a positive benefit to the study area.

For a roundabout control, it was determined that the Eastbound Ramp intersection will have a benefit-cost ratio of 2.66, while the Westbound Ramp intersection is expected to have a benefit-cost ratio of -0.65, yielding a total benefit-cost ratio for the interchange as a whole of 2.01. This indicates that the roundabout control improvement would be expected to have a positive benefit to the study area.

Right-of-Way and Other Considerations

The roundabout alternative is expected to require additional right-of-way, while all other alternatives are anticipated to fit within the proposed right-of-way. As noted earlier, a multilane roundabout was not analyzed as the volumes do not justify the need. Additionally, a multilane roundabout would require additional right-of-way beyond that required for a single lane roundabout. The all-way stop control alternative would require minimal capital costs and is anticipated to require minimal maintenance. Signals require additional costs for the supply of electricity as well as for the maintenance of the signal equipment, while a roundabout typically requires additional maintenance costs for the center island and additional intersection lighting.

Conclusions and Recommendation

The CSAH 5 and US 14 Ramp intersections currently have a crash rate at or above the critical crash rate, and above the statewide average, which indicates that there is a higher likelihood of safety concerns in the future.

The side-street stop control alternative is expected to have the lowest crash reduction as the intersection is currently under side-street stop control, so no additional crash reduction is anticipated by maintaining the existing traffic control. Of the studied alterantives, the all-way stop control alternative is expected to have the lowest overall crash rate. The alternatives which have traffic control on the mainline (i.e. all-way stop control, traffic signal control, and roundabout control) are expected to have the highest crash reduction due to the mainline being required to either temporarily yield to the side-street approaches or slow down to safely maneuver through the roundabout. The roundabout is expected to have the highest reduction in fatal and serious injury crashes. Note, the expected benefit-cost of a roundabout interchange is expected to be 2.01.

All alternatives except the existing side-street stop control are expected to operate with acceptable levels of service under Forecast Year 2045 volume conditions. The existing side-street stop control is expected to have operational issues in the future p.m. peak hour. Traffic signal control or multi-way stop warrants were not met under the existing or Forecast Year 2045 condition.

Additionally, while the future forecasted traffic volumes utilize a growth rate as they were based on data published in the MAPO LRTP, it should be noted that current historical trends indicate the volumes are decreasing. If these trends continue, the existing traffic control may be sufficient to accommodate future volumes and reduce the likelihood of any fatal or serious crashes.

Based on these factors, it is recommended that the intersections continue to be monitored for volume changes and crashes going into the future. No modifications to the current interchange configuration are expected to be needed from a capacity perspective. If safety concerns continue to persist in the future, a traffic control change to AWSC or roundabouts could be considered. Additionally, each intersection should be monitored and evaluated independently, as shown previously the calculated future delay values and past crash experience indicate that the Eastbound Ramp intersection will likely require attention before the Westbound Ramp intersection.

Both all-way stop and roundabout control address the safety needs by significantly reducing angle conflicts and maintaining acceptable intersection operations. Overall, the all-way stop control is expected to have a significantly higher benefit-cost ratio as compared to a roundabout. This is due to the significant cost difference between the two options.

Appendix

- Existing Intersection Turning Movement Volumes
- Existing Detailed Operations Analysis
- Forecast Year 2035 Detailed Operations Analysis
- Forecast Year 2045 Detailed Operations Analysis
- Existing Warrant Analysis
- Forecast Year 2045 Warrant Analysis
- Benefit-Cost Analysis

Existing Intersection Turning Movement Volumes

3rd Avenue & US 14 Eastbound Ramp - 13 Hour ... - TMC

Tue May 10, 2022
Full Length (6 AM-7 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950916, Location: 44.190459, -93.996029

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US

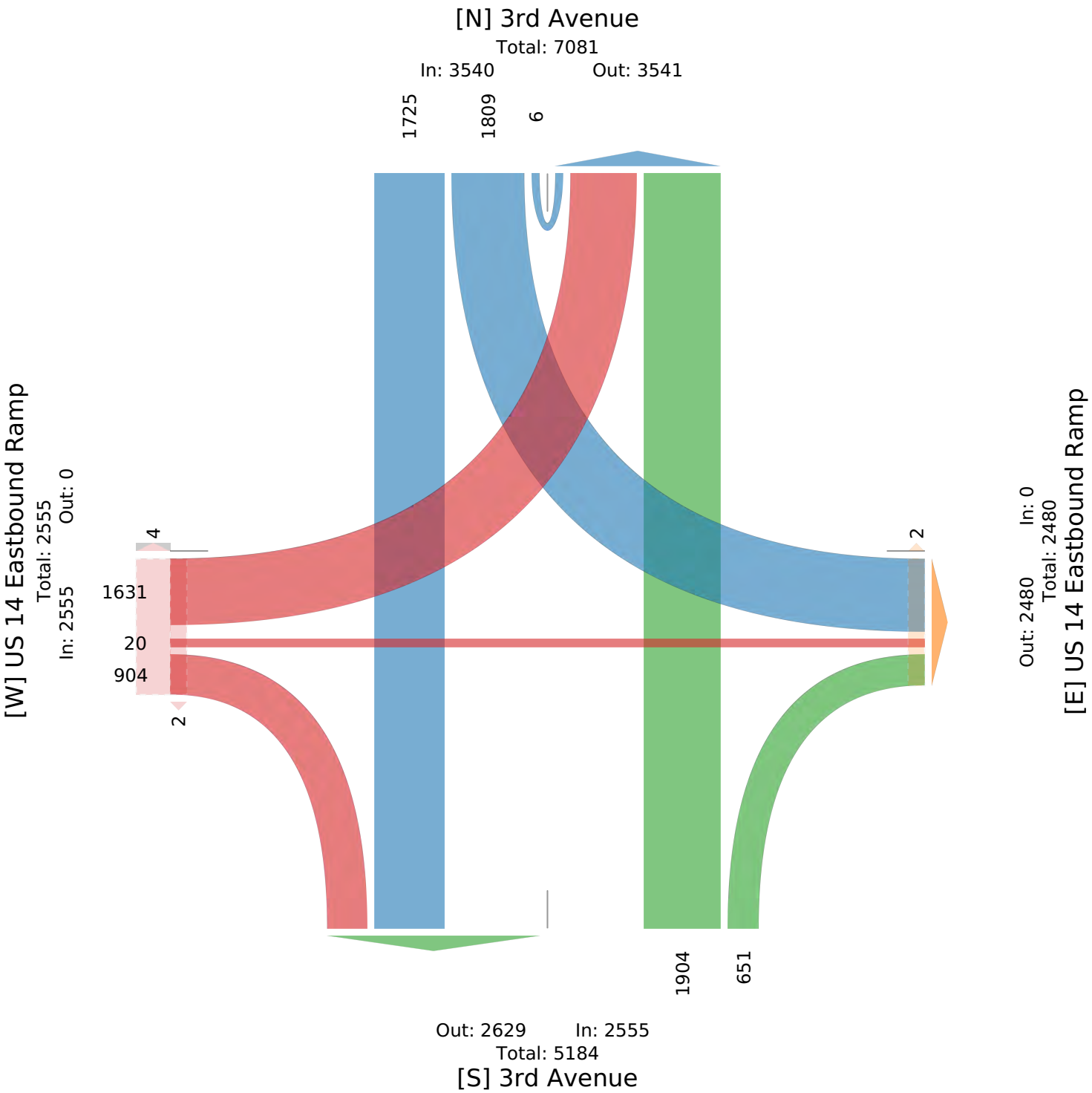
Leg Direction	US 14 Eastbound Ramp Eastbound					US 14 Eastbound Ramp Westbound		3rd Avenue Northbound					3rd Avenue Southbound					
Time	L	T	R	**App**	Ped*	**App**	Ped*	T	R	U	**App**	Ped*	L	T	U	**App**	Ped*	**Int**
2022-05-10 6:00AM	28	0	11	**39**	0	**0**	0	18	10	0	**28**	0	12	12	0	**24**	0	**91**
6:15AM	34	0	21	**55**	0	**0**	0	6	8	0	**14**	0	14	18	0	**32**	0	**101**
6:30AM	45	0	23	**68**	0	**0**	1	9	20	0	**29**	0	11	31	0	**42**	0	**139**
6:45AM	63	1	35	**99**	0	**0**	0	36	11	0	**47**	0	23	28	0	**51**	0	**197**
Hourly Total	170	1	90	**261**	0	**0**	1	69	49	0	**118**	0	60	89	0	**149**	0	**528**
7:00AM	33	0	16	**49**	0	**0**	0	26	9	0	**35**	0	26	24	0	**50**	0	**134**
7:15AM	38	0	17	**55**	0	**0**	0	35	7	0	**42**	0	22	17	0	**39**	0	**136**
7:30AM	41	0	32	**73**	0	**0**	0	40	11	0	**51**	0	27	37	0	**64**	0	**188**
7:45AM	44	1	36	**81**	0	**0**	0	45	8	0	**53**	0	27	42	0	**69**	0	**203**
Hourly Total	156	1	101	**258**	0	**0**	0	146	35	0	**181**	0	102	120	0	**222**	0	**661**
8:00AM	34	0	17	**51**	0	**0**	0	57	10	0	**67**	0	25	33	0	**58**	0	**176**
8:15AM	28	1	15	**44**	0	**0**	0	41	6	0	**47**	0	31	37	0	**68**	0	**159**
8:30AM	41	1	12	**54**	0	**0**	0	34	15	0	**49**	0	30	27	0	**57**	0	**160**
8:45AM	30	0	16	**46**	0	**0**	0	31	6	0	**37**	0	40	28	0	**68**	0	**151**
Hourly Total	133	2	60	**195**	0	**0**	0	163	37	0	**200**	0	126	125	0	**251**	0	**646**
9:00AM	22	1	13	**36**	0	**0**	0	35	6	0	**41**	0	20	23	0	**43**	0	**120**
9:15AM	27	1	19	**47**	0	**0**	0	22	8	0	**30**	0	20	30	0	**50**	0	**127**
9:30AM	25	1	17	**43**	0	**0**	0	35	13	0	**48**	0	23	25	0	**48**	0	**139**
9:45AM	30	0	22	**52**	0	**0**	0	28	11	0	**39**	0	28	27	0	**55**	0	**146**
Hourly Total	104	3	71	**178**	0	**0**	0	120	38	0	**158**	0	91	105	0	**196**	0	**532**
10:00AM	27	0	15	**42**	0	**0**	0	29	6	0	**35**	0	19	25	0	**44**	0	**121**
10:15AM	26	1	18	**45**	0	**0**	0	15	18	0	**33**	0	42	22	0	**64**	0	**142**
10:30AM	34	0	10	**44**	0	**0**	0	37	16	0	**53**	0	26	36	0	**62**	0	**159**
10:45AM	18	1	12	**31**	0	**0**	0	33	11	0	**44**	0	32	22	0	**54**	0	**129**
Hourly Total	105	2	55	**162**	0	**0**	0	114	51	0	**165**	0	119	105	0	**224**	0	**551**
11:00AM	24	0	14	**38**	0	**0**	0	36	10	0	**46**	0	34	27	0	**61**	0	**145**
11:15AM	28	0	9	**37**	0	**0**	0	33	13	0	**46**	0	30	38	0	**68**	0	**151**
11:30AM	35	0	19	**54**	0	**0**	0	48	7	0	**55**	0	35	33	1	**69**	0	**178**
11:45AM	46	0	17	**63**	0	**0**	0	47	12	0	**59**	0	49	34	0	**83**	0	**205**
Hourly Total	133	0	59	**192**	0	**0**	0	164	42	0	**206**	0	148	132	1	**281**	0	**679**
12:00PM	28	0	19	**47**	0	**0**	0	48	21	0	**69**	0	68	40	0	**108**	0	**224**
12:15PM	39	0	21	**60**	0	**0**	0	41	12	0	**53**	0	39	28	1	**68**	0	**181**
12:30PM	27	0	19	**46**	0	**0**	0	53	13	0	**66**	0	39	26	1	**66**	0	**178**
12:45PM	36	1	23	**60**	0	**0**	0	35	14	0	**49**	0	29	47	1	**77**	0	**186**
Hourly Total	130	1	82	**213**	0	**0**	0	177	60	0	**237**	0	175	141	3	**319**	0	**769**
1:00PM	35	1	12	**48**	0	**0**	0	49	9	0	**58**	0	34	33	1	**68**	0	**174**
1:15PM	39	0	18	**57**	0	**0**	0	41	12	0	**53**	0	33	34	0	**67**	0	**177**
1:30PM	35	0	15	**50**	0	**0**	0	29	12	0	**41**	0	38	46	0	**84**	0	**175**
1:45PM	36	1	15	**52**	0	**0**	0	37	10	0	**47**	0	39	38	0	**77**	0	**176**
Hourly Total	145	2	60	**207**	0	**0**	0	156	43	0	**199**	0	144	151	1	**296**	0	**702**
2:00PM	29	1	15	**45**	0	**0**	0	37	15	0	**52**	0	27	49	0	**76**	0	**173**
2:15PM	32	0	11	**43**	0	**0**	0	39	12	0	**51**	0	26	33	0	**59**	0	**153**
2:30PM	36	1	13	**50**	2	**0**	0	32	10	0	**42**	0	40	44	1	**85**	0	**177**
2:45PM	37	0	28	**65**	0	**0**	0	42	8	0	**50**	0	38	28	0	**66**	0	**181**
Hourly Total	134	2	67	**203**	2	**0**	0	150	45	0	**195**	0	131	154	1	**286**	0	**684**
3:00PM	41	0	18	**59**	0	**0**	0	39	16	0	**55**	0	63	47	0	**110**	0	**224**
3:15PM	37	0	18	**55**	0	**0**	1	43	13	0	**56**	0	43	32	0	**75**	0	**186**
3:30PM	36	0	22	**58**	0	**0**	0	47	17	0	**64**	0	46	44	0	**90**	0	**212**
3:45PM	40	0	22	**62**	0	**0**	0	44	18	0	**62**	0	37	42	0	**79**	0	**203**
Hourly Total	154	0	80	**234**	0	**0**	1	173	64	0	**237**	0	189	165	0	**354**	0	**825**
4:00PM	27	1	26	**54**	0	**0**	0	69	24	0	**93**	0	66	44	0	**110**	0	**257**
4:15PM	43	0	18	**61**	0	**0**	0	49	21	0	**70**	0	47	41	0	**88**	0	**219**
4:30PM	33	0	12	**45**	0	**0**	0	59	13	0	**72**	0	92	46	0	**138**	0	**255**

Leg	US 14 Eastbound Ramp					US 14 Eastbound Ramp		3rd Avenue					3rd Avenue					
Direction	Eastbound					Westbound		Northbound					Southbound					
Time	L	T	R	**App**	Ped*	**App**	Ped*	T	R	U	**App**	Ped*	L	T	U	**App**	Ped*	**Int**
4:45PM	25	3	13	**41**	0	**0**	0	36	26	0	**62**	0	59	42	0	**101**	0	**204**
Hourly Total	128	4	69	**201**	0	**0**	0	213	84	0	**297**	0	264	173	0	**437**	0	**935**
5:00PM	21	0	17	**38**	0	**0**	0	55	21	0	**76**	0	59	49	0	**108**	0	**222**
5:15PM	24	0	16	**40**	0	**0**	0	29	17	0	**46**	0	42	37	0	**79**	0	**165**
5:30PM	23	0	17	**40**	0	**0**	0	31	14	0	**45**	0	42	51	0	**93**	0	**178**
5:45PM	16	0	17	**33**	0	**0**	0	35	8	0	**43**	0	45	31	0	**76**	0	**152**
Hourly Total	84	0	67	**151**	0	**0**	0	150	60	0	**210**	0	188	168	0	**356**	0	**717**
6:00PM	19	1	6	**26**	0	**0**	0	35	19	0	**54**	0	30	37	0	**67**	0	**147**
6:15PM	12	1	10	**23**	4	**0**	0	18	8	0	**26**	0	17	22	0	**39**	0	**88**
6:30PM	13	0	9	**22**	0	**0**	0	27	9	0	**36**	0	13	22	0	**35**	0	**93**
6:45PM	11	0	18	**29**	0	**0**	0	29	7	0	**36**	0	12	16	0	**28**	0	**93**
Hourly Total	55	2	43	**100**	4	**0**	0	109	43	0	**152**	0	72	97	0	**169**	0	**421**
Total	1631	20	904	**2555**	6	**0**	2	1904	651	0	**2555**	0	1809	1725	6	**3540**	0	**8650**
% Approach	63.8%	0.8%	35.4%	**-**	-	**-**	-	74.5%	25.5%	0%	**-**	-	51.1%	48.7%	0.2%	**-**	-	-
% Total	18.9%	0.2%	10.5%	**29.5%**	-	**0%**	-	22.0%	7.5%	0%	**29.5%**	-	20.9%	19.9%	0.1%	**40.9%**	-	-
Motorcycles	18	1	11	**30**	-	**0**	-	26	3	0	**29**	-	14	20	0	**34**	-	93
% Motorcycles	1.1%	5.0%	1.2%	**1.2%**	-	**-**	-	1.4%	0.5%	0%	**1.1%**	-	0.8%	1.2%	0%	**1.0%**	-	1.1%
Lights	1177	16	672	**1865**	-	**0**	-	1547	488	0	**2035**	-	1487	1465	6	**2958**	-	6858
% Lights	72.2%	80.0%	74.3%	**73.0%**	-	**-**	-	81.3%	75.0%	0%	**79.6%**	-	82.2%	84.9%	100%	**83.6%**	-	79.3%
Single-Unit Trucks	256	1	37	**294**	-	**0**	-	131	83	0	**214**	-	182	134	0	**316**	-	824
% Single-Unit Trucks	15.7%	5.0%	4.1%	**11.5%**	-	**-**	-	6.9%	12.7%	0%	**8.4%**	-	10.1%	7.8%	0%	**8.9%**	-	9.5%
Articulated Trucks	179	2	180	**361**	-	**0**	-	200	71	0	**271**	-	123	100	0	**223**	-	855
% Articulated Trucks	11.0%	10.0%	19.9%	**14.1%**	-	**-**	-	10.5%	10.9%	0%	**10.6%**	-	6.8%	5.8%	0%	**6.3%**	-	9.9%
Buses	1	0	4	**5**	-	**0**	-	0	6	0	**6**	-	3	6	0	**9**	-	20
% Buses	0.1%	0%	0.4%	**0.2%**	-	**-**	-	0%	0.9%	0%	**0.2%**	-	0.2%	0.3%	0%	**0.3%**	-	0.2%
Pedestrians	-	-	-	-	0	-	1	-	-	-	-	0	-	-	-	-	0	
% Pedestrians	-	-	-	-	0%	-	50.0%	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	6	-	1	-	-	-	-	0	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	100%	-	50.0%	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

3rd Avenue & US 14 Eastbound Ramp - 13 Hour ... - TMC
Tue May 10, 2022
Full Length (6 AM-7 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950916, Location: 44.190459, -93.996029

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US



3rd Avenue & US 14 Eastbound Ramp - 13 Hour ... - TMC

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US

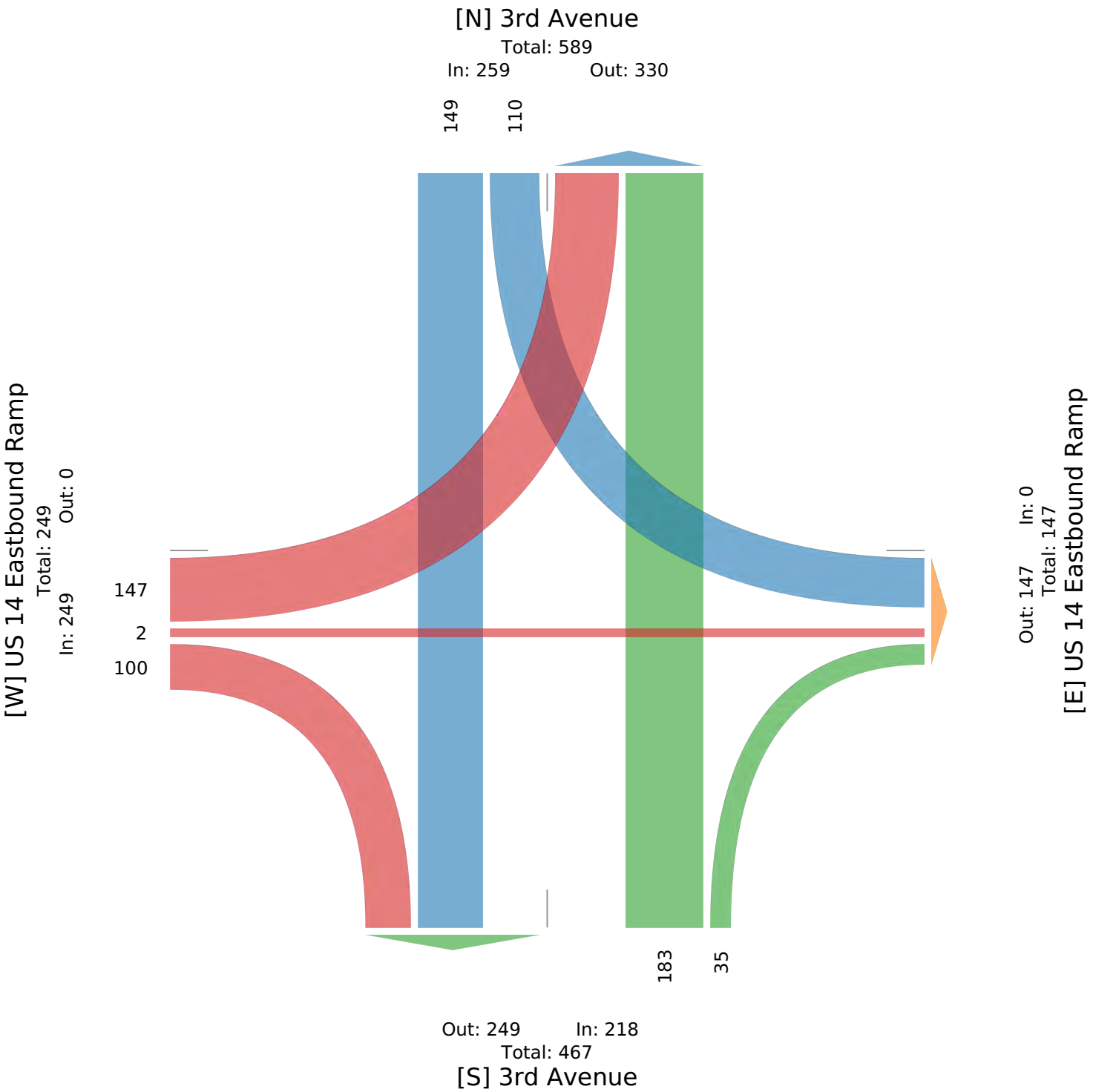
Tue May 10, 2022
AM Peak (7:30 AM - 8:30 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950916, Location: 44.190459, -93.996029

Leg Direction	US 14 Eastbound Ramp Eastbound					US 14 Eastbound Ramp Westbound		3rd Avenue Northbound					3rd Avenue Southbound					
Time	L	T	R	**App**	Ped*	**App**	Ped*	T	R	U	**App**	Ped*	L	T	U	**App**	Ped*	**Int**
2022-05-10 7:30AM	41	0	32	**73**	0	**0**	0	40	11	0	**51**	0	27	37	0	**64**	0	**188**
7:45AM	44	1	36	**81**	0	**0**	0	45	8	0	**53**	0	27	42	0	**69**	0	**203**
8:00AM	34	0	17	**51**	0	**0**	0	57	10	0	**67**	0	25	33	0	**58**	0	**176**
8:15AM	28	1	15	**44**	0	**0**	0	41	6	0	**47**	0	31	37	0	**68**	0	**159**
Total	147	2	100	**249**	0	**0**	0	183	35	0	**218**	0	110	149	0	**259**	0	**726**
% Approach	59.0%	0.8%	40.2%	**-**	-	**-**	-	83.9%	16.1%	0%	**-**	-	42.5%	57.5%	0%	**-**	-	-
% Total	20.2%	0.3%	13.8%	**34.3%**	-	**0%**	-	25.2%	4.8%	0%	**30.0%**	-	15.2%	20.5%	0%	**35.7%**	-	-
PHF	0.835	0.500	0.694	**0.769**	-	**-**	-	0.803	0.795	-	**0.813**	-	0.887	0.887	-	**0.938**	-	0.894
Motorcycles	0	0	1	**1**	-	**0**	-	1	0	0	**1**	-	0	1	0	**1**	-	3
% Motorcycles	0%	0%	1.0%	**0.4%**	-	**-**	-	0.5%	0%	0%	**0.5%**	-	0%	0.7%	0%	**0.4%**	-	0.4%
Lights	119	2	75	**196**	-	**0**	-	146	27	0	**173**	-	85	122	0	**207**	-	576
% Lights	81.0%	100%	75.0%	**78.7%**	-	**-**	-	79.8%	77.1%	0%	**79.4%**	-	77.3%	81.9%	0%	**79.9%**	-	79.3%
Single-Unit Trucks	17	0	4	**21**	-	**0**	-	12	2	0	**14**	-	16	13	0	**29**	-	64
% Single-Unit Trucks	11.6%	0%	4.0%	**8.4%**	-	**-**	-	6.6%	5.7%	0%	**6.4%**	-	14.5%	8.7%	0%	**11.2%**	-	8.8%
Articulated Trucks	10	0	20	**30**	-	**0**	-	24	6	0	**30**	-	9	12	0	**21**	-	81
% Articulated Trucks	6.8%	0%	20.0%	**12.0%**	-	**-**	-	13.1%	17.1%	0%	**13.8%**	-	8.2%	8.1%	0%	**8.1%**	-	11.2%
Buses	1	0	0	**1**	-	**0**	-	0	0	0	**0**	-	0	1	0	**1**	-	2
% Buses	0.7%	0%	0%	**0.4%**	-	**-**	-	0%	0%	0%	**0%**	-	0%	0.7%	0%	**0.4%**	-	0.3%
Pedestrians	-	-	-	-	0	-	0	-	-	-	-	0	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	0	-	0	-	-	-	-	0	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

3rd Avenue & US 14 Eastbound Ramp - 13 Hour ... - TMC
Tue May 10, 2022
AM Peak (7:30 AM - 8:30 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950916, Location: 44.190459, -93.996029

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US



3rd Avenue & US 14 Eastbound Ramp - 13 Hour ... - TMC

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US

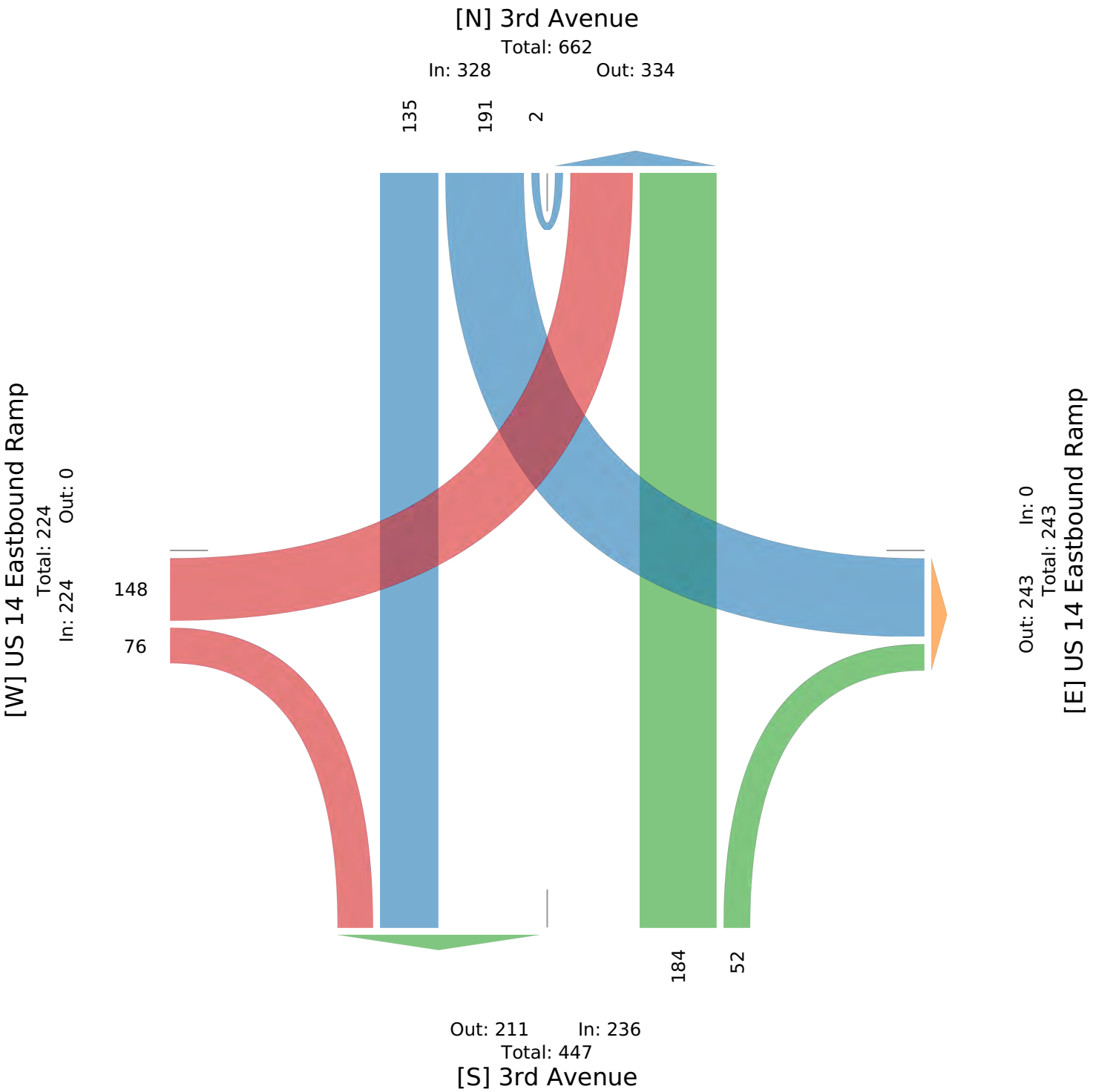
Tue May 10, 2022
Midday Peak (11:30 AM - 12:30 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950916, Location: 44.190459, -93.996029

Leg Direction	US 14 Eastbound Ramp Eastbound					US 14 Eastbound Ramp Westbound		3rd Avenue Northbound					3rd Avenue Southbound					
Time	L	T	R	**App**	Ped*	**App**	Ped*	T	R	U	**App**	Ped*	L	T	U	**App**	Ped*	**Int**
2022-05-10 11:30AM	35	0	19	**54**	0	**0**	0	48	7	0	**55**	0	35	33	1	**69**	0	**178**
11:45AM	46	0	17	**63**	0	**0**	0	47	12	0	**59**	0	49	34	0	**83**	0	**205**
12:00PM	28	0	19	**47**	0	**0**	0	48	21	0	**69**	0	68	40	0	**108**	0	**224**
12:15PM	39	0	21	**60**	0	**0**	0	41	12	0	**53**	0	39	28	1	**68**	0	**181**
Total	148	0	76	**224**	0	**0**	0	184	52	0	**236**	0	191	135	2	**328**	0	**788**
% Approach	66.1%	0%	33.9%	**-**	-	**-**	-	78.0%	22.0%	0%	**-**	-	58.2%	41.2%	0.6%	**-**	-	-
% Total	18.8%	0%	9.6%	**28.4%**	-	**0%**	-	23.4%	6.6%	0%	**29.9%**	-	24.2%	17.1%	0.3%	**41.6%**	-	-
PHF	0.804	-	0.905	**0.889**	-	**-**	-	0.958	0.619	-	**0.855**	-	0.702	0.844	0.500	**0.759**	-	0.879
Motorcycles	1	0	0	**1**	-	**0**	-	0	0	0	**0**	-	1	0	0	**1**	-	2
% Motorcycles	0.7%	0%	0%	**0.4%**	-	**-**	-	0%	0%	0%	**0%**	-	0.5%	0%	0%	**0.3%**	-	0.3%
Lights	112	0	59	**171**	-	**0**	-	152	33	0	**185**	-	158	113	2	**273**	-	629
% Lights	75.7%	0%	77.6%	**76.3%**	-	**-**	-	82.6%	63.5%	0%	**78.4%**	-	82.7%	83.7%	100%	**83.2%**	-	79.8%
Single-Unit Trucks	21	0	2	**23**	-	**0**	-	8	10	0	**18**	-	21	11	0	**32**	-	73
% Single-Unit Trucks	14.2%	0%	2.6%	**10.3%**	-	**-**	-	4.3%	19.2%	0%	**7.6%**	-	11.0%	8.1%	0%	**9.8%**	-	9.3%
Articulated Trucks	14	0	15	**29**	-	**0**	-	24	9	0	**33**	-	11	11	0	**22**	-	84
% Articulated Trucks	9.5%	0%	19.7%	**12.9%**	-	**-**	-	13.0%	17.3%	0%	**14.0%**	-	5.8%	8.1%	0%	**6.7%**	-	10.7%
Buses	0	0	0	**0**	-	**0**	-	0	0	0	**0**	-	0	0	0	**0**	-	0
% Buses	0%	0%	0%	**0%**	-	**-**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%
Pedestrians	-	-	-	-	0	-	0	-	-	-	-	0	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	0	-	0	-	-	-	-	0	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

3rd Avenue & US 14 Eastbound Ramp - 13 Hour ... - TMC
Tue May 10, 2022
Midday Peak (11:30 AM - 12:30 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950916, Location: 44.190459, -93.996029

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US



3rd Avenue & US 14 Eastbound Ramp - 13 Hour ... - TMC

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US

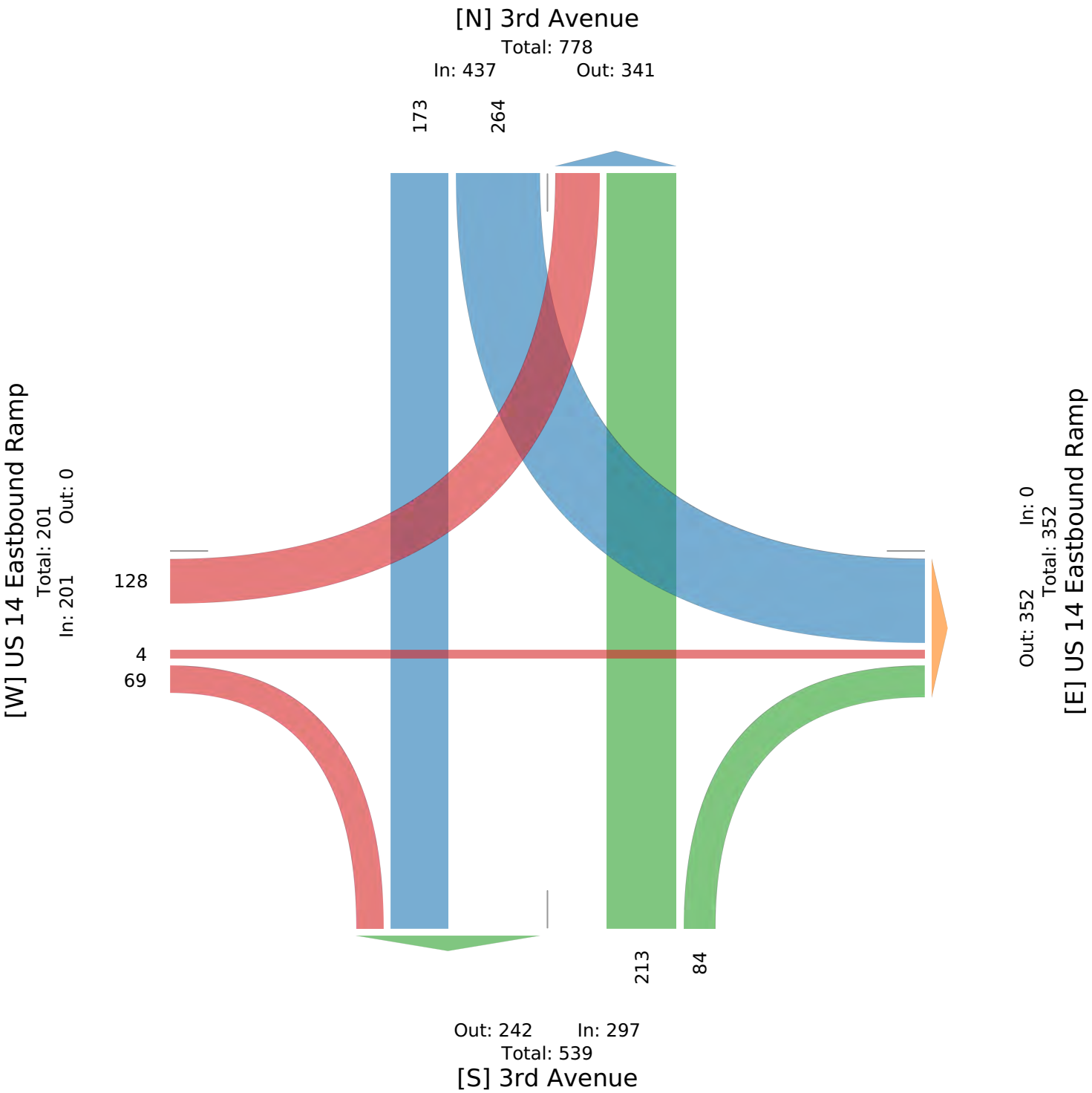
Tue May 10, 2022
PM Peak (4 PM - 5 PM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950916, Location: 44.190459, -93.996029

Leg Direction	US 14 Eastbound Ramp Eastbound					US 14 Eastbound Ramp Westbound		3rd Avenue Northbound					3rd Avenue Southbound					
Time	L	T	R	**App**	Ped*	**App**	Ped*	T	R	U	**App**	Ped*	L	T	U	**App**	Ped*	**Int**
2022-05-10 4:00PM	27	1	26	**54**	0	**0**	0	69	24	0	**93**	0	66	44	0	**110**	0	**257**
4:15PM	43	0	18	**61**	0	**0**	0	49	21	0	**70**	0	47	41	0	**88**	0	**219**
4:30PM	33	0	12	**45**	0	**0**	0	59	13	0	**72**	0	92	46	0	**138**	0	**255**
4:45PM	25	3	13	**41**	0	**0**	0	36	26	0	**62**	0	59	42	0	**101**	0	**204**
Total	128	4	69	**201**	0	**0**	0	213	84	0	**297**	0	264	173	0	**437**	0	**935**
% Approach	63.7%	2.0%	34.3%	**-**	-	**-**	-	71.7%	28.3%	0%	**-**	-	60.4%	39.6%	0%	**-**	-	-
% Total	13.7%	0.4%	7.4%	**21.5%**	-	**0%**	-	22.8%	9.0%	0%	**31.8%**	-	28.2%	18.5%	0%	**46.7%**	-	-
PHF	0.744	0.333	0.663	**0.824**	-	**-**	-	0.772	0.808	-	**0.798**	-	0.717	0.940	-	**0.792**	-	0.910
Motorcycles	0	0	1	**1**	-	**0**	-	2	0	0	**2**	-	1	2	0	**3**	-	6
% Motorcycles	0%	0%	1.4%	**0.5%**	-	**-**	-	0.9%	0%	0%	**0.7%**	-	0.4%	1.2%	0%	**0.7%**	-	0.6%
Lights	84	4	53	**141**	-	**0**	-	190	68	0	**258**	-	232	147	0	**379**	-	778
% Lights	65.6%	100%	76.8%	**70.1%**	-	**-**	-	89.2%	81.0%	0%	**86.9%**	-	87.9%	85.0%	0%	**86.7%**	-	83.2%
Single-Unit Trucks	29	0	1	**30**	-	**0**	-	7	11	0	**18**	-	17	18	0	**35**	-	83
% Single-Unit Trucks	22.7%	0%	1.4%	**14.9%**	-	**-**	-	3.3%	13.1%	0%	**6.1%**	-	6.4%	10.4%	0%	**8.0%**	-	8.9%
Articulated Trucks	15	0	14	**29**	-	**0**	-	14	5	0	**19**	-	14	4	0	**18**	-	66
% Articulated Trucks	11.7%	0%	20.3%	**14.4%**	-	**-**	-	6.6%	6.0%	0%	**6.4%**	-	5.3%	2.3%	0%	**4.1%**	-	7.1%
Buses	0	0	0	**0**	-	**0**	-	0	0	0	**0**	-	0	2	0	**2**	-	2
% Buses	0%	0%	0%	**0%**	-	**-**	-	0%	0%	0%	**0%**	-	0%	1.2%	0%	**0.5%**	-	0.2%
Pedestrians	-	-	-	-	0	-	0	-	-	-	-	0	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	-	-	-	0	-	0	-	-	-	-	0	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

3rd Avenue & US 14 Eastbound Ramp - 13 Hour ... - TMC
Tue May 10, 2022
PM Peak (4 PM - 5 PM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950916, Location: 44.190459, -93.996029

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US



3rd Avenue & US 14 Westbound Ramp - 13 Hour... - TMC

Tue May 10, 2022
Full Length (6 AM-7 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950905, Location: 44.191788, -93.996376

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US

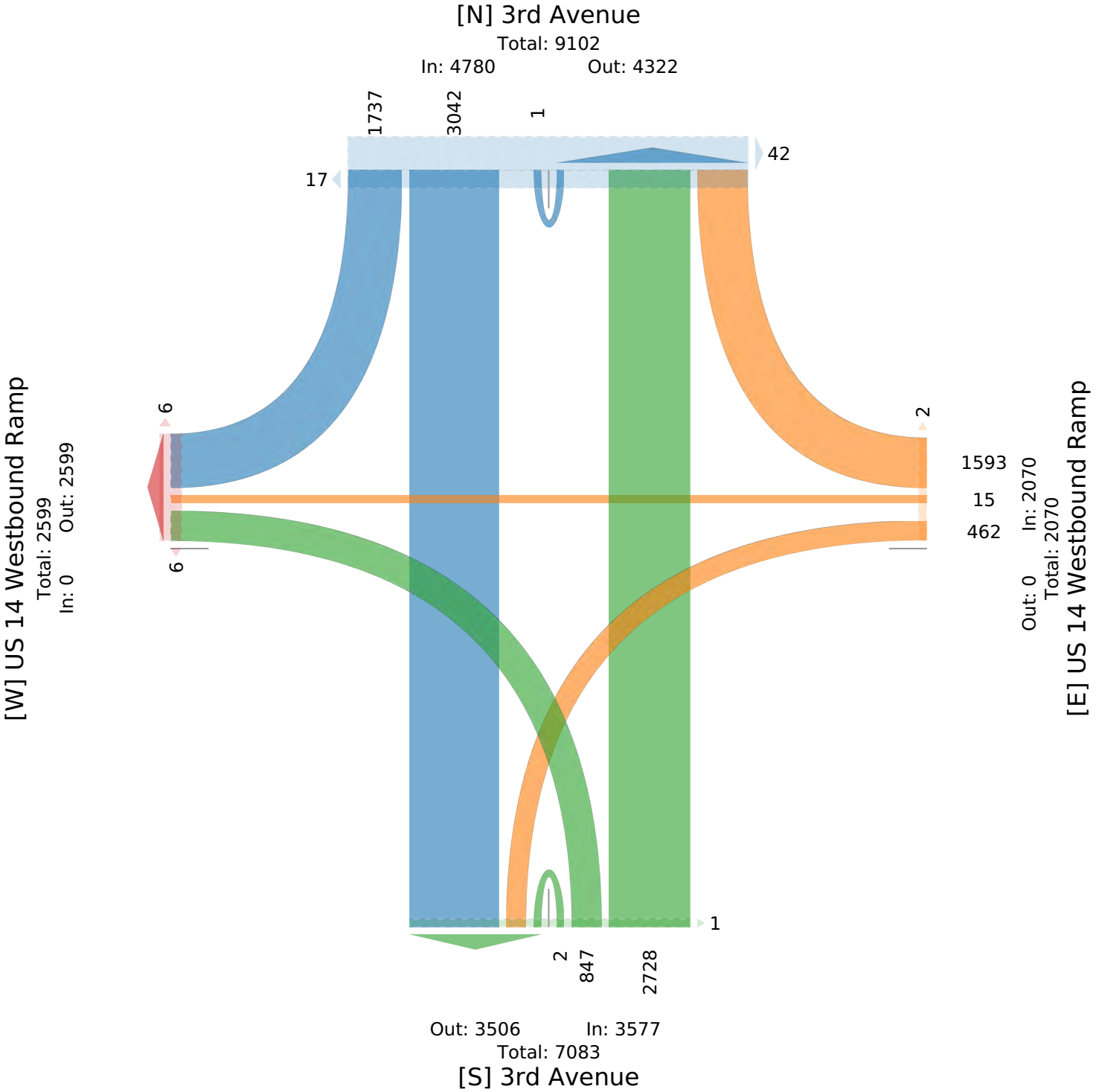
Leg / Direction	US 14 Westbound Ramp Eastbound		US 14 Westbound Ramp Westbound					3rd Avenue Northbound					3rd Avenue Southbound					
Time	**App**	Ped*	L	T	R	**App**	Ped*	L	T	U	**App**	Ped*	T	R	U	**App**	Ped*	**Int**
2022-05-10 6:00AM	**0**	0	6	0	23	**29**	0	12	35	0	**47**	0	17	14	0	**31**	1	**107**
6:15AM	**0**	0	16	0	48	**64**	0	4	36	0	**40**	0	20	16	0	**36**	1	**140**
6:30AM	**0**	1	19	0	52	**71**	1	6	48	0	**54**	0	23	23	0	**46**	0	**171**
6:45AM	**0**	0	18	0	61	**79**	0	12	86	0	**98**	0	33	30	0	**63**	0	**240**
Hourly Total	**0**	1	59	0	184	**243**	1	34	205	0	**239**	0	93	83	0	**176**	2	**658**
7:00AM	**0**	0	6	0	29	**35**	0	14	46	0	**60**	0	43	25	0	**68**	1	**163**
7:15AM	**0**	0	6	0	37	**43**	0	15	59	0	**74**	0	34	27	0	**61**	1	**178**
7:30AM	**0**	0	17	0	37	**54**	0	11	71	0	**82**	0	47	37	0	**84**	0	**220**
7:45AM	**0**	0	11	0	42	**53**	0	20	70	0	**90**	0	56	24	0	**80**	0	**223**
Hourly Total	**0**	0	40	0	145	**185**	0	60	246	0	**306**	0	180	113	0	**293**	2	**784**
8:00AM	**0**	0	8	0	40	**48**	0	22	69	0	**91**	0	52	33	0	**85**	0	**224**
8:15AM	**0**	0	6	2	30	**38**	0	10	59	0	**69**	0	57	37	0	**94**	0	**201**
8:30AM	**0**	0	4	1	38	**43**	0	14	61	0	**75**	0	51	28	0	**79**	0	**197**
8:45AM	**0**	0	7	0	31	**38**	0	17	46	0	**63**	0	59	42	0	**101**	0	**202**
Hourly Total	**0**	0	25	3	139	**167**	0	63	235	0	**298**	0	219	140	0	**359**	0	**824**
9:00AM	**0**	0	7	1	24	**32**	0	21	36	0	**57**	0	32	33	0	**65**	2	**154**
9:15AM	**0**	0	3	0	14	**17**	0	9	40	0	**49**	0	45	28	0	**73**	0	**139**
9:30AM	**0**	0	8	0	20	**28**	0	13	48	0	**61**	0	38	33	0	**71**	0	**160**
9:45AM	**0**	0	11	0	20	**31**	0	9	47	0	**56**	0	44	21	0	**65**	3	**152**
Hourly Total	**0**	0	29	1	78	**108**	0	52	171	0	**223**	0	159	115	0	**274**	5	**605**
10:00AM	**0**	0	6	0	33	**39**	0	14	46	0	**60**	0	37	29	0	**66**	0	**165**
10:15AM	**0**	0	12	1	24	**37**	0	8	32	0	**40**	0	48	43	0	**91**	0	**168**
10:30AM	**0**	0	13	0	27	**40**	0	20	53	0	**73**	0	47	27	0	**74**	0	**187**
10:45AM	**0**	0	7	0	23	**30**	0	12	37	0	**49**	0	46	29	0	**75**	0	**154**
Hourly Total	**0**	0	38	1	107	**146**	0	54	168	0	**222**	0	178	128	0	**306**	0	**674**
11:00AM	**0**	0	9	0	32	**41**	0	17	42	0	**59**	0	50	28	0	**78**	0	**178**
11:15AM	**0**	0	8	0	28	**36**	0	8	55	0	**63**	0	61	32	0	**93**	0	**192**
11:30AM	**0**	0	12	0	32	**44**	0	17	67	0	**84**	0	58	35	0	**93**	0	**221**
11:45AM	**0**	0	6	0	42	**48**	0	16	76	0	**92**	0	77	42	0	**119**	0	**259**
Hourly Total	**0**	0	35	0	134	**169**	0	58	240	0	**298**	0	246	137	0	**383**	0	**850**
12:00PM	**0**	0	9	0	46	**55**	0	27	47	0	**74**	0	96	40	0	**136**	0	**265**
12:15PM	**0**	0	8	0	34	**42**	0	24	58	0	**82**	0	58	34	0	**92**	1	**216**
12:30PM	**0**	0	8	0	34	**42**	0	20	63	0	**83**	0	57	24	1	**82**	1	**207**
12:45PM	**0**	0	13	0	42	**55**	0	15	57	0	**72**	0	63	23	0	**86**	0	**213**
Hourly Total	**0**	0	38	0	156	**194**	0	86	225	0	**311**	0	274	121	1	**396**	2	**901**
1:00PM	**0**	0	12	0	36	**48**	0	17	68	0	**85**	0	57	23	0	**80**	0	**213**
1:15PM	**0**	0	9	0	43	**52**	0	9	73	0	**82**	0	64	35	0	**99**	0	**233**
1:30PM	**0**	0	9	0	32	**41**	0	12	52	0	**64**	0	71	32	0	**103**	1	**208**
1:45PM	**0**	0	8	1	37	**46**	0	18	59	0	**77**	0	64	35	0	**99**	0	**222**
Hourly Total	**0**	0	38	1	148	**187**	0	56	252	0	**308**	0	256	125	0	**381**	1	**876**
2:00PM	**0**	0	7	1	34	**42**	0	10	59	0	**69**	0	67	36	0	**103**	0	**214**
2:15PM	**0**	0	7	0	30	**37**	0	11	63	0	**74**	0	51	45	0	**96**	1	**207**
2:30PM	**0**	2	12	1	25	**38**	0	18	58	0	**76**	0	68	44	0	**112**	1	**226**
2:45PM	**0**	0	8	1	26	**35**	0	11	69	1	**81**	0	59	35	0	**94**	0	**210**
Hourly Total	**0**	2	34	3	115	**152**	0	50	249	1	**300**	0	245	160	0	**405**	2	**857**
3:00PM	**0**	0	12	0	27	**39**	0	26	54	0	**80**	0	95	51	0	**146**	2	**265**
3:15PM	**0**	0	3	0	31	**34**	1	12	72	1	**85**	0	70	47	0	**117**	6	**236**
3:30PM	**0**	0	6	2	34	**42**	0	17	65	0	**82**	0	83	47	0	**130**	1	**254**
3:45PM	**0**	5	9	0	46	**55**	0	20	62	0	**82**	1	71	43	0	**114**	1	**251**
Hourly Total	**0**	5	30	2	138	**170**	1	75	253	1	**329**	1	319	188	0	**507**	10	**1006**
4:00PM	**0**	0	8	0	33	**41**	0	35	62	0	**97**	0	104	44	0	**148**	0	**286**
4:15PM	**0**	0	11	1	19	**31**	0	24	71	0	**95**	0	77	36	0	**113**	1	**239**
4:30PM	**0**	1	4	0	33	**37**	0	23	65	0	**88**	0	138	70	0	**208**	1	**333**

Leg	US 14 Westbound Ramp		US 14 Westbound Ramp					3rd Avenue					3rd Avenue					
Direction	Eastbound		Westbound					Northbound					Southbound					
Time	**App**	Ped*	L	T	R	**App**	Ped*	L	T	U	**App**	Ped*	T	R	U	**App**	Ped*	**Int**
4:45PM	**0**	0	14	0	29	**43**	0	23	42	0	**65**	0	85	50	0	**135**	2	**243**
Hourly Total	**0**	1	37	1	114	**152**	0	105	240	0	**345**	0	404	200	0	**604**	4	**1101**
5:00PM	**0**	0	10	0	26	**36**	0	35	40	0	**75**	0	101	45	0	**146**	4	**257**
5:15PM	**0**	0	8	1	31	**40**	0	12	41	0	**53**	0	69	30	0	**99**	5	**192**
5:30PM	**0**	0	9	0	20	**29**	0	22	32	0	**54**	0	84	44	0	**128**	0	**211**
5:45PM	**0**	0	9	1	13	**23**	0	16	33	0	**49**	0	69	26	0	**95**	11	**167**
Hourly Total	**0**	0	36	2	90	**128**	0	85	146	0	**231**	0	323	145	0	**468**	20	**827**
6:00PM	**0**	0	3	0	11	**14**	0	23	34	0	**57**	0	61	40	0	**101**	2	**172**
6:15PM	**0**	3	6	0	13	**19**	0	16	15	0	**31**	0	37	17	0	**54**	3	**104**
6:30PM	**0**	0	9	1	12	**22**	0	19	19	0	**38**	0	23	17	0	**40**	0	**100**
6:45PM	**0**	0	5	0	9	**14**	0	11	30	0	**41**	0	25	8	0	**33**	6	**88**
Hourly Total	**0**	3	23	1	45	**69**	0	69	98	0	**167**	0	146	82	0	**228**	11	**464**
Total	**0**	12	462	15	1593	**2070**	2	847	2728	2	**3577**	1	3042	1737	1	**4780**	59	**10427**
% Approach	**-**	-	22.3%	0.7%	77.0%	**-**	-	23.7%	76.3%	0.1%	**-**	-	63.6%	36.3%	0%	**-**	-	-
% Total	**0%**	-	4.4%	0.1%	15.3%	**19.9%**	-	8.1%	26.2%	0%	**34.3%**	-	29.2%	16.7%	0%	**45.8%**	-	-
Motorcycles	**0**	-	4	1	14	**19**	-	5	42	0	**47**	-	38	10	0	**48**	-	114
% Motorcycles	**-**	-	0.9%	6.7%	0.9%	**0.9%**	-	0.6%	1.5%	0%	**1.3%**	-	1.2%	0.6%	0%	**1.0%**	-	1.1%
Lights	**0**	-	368	14	1355	**1737**	-	656	2104	2	**2762**	-	2615	1267	1	**3883**	-	8382
% Lights	**-**	-	79.7%	93.3%	85.1%	**83.9%**	-	77.4%	77.1%	100%	**77.2%**	-	86.0%	72.9%	100%	**81.2%**	-	80.4%
Single-Unit Trucks	**0**	-	62	0	179	**241**	-	38	375	0	**413**	-	247	257	0	**504**	-	1158
% Single-Unit Trucks	**-**	-	13.4%	0%	11.2%	**11.6%**	-	4.5%	13.7%	0%	**11.5%**	-	8.1%	14.8%	0%	**10.5%**	-	11.1%
Articulated Trucks	**0**	-	26	0	43	**69**	-	147	204	0	**351**	-	136	200	0	**336**	-	756
% Articulated Trucks	**-**	-	5.6%	0%	2.7%	**3.3%**	-	17.4%	7.5%	0%	**9.8%**	-	4.5%	11.5%	0%	**7.0%**	-	7.3%
Buses	**0**	-	2	0	2	**4**	-	1	3	0	**4**	-	6	3	0	**9**	-	17
% Buses	**-**	-	0.4%	0%	0.1%	**0.2%**	-	0.1%	0.1%	0%	**0.1%**	-	0.2%	0.2%	0%	**0.2%**	-	0.2%
Pedestrians	-	7	-	-	-	-	1	-	-	-	-	1	-	-	-	-	5	
% Pedestrians	-	58.3%	-	-	-	-	50.0%	-	-	-	-	100%	-	-	-	-	8.5%	-
Bicycles on Crosswalk	-	5	-	-	-	-	1	-	-	-	-	0	-	-	-	-	54	
% Bicycles on Crosswalk	-	41.7%	-	-	-	-	50.0%	-	-	-	-	0%	-	-	-	-	91.5%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

3rd Avenue & US 14 Westbound Ramp - 13 Hour... - TMC
Tue May 10, 2022
Full Length (6 AM-7 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950905, Location: 44.191788, -93.996376

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US



3rd Avenue & US 14 Westbound Ramp - 13 Hour... - TMC

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US

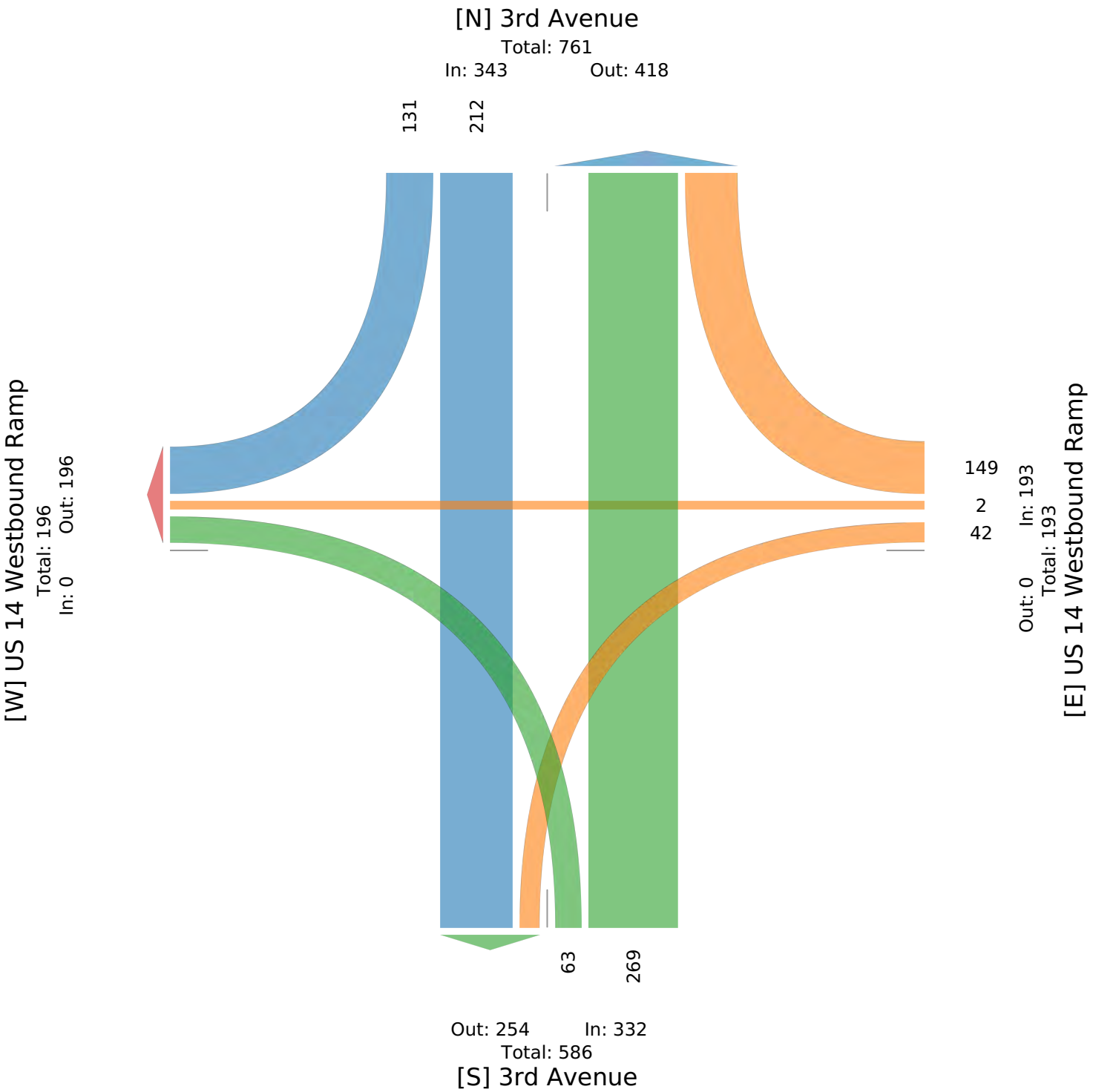
Tue May 10, 2022
AM Peak (7:30 AM - 8:30 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950905, Location: 44.191788, -93.996376

Leg Direction	US 14 Westbound Ramp Eastbound		US 14 Westbound Ramp Westbound					3rd Avenue Northbound					3rd Avenue Southbound					
Time	**App**	Ped*	L	T	R	**App**	Ped*	L	T	U	**App**	Ped*	T	R	U	**App**	Ped*	**Int**
2022-05-10 7:30AM	**0**	0	17	0	37	**54**	0	11	71	0	**82**	0	47	37	0	**84**	0	**220**
7:45AM	**0**	0	11	0	42	**53**	0	20	70	0	**90**	0	56	24	0	**80**	0	**223**
8:00AM	**0**	0	8	0	40	**48**	0	22	69	0	**91**	0	52	33	0	**85**	0	**224**
8:15AM	**0**	0	6	2	30	**38**	0	10	59	0	**69**	0	57	37	0	**94**	0	**201**
Total	**0**	0	42	2	149	**193**	0	63	269	0	**332**	0	212	131	0	**343**	0	**868**
% Approach	**-**	-	21.8%	1.0%	77.2%	**-**	-	19.0%	81.0%	0%	**-**	-	61.8%	38.2%	0%	**-**	-	-
% Total	**0%**	-	4.8%	0.2%	17.2%	**22.2%**	-	7.3%	31.0%	0%	**38.2%**	-	24.4%	15.1%	0%	**39.5%**	-	-
PHF	**-**	-	0.618	0.250	0.887	**0.894**	-	0.716	0.947	-	**0.912**	-	0.930	0.885	-	**0.912**	-	0.969
Motorcycles	**0**	-	0	0	0	**0**	-	0	2	0	**2**	-	1	0	0	**1**	-	3
% Motorcycles	**-**	-	0%	0%	0%	**0%**	-	0%	0.7%	0%	**0.6%**	-	0.5%	0%	0%	**0.3%**	-	0.3%
Lights	**0**	-	37	2	132	**171**	-	38	230	0	**268**	-	175	78	0	**253**	-	692
% Lights	**-**	-	88.1%	100%	88.6%	**88.6%**	-	60.3%	85.5%	0%	**80.7%**	-	82.5%	59.5%	0%	**73.8%**	-	79.7%
Single-Unit Trucks	**0**	-	2	0	15	**17**	-	3	22	0	**25**	-	25	28	0	**53**	-	95
% Single-Unit Trucks	**-**	-	4.8%	0%	10.1%	**8.8%**	-	4.8%	8.2%	0%	**7.5%**	-	11.8%	21.4%	0%	**15.5%**	-	10.9%
Articulated Trucks	**0**	-	3	0	2	**5**	-	21	14	0	**35**	-	10	23	0	**33**	-	73
% Articulated Trucks	**-**	-	7.1%	0%	1.3%	**2.6%**	-	33.3%	5.2%	0%	**10.5%**	-	4.7%	17.6%	0%	**9.6%**	-	8.4%
Buses	**0**	-	0	0	0	**0**	-	1	1	0	**2**	-	1	2	0	**3**	-	5
% Buses	**-**	-	0%	0%	0%	**0%**	-	1.6%	0.4%	0%	**0.6%**	-	0.5%	1.5%	0%	**0.9%**	-	0.6%
Pedestrians	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicycles on Crosswalk	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

3rd Avenue & US 14 Westbound Ramp - 13 Hour... - TMC
Tue May 10, 2022
AM Peak (7:30 AM - 8:30 AM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950905, Location: 44.191788, -93.996376

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US



3rd Avenue & US 14 Westbound Ramp - 13 Hour... - TMC

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US

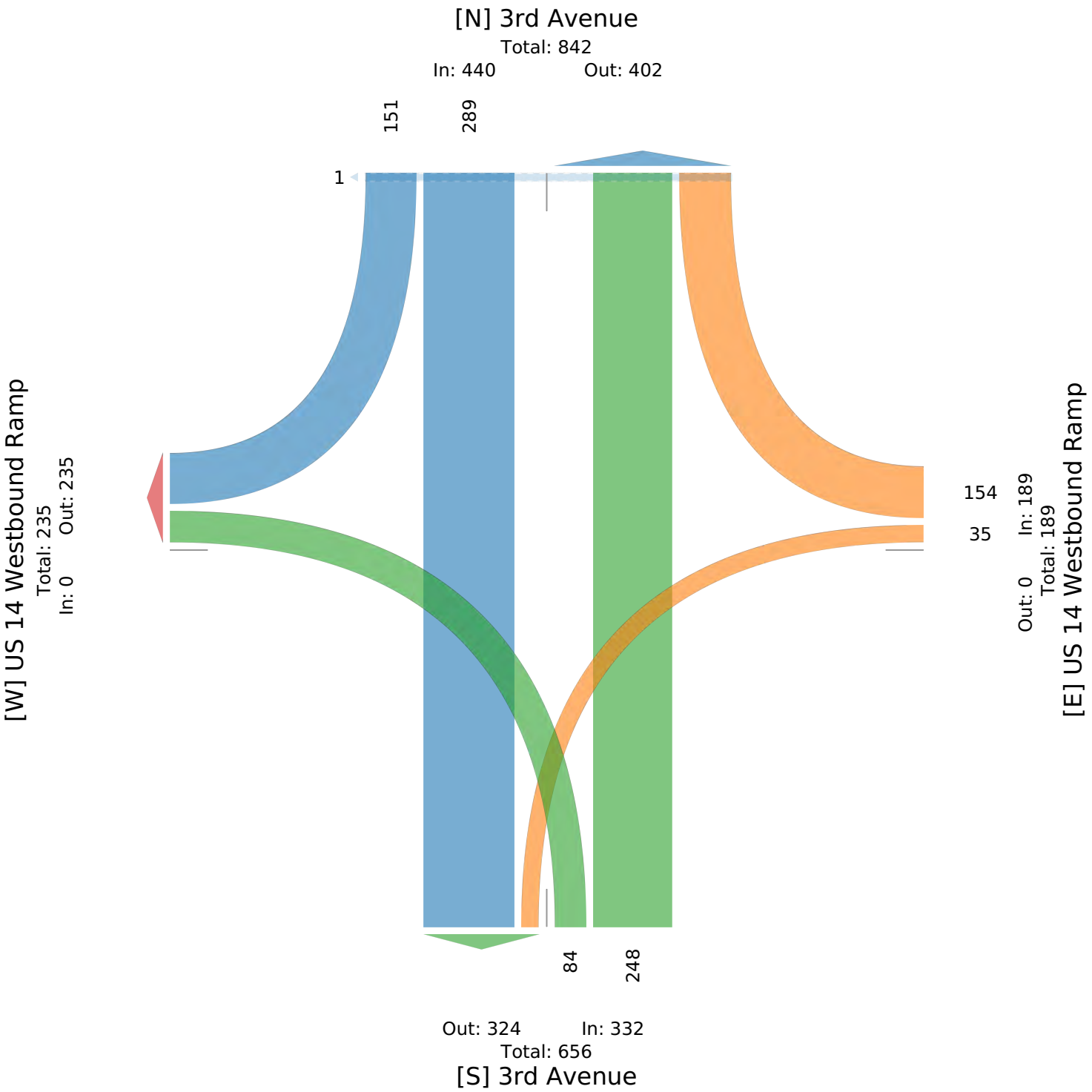
Tue May 10, 2022
Midday Peak (11:30 AM - 12:30 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950905, Location: 44.191788, -93.996376

Leg Direction	US 14 Westbound Ramp Eastbound		US 14 Westbound Ramp Westbound					3rd Avenue Northbound					3rd Avenue Southbound					
Time	**App**	Ped*	L	T	R	**App**	Ped*	L	T	U	**App**	Ped*	T	R	U	**App**	Ped*	**Int**
2022-05-10 11:30AM	**0**	0	12	0	32	**44**	0	17	67	0	**84**	0	58	35	0	**93**	0	**221**
11:45AM	**0**	0	6	0	42	**48**	0	16	76	0	**92**	0	77	42	0	**119**	0	**259**
12:00PM	**0**	0	9	0	46	**55**	0	27	47	0	**74**	0	96	40	0	**136**	0	**265**
12:15PM	**0**	0	8	0	34	**42**	0	24	58	0	**82**	0	58	34	0	**92**	1	**216**
Total	**0**	0	35	0	154	**189**	0	84	248	0	**332**	0	289	151	0	**440**	1	**961**
% Approach	**-**	-	18.5%	0%	81.5%	**-**	-	25.3%	74.7%	0%	**-**	-	65.7%	34.3%	0%	**-**	-	-
% Total	**0%**	-	3.6%	0%	16.0%	**19.7%**	-	8.7%	25.8%	0%	**34.5%**	-	30.1%	15.7%	0%	**45.8%**	-	-
PHF	**-**	-	0.729	-	0.837	**0.859**	-	0.778	0.816	-	**0.902**	-	0.753	0.899	-	**0.809**	-	0.907
Motorcycles	**0**	-	0	0	0	**0**	-	0	1	0	**1**	-	1	1	0	**2**	-	3
% Motorcycles	**-**	-	0%	0%	0%	**0%**	-	0%	0.4%	0%	**0.3%**	-	0.3%	0.7%	0%	**0.5%**	-	0.3%
Lights	**0**	-	27	0	133	**160**	-	65	200	0	**265**	-	247	109	0	**356**	-	781
% Lights	**-**	-	77.1%	0%	86.4%	**84.7%**	-	77.4%	80.6%	0%	**79.8%**	-	85.5%	72.2%	0%	**80.9%**	-	81.3%
Single-Unit Trucks	**0**	-	6	0	18	**24**	-	3	32	0	**35**	-	28	26	0	**54**	-	113
% Single-Unit Trucks	**-**	-	17.1%	0%	11.7%	**12.7%**	-	3.6%	12.9%	0%	**10.5%**	-	9.7%	17.2%	0%	**12.3%**	-	11.8%
Articulated Trucks	**0**	-	2	0	3	**5**	-	16	15	0	**31**	-	13	15	0	**28**	-	64
% Articulated Trucks	**-**	-	5.7%	0%	1.9%	**2.6%**	-	19.0%	6.0%	0%	**9.3%**	-	4.5%	9.9%	0%	**6.4%**	-	6.7%
Buses	**0**	-	0	0	0	**0**	-	0	0	0	**0**	-	0	0	0	**0**	-	0
% Buses	**-**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%	0%	0%	**0%**	-	0%
Pedestrians	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	1	
% Pedestrians	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	100%	-
Bicycles on Crosswalk	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	0	
% Bicycles on Crosswalk	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

3rd Avenue & US 14 Westbound Ramp - 13 Hour... - TMC
Tue May 10, 2022
Midday Peak (11:30 AM - 12:30 PM)
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950905, Location: 44.191788, -93.996376

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US



3rd Avenue & US 14 Westbound Ramp - 13 Hour... - TMC

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US

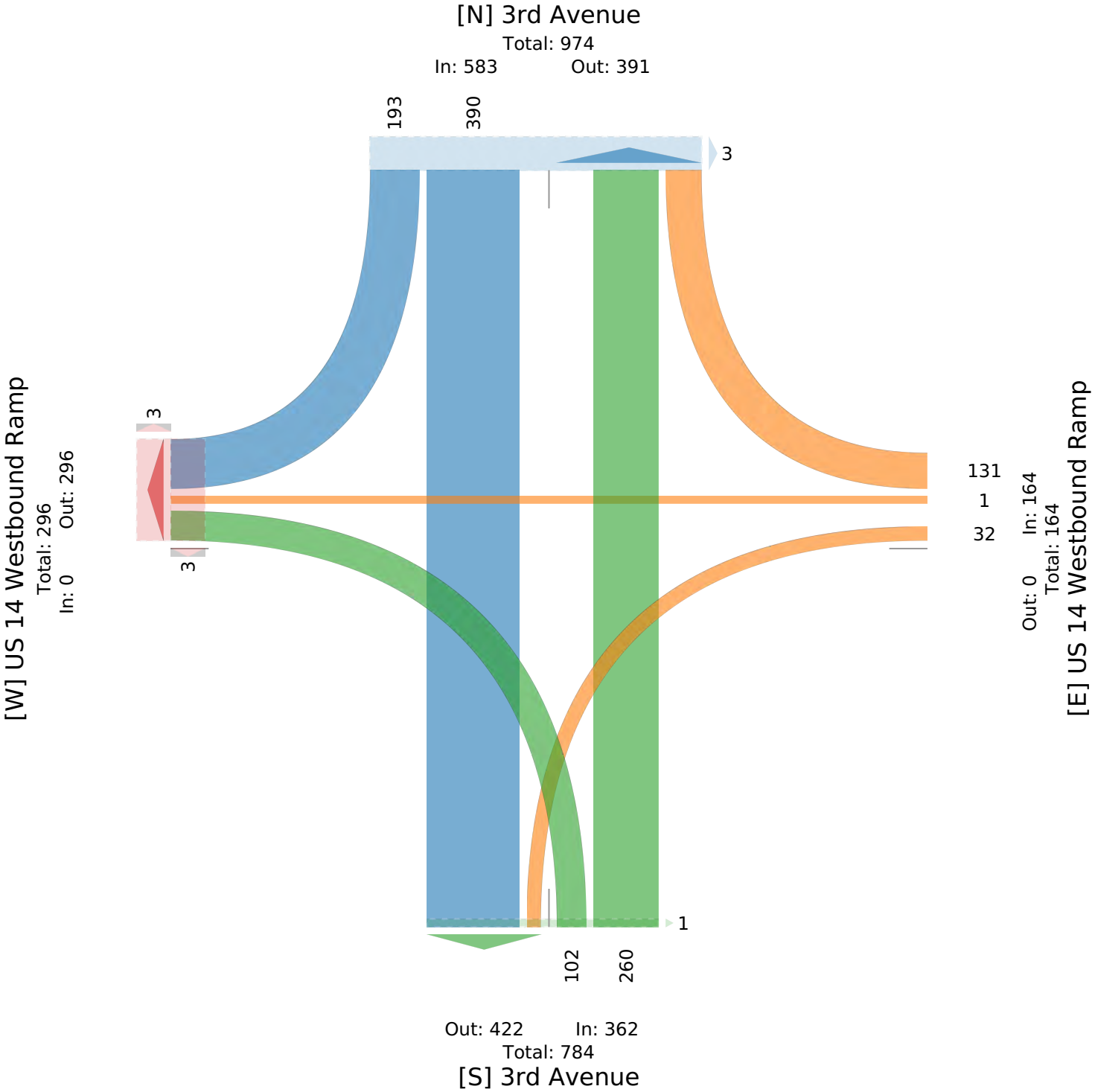
Tue May 10, 2022
PM Peak (3:45 PM - 4:45 PM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950905, Location: 44.191788, -93.996376

Leg Direction	US 14 Westbound Ramp Eastbound		US 14 Westbound Ramp Westbound					3rd Avenue Northbound					3rd Avenue Southbound					
Time	**App**	Ped*	L	T	R	**App**	Ped*	L	T	U	**App**	Ped*	T	R	U	**App**	Ped*	**Int**
2022-05-10 3:45PM	**0**	5	9	0	46	**55**	0	20	62	0	**82**	1	71	43	0	**114**	1	**251**
4:00PM	**0**	0	8	0	33	**41**	0	35	62	0	**97**	0	104	44	0	**148**	0	**286**
4:15PM	**0**	0	11	1	19	**31**	0	24	71	0	**95**	0	77	36	0	**113**	1	**239**
4:30PM	**0**	1	4	0	33	**37**	0	23	65	0	**88**	0	138	70	0	**208**	1	**333**
Total	**0**	6	32	1	131	**164**	0	102	260	0	**362**	1	390	193	0	**583**	3	**1109**
% Approach	**-**	-	19.5%	0.6%	79.9%	**-**	-	28.2%	71.8%	0%	**-**	-	66.9%	33.1%	0%	**-**	-	-
% Total	**0%**	-	2.9%	0.1%	11.8%	**14.8%**	-	9.2%	23.4%	0%	**32.6%**	-	35.2%	17.4%	0%	**52.6%**	-	-
PHF	**-**	-	0.727	0.250	0.712	**0.745**	-	0.729	0.915	-	**0.933**	-	0.707	0.689	-	**0.701**	-	0.833
Motorcycles	**0**	-	0	0	1	**1**	-	0	5	0	**5**	-	4	2	0	**6**	-	12
% Motorcycles	**-**	-	0%	0%	0.8%	**0.6%**	-	0%	1.9%	0%	**1.4%**	-	1.0%	1.0%	0%	**1.0%**	-	1.1%
Lights	**0**	-	21	1	112	**134**	-	93	187	0	**280**	-	352	162	0	**514**	-	928
% Lights	**-**	-	65.6%	100%	85.5%	**81.7%**	-	91.2%	71.9%	0%	**77.3%**	-	90.3%	83.9%	0%	**88.2%**	-	83.7%
Single-Unit Trucks	**0**	-	9	0	14	**23**	-	2	45	0	**47**	-	25	20	0	**45**	-	115
% Single-Unit Trucks	**-**	-	28.1%	0%	10.7%	**14.0%**	-	2.0%	17.3%	0%	**13.0%**	-	6.4%	10.4%	0%	**7.7%**	-	10.4%
Articulated Trucks	**0**	-	2	0	3	**5**	-	7	23	0	**30**	-	8	9	0	**17**	-	52
% Articulated Trucks	**-**	-	6.3%	0%	2.3%	**3.0%**	-	6.9%	8.8%	0%	**8.3%**	-	2.1%	4.7%	0%	**2.9%**	-	4.7%
Buses	**0**	-	0	0	1	**1**	-	0	0	0	**0**	-	1	0	0	**1**	-	2
% Buses	**-**	-	0%	0%	0.8%	**0.6%**	-	0%	0%	0%	**0%**	-	0.3%	0%	0%	**0.2%**	-	0.2%
Pedestrians	-	6	-	-	-	-	0	-	-	-	-	1	-	-	-	-	0	
% Pedestrians	-	100%	-	-	-	-	-	-	-	-	-	100%	-	-	-	-	0%	-
Bicycles on Crosswalk	-	0	-	-	-	-	0	-	-	-	-	0	-	-	-	-	3	
% Bicycles on Crosswalk	-	0%	-	-	-	-	-	-	-	-	-	0%	-	-	-	-	100%	-

*Pedestrians and Bicycles on Crosswalk. L: Left, R: Right, T: Thru, U: U-Turn

3rd Avenue & US 14 Westbound Ramp - 13 Hour... - TMC
Tue May 10, 2022
PM Peak (3:45 PM - 4:45 PM) - Overall Peak Hour
All Classes (Motorcycles, Lights, Single-Unit Trucks, Articulated Trucks, Buses, Pedestrians, Bicycles on Crosswalk)
All Movements
ID: 950905, Location: 44.191788, -93.996376

Provided by: SRF Consulting Group, Inc.
Minneapolis, MN, US



Existing Detailed Operations Analysis

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.2	0.0	0.5	0.7
Total Del/Veh (s)	5.6	1.5	0.9	2.1

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	1.9	0.0	0.0	0.7
Total Del/Veh (s)	8.8	0.4	1.6	3.8

Total Zone Performance

Denied Del/Veh (s)	2.0
Total Del/Veh (s)	459.1

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	SB
Directions Served	LT	R	L	R
Maximum Queue (ft)	86	93	89	23
Average Queue (ft)	31	44	21	2
95th Queue (ft)	66	76	64	13
Link Distance (ft)	1246			
Upstream Blk Time (%)				
Queuing Penalty (veh)				
Storage Bay Dist (ft)		215	325	330
Storage Blk Time (%)				
Queuing Penalty (veh)				

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB
Directions Served	L	TR	T	T	R	L
Maximum Queue (ft)	164	81	7	4	27	80
Average Queue (ft)	65	41	0	0	1	23
95th Queue (ft)	119	70	5	3	12	60
Link Distance (ft)		1131	372	372		
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	310				225	300
Storage Blk Time (%)						
Queuing Penalty (veh)						

Zone Summary

Zone wide Queuing Penalty: 0

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Delay (hr)	0.1	0.0	0.0	0.2
Total Delay (hr)	0.2	0.8	0.7	1.6

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Delay (hr)	0.1	0.0	0.0	0.1
Total Delay (hr)	0.4	0.4	0.6	1.4

Total Zone Performance

Denied Delay (hr)	0.3
Total Delay (hr)	3.0

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	T	T	T	T	R
Maximum Queue (ft)	66	106	83	89	75	101	86	100
Average Queue (ft)	27	51	32	49	44	50	37	45
95th Queue (ft)	58	86	64	75	68	80	74	77
Link Distance (ft)	1246			424	424	1587	1587	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		215	325					330
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	105	88	86	80	77	80	64	86
Average Queue (ft)	54	40	46	38	29	38	33	37
95th Queue (ft)	87	73	76	67	65	63	61	69
Link Distance (ft)		1131	372	372			424	424
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310				225	300		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Zone Summary

Zone wide Queuing Penalty: 0

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.3	0.0	0.5	0.7
Total Del/Veh (s)	5.8	7.0	6.4	6.5

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.0	0.0	0.0	0.7
Total Del/Veh (s)	9.9	10.4	8.7	9.6

Total Zone Performance

Denied Del/Veh (s)	2.1
Total Del/Veh (s)	978.4

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	T	T	T	T	R
Maximum Queue (ft)	75	88	72	89	108	122	79	91
Average Queue (ft)	26	47	30	37	34	50	23	39
95th Queue (ft)	59	79	65	77	80	101	64	78
Link Distance (ft)	1246			424	424	1587	1587	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		215	325					330
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	158	84	109	95	63	118	82	90
Average Queue (ft)	67	35	45	35	21	51	26	31
95th Queue (ft)	125	72	89	71	55	102	61	74
Link Distance (ft)		1131	372	372			424	424
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310				225	300		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Zone Summary

Zone wide Queuing Penalty: 0

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 EB Enter	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 EB Exit	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 EB Enter	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 EB Exit	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2023 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	109	147	0	0	20.0	1.00	0.890
2	TH 14 EB Enter	0	149	2	102	0	20.0	1.00	0.890
3	CSAH 5 NB	0	0	183	35	0	20.0	1.00	0.890
4	TH 14 EB Exit	0	0	0	0	0	20.0	1.00	0.890

Operational Results

2023 AM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	4.27		4.27	0.93		A		A
2	TH 14 EB Enter	None	5.13		5.13	1.14		A		A
3	CSAH 5 NB	None	4.91		4.91	0.93		A		A
4	TH 14 EB Exit	None	0.00		0.00	0.00		A		A

Global Results

Performance and Accidents

2023 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	727		727
Capacity	veh/hr	2624		2624
Average Delay	sec/veh	4.76		4.76
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	0.96		0.96

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 WB Exit	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 WB Enter	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 WB Exit	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 WB Enter	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2023 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	0	214	132	0	20.0	1.00	0.890
2	TH 14 WB Exit	0	0	0	0	0	20.0	1.00	0.890
3	CSAH 5 NB	0	63	269	0	0	20.0	1.00	0.890
4	TH 14 WB Enter	0	42	2	148	0	20.0	1.00	0.890

Operational Results

2023 AM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	5.15		5.15	1.56		A		A
2	TH 14 WB Exit	None	0.00		0.00	0.00		A		A
3	CSAH 5 NB	None	4.66		4.66	1.33		A		A
4	TH 14 WB Enter	None	5.02		5.02	0.85		A		A

Global Results

Performance and Accidents

2023 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	870		870
Capacity	veh/hr	2662		2662
Average Delay	sec/veh	4.94		4.94
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	1.19		1.19

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.3	0.0	0.4	0.6
Total Del/Veh (s)	6.2	3.1	1.2	2.6

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.1	0.0	0.0	0.5
Total Del/Veh (s)	17.8	0.6	2.7	5.7

Total Zone Performance

Denied Del/Veh (s)	2.0
Total Del/Veh (s)	732.2

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	L	T	R
Maximum Queue (ft)	69	105	123	4	31
Average Queue (ft)	23	46	42	0	2
95th Queue (ft)	56	80	91	3	15
Link Distance (ft)	1246			1587	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		215	325		330
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB
Directions Served	L	TR	T	T	R	L
Maximum Queue (ft)	189	75	12	33	36	117
Average Queue (ft)	78	33	1	2	2	43
95th Queue (ft)	154	63	7	14	16	88
Link Distance (ft)		1131	372	372		
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	310				225	300
Storage Blk Time (%)						
Queuing Penalty (veh)						

Zone Summary

Zone wide Queuing Penalty: 0

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Delay (hr)	0.1	0.0	0.1	0.2
Total Delay (hr)	0.2	0.8	1.3	2.3

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Delay (hr)	0.1	0.0	0.0	0.1
Total Delay (hr)	0.4	0.7	1.1	2.2

Total Zone Performance

Denied Delay (hr)	0.3
Total Delay (hr)	4.5

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	T	T	T	T	R
Maximum Queue (ft)	69	84	75	88	79	110	80	92
Average Queue (ft)	24	43	39	47	42	62	44	53
95th Queue (ft)	57	70	66	75	68	95	72	83
Link Distance (ft)	1246			424	424	1587	1587	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		215	325					330
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	103	77	89	96	88	136	71	81
Average Queue (ft)	52	36	48	39	37	57	32	41
95th Queue (ft)	90	65	76	74	70	101	57	69
Link Distance (ft)		1131	372	372			424	424
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310				225	300		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Zone Summary

Zone wide Queuing Penalty: 0

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.4	0.0	0.4	0.6
Total Del/Veh (s)	6.1	6.6	7.4	7.0

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.1	0.0	0.0	0.5
Total Del/Veh (s)	12.4	11.0	9.1	10.5

Total Zone Performance

Denied Del/Veh (s)	2.0
Total Del/Veh (s)	1024.3

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	T	T	T	T	R
Maximum Queue (ft)	60	95	109	73	90	163	125	124
Average Queue (ft)	20	44	46	27	27	72	35	45
95th Queue (ft)	55	77	86	64	68	130	85	87
Link Distance (ft)	1246			424	424	1587	1587	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		215	325					330
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	148	76	148	113	87	190	65	105
Average Queue (ft)	68	30	58	39	35	79	19	33
95th Queue (ft)	121	65	111	87	73	143	50	84
Link Distance (ft)		1131	372	372			424	424
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310				225	300		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Zone Summary

Zone wide Queuing Penalty: 0

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 EB Enter	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 EB Exit	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 EB Enter	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 EB Exit	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2023 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	245	173	0	0	15.0	1.00	0.890
2	TH 14 EB Enter	0	142	1	77	0	15.0	1.00	0.890
3	CSAH 5 NB	0	0	220	76	0	15.0	1.00	0.890
4	TH 14 EB Exit	0	0	0	0	0	15.0	1.00	0.890

Operational Results

2023 PM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	4.87		4.87	1.77		A		A
2	TH 14 EB Enter	None	5.22		5.22	1.02		A		A
3	CSAH 5 NB	None	5.67		5.67	1.51		A		A
4	TH 14 EB Exit	None	0.00		0.00	0.00		A		A

Global Results

Performance and Accidents

2023 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	934		934
Capacity	veh/hr	2718		2718
Average Delay	sec/veh	5.21		5.21
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	1.35		1.35

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 WB Exit	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 WB Enter	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 WB Exit	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 WB Enter	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2023 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	0	386	192	0	15.0	1.00	0.890
2	TH 14 WB Exit	0	0	0	0	0	15.0	1.00	0.890
3	CSAH 5 NB	0	102	260	0	0	15.0	1.00	0.890
4	TH 14 WB Enter	0	32	1	130	0	15.0	1.00	0.890

Operational Results

2023 PM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	7.04		7.04	3.74		A		A
2	TH 14 WB Exit	None	0.00		0.00	0.00		A		A
3	CSAH 5 NB	None	4.55		4.55	1.42		A		A
4	TH 14 WB Enter	None	4.65		4.65	0.66		A		A

Global Results

Performance and Accidents

2023 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1103		1103
Capacity	veh/hr	2878		2878
Average Delay	sec/veh	5.87		5.87
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	1.80		1.80

Forecast Year 2035 Detailed Operations Analysis

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 EB Enter	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 EB Exit	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 EB Enter	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 EB Exit	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2035 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	122	165	0	0	20.0	1.00	0.890
2	TH 14 EB Enter	0	167	2	115	0	20.0	1.00	0.890
3	CSAH 5 NB	0	0	206	39	0	20.0	1.00	0.890
4	TH 14 EB Exit	0	0	0	0	0	20.0	1.00	0.890

Operational Results

2035 AM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	4.42		4.42	1.08		A		A
2	TH 14 EB Enter	None	5.49		5.49	1.38		A		A
3	CSAH 5 NB	None	5.22		5.22	1.13		A		A
4	TH 14 EB Exit	None	0.00		0.00	0.00		A		A

Global Results

Performance and Accidents

2035 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	816		816
Capacity	veh/hr	2593		2593
Average Delay	sec/veh	5.03		5.03
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	1.14		1.14

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 EB Enter	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 EB Exit	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 EB Enter	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 EB Exit	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2035 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	275	194	0	0	15.0	1.00	0.890
2	TH 14 EB Enter	0	160	1	87	0	15.0	1.00	0.890
3	CSAH 5 NB	0	0	247	85	0	15.0	1.00	0.890
4	TH 14 EB Exit	0	0	0	0	0	15.0	1.00	0.890

Operational Results

2035 PM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	5.21		5.21	2.14		A		A
2	TH 14 EB Enter	None	5.68		5.68	1.27		A		A
3	CSAH 5 NB	None	6.28		6.28	1.91		A		A
4	TH 14 EB Exit	None	0.00		0.00	0.00		A		A

Global Results

Performance and Accidents

2035 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1049		1049
Capacity	veh/hr	2666		2666
Average Delay	sec/veh	5.66		5.66
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	1.65		1.65

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 WB Exit	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 WB Enter	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 WB Exit	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 WB Enter	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2035 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	0	240	148	0	20.0	1.00	0.890
2	TH 14 WB Exit	0	0	0	0	0	20.0	1.00	0.890
3	CSAH 5 NB	0	71	302	0	0	20.0	1.00	0.890
4	TH 14 WB Enter	0	47	2	166	0	20.0	1.00	0.890

Operational Results

2035 AM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	5.52		5.52	1.89		A		A
2	TH 14 WB Exit	None	0.00		0.00	0.00		A		A
3	CSAH 5 NB	None	4.91		4.91	1.58		A		A
4	TH 14 WB Enter	None	5.36		5.36	1.02		A		A

Global Results

Performance and Accidents

2035 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	976		976
Capacity	veh/hr	2635		2635
Average Delay	sec/veh	5.25		5.25
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	1.42		1.42

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 WB Exit	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 WB Enter	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 WB Exit	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 WB Enter	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2035 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	0	434	216	0	15.0	1.00	0.890
2	TH 14 WB Exit	0	0	0	0	0	15.0	1.00	0.890
3	CSAH 5 NB	0	115	292	0	0	15.0	1.00	0.890
4	TH 14 WB Enter	0	36	1	146	0	15.0	1.00	0.890

Operational Results

2035 PM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	8.32		8.32	5.12		A		A
2	TH 14 WB Exit	None	0.00		0.00	0.00		A		A
3	CSAH 5 NB	None	4.81		4.81	1.70		A		A
4	TH 14 WB Enter	None	4.93		4.93	0.80		A		A

Global Results

Performance and Accidents

2035 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1240		1240
Capacity	veh/hr	2846		2846
Average Delay	sec/veh	6.67		6.67
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	2.30		2.30

Forecast Year 2045 Detailed Operations Analysis

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.3	0.0	0.4	0.7
Total Del/Veh (s)	7.0	1.7	1.0	2.7

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.0	0.0	0.0	0.7
Total Del/Veh (s)	12.1	0.6	1.9	5.1

Total Zone Performance

Denied Del/Veh (s)	2.0
Total Del/Veh (s)	614.7

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	L	T	R
Maximum Queue (ft)	98	107	101	6	17
Average Queue (ft)	35	54	25	0	2
95th Queue (ft)	75	91	68	4	11
Link Distance (ft)	1246			1587	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		215	325		330
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	219	91	9	20	17	82	11	12
Average Queue (ft)	84	45	0	1	1	29	0	0
95th Queue (ft)	166	76	7	10	8	66	5	7
Link Distance (ft)		1131	372	372			424	424
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310				225	300		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Zone Summary

Zone wide Queuing Penalty: 0

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.3	0.0	0.4	0.7
Total Del/Veh (s)	7.0	1.7	1.0	2.7

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.0	0.0	0.0	0.7
Total Del/Veh (s)	12.1	0.6	1.9	5.1

Total Zone Performance

Denied Del/Veh (s)	2.0
Total Del/Veh (s)	614.7

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	L	T	R
Maximum Queue (ft)	98	107	101	6	17
Average Queue (ft)	35	54	25	0	2
95th Queue (ft)	75	91	68	4	11
Link Distance (ft)	1246			1587	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		215	325		330
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	219	91	9	20	17	82	11	12
Average Queue (ft)	84	45	0	1	1	29	0	0
95th Queue (ft)	166	76	7	10	8	66	5	7
Link Distance (ft)		1131	372	372			424	424
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310				225	300		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Zone Summary

Zone wide Queuing Penalty: 0

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.2	0.0	0.4	0.6
Total Del/Veh (s)	6.7	7.7	7.0	7.2

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.0	0.0	0.0	0.7
Total Del/Veh (s)	10.6	11.5	9.0	10.3

Total Zone Performance

Denied Del/Veh (s)	2.0
Total Del/Veh (s)	1054.4

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	T	T	T	T	R
Maximum Queue (ft)	79	140	98	102	118	134	96	110
Average Queue (ft)	31	53	38	46	40	52	31	45
95th Queue (ft)	66	101	76	86	89	104	73	87
Link Distance (ft)	1246			424	424	1587	1587	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		215	325					330
Storage Blk Time (%)		0						
Queuing Penalty (veh)		0						

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	177	103	136	100	78	131	94	110
Average Queue (ft)	87	39	57	41	23	51	31	36
95th Queue (ft)	148	79	112	78	61	101	73	85
Link Distance (ft)		1131	372	372			424	424
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310				225	300		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Zone Summary

Zone wide Queuing Penalty: 0

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 EB Enter	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 EB Exit	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 EB Enter	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 EB Exit	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2045 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	134	181	0	0	20.0	1.00	0.890
2	TH 14 EB Enter	0	183	2	125	0	20.0	1.00	0.890
3	CSAH 5 NB	0	0	225	43	0	20.0	1.00	0.890
4	TH 14 EB Exit	0	0	0	0	0	20.0	1.00	0.890

Operational Results

2045 AM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	4.57		4.57	1.23		A		A
2	TH 14 EB Enter	None	5.85		5.85	1.62		A		A
3	CSAH 5 NB	None	5.52		5.52	1.31		A		A
4	TH 14 EB Exit	None	0.00		0.00	0.00		A		A

Global Results

Performance and Accidents

2045 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	893		893
Capacity	veh/hr	2565		2565
Average Delay	sec/veh	5.30		5.30
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	1.31		1.31

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 WB Exit	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 WB Enter	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 WB Exit	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 WB Enter	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2045 AM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	0	263	160	0	20.0	1.00	0.890
2	TH 14 WB Exit	0	0	0	0	0	20.0	1.00	0.890
3	CSAH 5 NB	0	77	331	0	0	20.0	1.00	0.890
4	TH 14 WB Enter	0	52	2	181	0	20.0	1.00	0.890

Operational Results

2045 AM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	5.87		5.87	2.21		A		A
2	TH 14 WB Exit	None	0.00		0.00	0.00		A		A
3	CSAH 5 NB	None	5.14		5.14	1.82		A		A
4	TH 14 WB Enter	None	5.68		5.68	1.19		A		A

Global Results

Performance and Accidents

2045 AM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1066		1066
Capacity	veh/hr	2612		2612
Average Delay	sec/veh	5.55		5.55
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	1.64		1.64

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.3	0.0	0.4	0.6
Total Del/Veh (s)	9.2	3.4	1.5	3.4

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.2	0.0	0.0	0.5
Total Del/Veh (s)	78.1	0.8	3.9	21.4

Total Zone Performance

Denied Del/Veh (s)	2.1
Total Del/Veh (s)	1275.9

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	SB	SB
Directions Served	LT	R	L	T	R
Maximum Queue (ft)	108	117	112	8	45
Average Queue (ft)	36	51	49	0	6
95th Queue (ft)	84	90	89	6	25
Link Distance (ft)	1246			1587	
Upstream Blk Time (%)					
Queuing Penalty (veh)					
Storage Bay Dist (ft)		215	325		330
Storage Blk Time (%)					
Queuing Penalty (veh)					

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB
Directions Served	L	TR	T	T	R	L
Maximum Queue (ft)	394	498	22	22	46	166
Average Queue (ft)	196	127	1	1	5	68
95th Queue (ft)	396	509	8	10	25	134
Link Distance (ft)		1131	372	372		
Upstream Blk Time (%)						
Queuing Penalty (veh)						
Storage Bay Dist (ft)	310				225	300
Storage Blk Time (%)	16	0				
Queuing Penalty (veh)	16	0				

Zone Summary

Zone wide Queuing Penalty: 16

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.3	0.0	0.4	0.5
Total Del/Veh (s)	4.8	8.4	9.5	8.4

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.2	0.0	0.0	0.5
Total Del/Veh (s)	8.8	9.4	13.6	11.1

Total Zone Performance

Denied Del/Veh (s)	2.1
Total Del/Veh (s)	1276.3

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	T	T	T	T	R
Maximum Queue (ft)	67	100	89	77	75	150	90	114
Average Queue (ft)	26	50	42	47	47	74	50	62
95th Queue (ft)	56	82	71	72	70	120	77	98
Link Distance (ft)	1246			424	424	1587	1587	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		215	325					330
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	153	96	113	101	96	215	68	75
Average Queue (ft)	62	40	56	46	44	87	34	46
95th Queue (ft)	112	75	96	81	79	164	58	69
Link Distance (ft)		1131	372	372			424	424
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310				225	300		
Storage Blk Time (%)								
Queuing Penalty (veh)								

Zone Summary

Zone wide Queuing Penalty: 0

60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp Performance by approach

Approach	WB	NB	SB	All
Denied Del/Veh (s)	2.4	0.0	0.4	0.6
Total Del/Veh (s)	7.0	7.1	9.0	8.1

70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp Performance by approach

Approach	EB	NB	SB	All
Denied Del/Veh (s)	2.1	0.0	0.0	0.5
Total Del/Veh (s)	13.9	13.0	12.0	12.8

Total Zone Performance

Denied Del/Veh (s)	2.1
Total Del/Veh (s)	1711.2

Intersection: 60: CSAH 5 & US 14 WB Exit Ramp/US 14 WB Entrance Ramp

Movement	WB	WB	NB	NB	NB	SB	SB	SB
Directions Served	LT	R	L	T	T	T	T	R
Maximum Queue (ft)	81	102	127	94	96	186	142	109
Average Queue (ft)	26	49	50	33	35	94	47	53
95th Queue (ft)	64	80	93	73	83	165	97	93
Link Distance (ft)	1246			424	424	1587	1587	
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)		215	325					330
Storage Blk Time (%)								
Queuing Penalty (veh)								

Intersection: 70: CSAH 5 & US 14 EB Exit Ramp/US 14 EB Entrance Ramp

Movement	EB	EB	NB	NB	NB	SB	SB	SB
Directions Served	L	TR	T	T	R	L	T	T
Maximum Queue (ft)	166	81	155	122	101	253	91	115
Average Queue (ft)	85	33	68	51	41	119	25	41
95th Queue (ft)	145	64	120	97	83	217	68	92
Link Distance (ft)		1131	372	372			424	424
Upstream Blk Time (%)								
Queuing Penalty (veh)								
Storage Bay Dist (ft)	310				225	300		
Storage Blk Time (%)						0		
Queuing Penalty (veh)						0		

Zone Summary

Zone wide Queuing Penalty: 0

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 EB Enter	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 EB Exit	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 EB Enter	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 EB Exit	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2045 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	301	213	0	0	15.0	1.00	0.890
2	TH 14 EB Enter	0	174	1	95	0	15.0	1.00	0.890
3	CSAH 5 NB	0	0	270	93	0	15.0	1.00	0.890
4	TH 14 EB Exit	0	0	0	0	0	15.0	1.00	0.890

Operational Results

2045 PM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	5.55		5.55	2.52		A		A
2	TH 14 EB Enter	None	6.13		6.13	1.51		A		A
3	CSAH 5 NB	None	6.91		6.91	2.34		A		A
4	TH 14 EB Exit	None	0.00		0.00	0.00		A		A

Global Results

Performance and Accidents

2045 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1147		1147
Capacity	veh/hr	2622		2622
Average Delay	sec/veh	6.12		6.12
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	1.95		1.95

Operational Data

Main Geometry (ft)

Approach and Entry Geometry

Leg	Leg Names	Approach Bearing (deg)	Grade Separation G	Half Width V	Approach Lanes n	Entry Width E	Entry Lanes n	Flare Length L'	Entry Radius R	Entry Angle Phi
1	CSAH 5 SB	0	0	18.00	1	19.90	1	140.00	110.00	25.00
2	TH 14 WB Exit	90	0	18.00	1	19.90	1	140.00	110.00	25.00
3	CSAH 5 NB	180	0	18.00	1	19.90	1	140.00	110.00	25.00
4	TH 14 WB Enter	270	0	18.00	1	19.90	1	140.00	110.00	25.00

Circulating and Exit Geometry

Leg	Leg Names	Inscribed Diameter D	Circulating Width C	Circulating Lanes nc	Exit Width Ex	Exit Lanes nex	Exit Half Width Vx	Exit Half Width Lanes nvx
1	CSAH 5 SB	150.00	22.00	1	20.00	1	16.00	1
2	TH 14 WB Exit	150.00	22.00	1	20.00	1	16.00	1
3	CSAH 5 NB	150.00	22.00	1	20.00	1	16.00	1
4	TH 14 WB Enter	150.00	22.00	1	20.00	1	16.00	1

Traffic Flow Data (veh/hr)

2045 PM Peak Peak Hour Flows

Leg	Leg Names	Turning Flows					Flow Modifiers		
		U-Turn	Exit-3	Exit-2	Exit-1	Bypass	Trucks %	Flow Factor	Peak Hour Factor
1	CSAH 5 SB	0	0	475	234	0	15.0	1.00	0.890
2	TH 14 WB Exit	0	0	0	0	0	15.0	1.00	0.890
3	CSAH 5 NB	0	125	319	0	0	15.0	1.00	0.890
4	TH 14 WB Enter	0	39	1	161	0	15.0	1.00	0.890

Operational Results

2045 PM Peak - 60 minutes

Delays, Queues and Level of Service

Leg	Leg Names	Bypass Type	Average Delay (sec)			95% Queue (veh)		Level of Service		
			Entry	Bypass	Leg	Entry	Bypass	Entry	Bypass	Leg
1	CSAH 5 SB	None	9.76		9.76	6.77		A		A
2	TH 14 WB Exit	None	0.00		0.00	0.00		A		A
3	CSAH 5 NB	None	5.04		5.04	1.95		A		A
4	TH 14 WB Enter	None	5.20		5.20	0.93		A		A

Global Results

Performance and Accidents

2045 PM Peak Global Performance

Parameter	Units	Entries	Bypasses	Total
Arrive Flows	veh/hr	1354		1354
Capacity	veh/hr	2820		2820
Average Delay	sec/veh	7.54		7.54
L.O.S. (Signal)	A – F	A		A
L.O.S. (Unsig)	A – F	A		A
Total Delay	veh.hrs	2.83		2.83

Existing Warrant Analysis

WARRANTS ANALYSIS

2022

CSAH 5/US 14 WB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Background Information

		Speed (mph)	Lanes	Approach	
Location :	Mankato Mn	30	2 or more	Major Approach 1:	Northbound CSAH 5
Date:	1/6/2023	40	2 or more	Major Approach 3:	Southbound CSAH 5
Analysis Prepared By:	Ashley Sherry	30	1	Minor Approach 2:	Westbound US 14 WB Ramp
Population Less than 10,000:	No			Minor Approach 4:	
Seventy Percent Factor Used:	No				

Warrants Analysis: Warrants 1A, 1B and 1C

Hour	Major Approach 1	Major Approach 3	Total 1 + 3	Warrant Met 600	Warrant Met 900	Minor Approach 2	Minor Approach 4	Largest Minor App.	Warrant Met 150	Warrant Met 75	Met Same Hours Condition A	Met Same Hours Condition B	Combination A	Combination B	MWSA (C) 300	MWSA (C) 200
6 - 7 AM	239	176	415			59	0	59							X	
7 - 8 AM	306	293	599			40	0	40							X	
8 - 9 AM	298	359	657	X		28	0	28							X	
9 - 10 AM	223	274	497			30	0	30							X	
10 - 11 AM	222	306	528			39	0	39							X	
11 - 12 AM	298	383	681	X		35	0	35							X	
12 - 1 PM	311	396	707	X		38	0	38							X	
1 - 2 PM	308	381	689	X		39	0	39							X	
2 - 3 PM	300	405	705	X		37	0	37							X	
3 - 4 PM	329	507	836	X		32	0	32							X	
4 - 5 PM	345	604	949	X	X	38	0	38							X	
5 - 6 PM	231	468	699	X		38	0	38							X	
6 - 7 PM	167	228	395			24	0	24							X	
7 - 8 PM	0	0	0			0	0	0								
8 - 9 PM	0	0	0			0	0	0								
9 - 10 PM	0	0	0			0	0	0								
10 - 11 PM	0	0	0			0	0	0								
											0	0	0	0	0	

Warrant Summary

Warrant and Description		Hours Met	Hours Required	Met/Not Met
Warrant 1A:	Minimum Vehicular Volume	0	8	Not Met
Warrant 1B:	Interruption of Continuous Traffic	0	8	Not Met
Warrant 1C:	Combination of Warrants	0	8	Not Met
Warrant 2:	Four-Hour Vehicular Volume	0	4	Not Met
Warrant 3B:	Peak Hour	0	1	Not Met
MWSA (C):	Multiway Stop Applications Condition C	0	8	Not Met

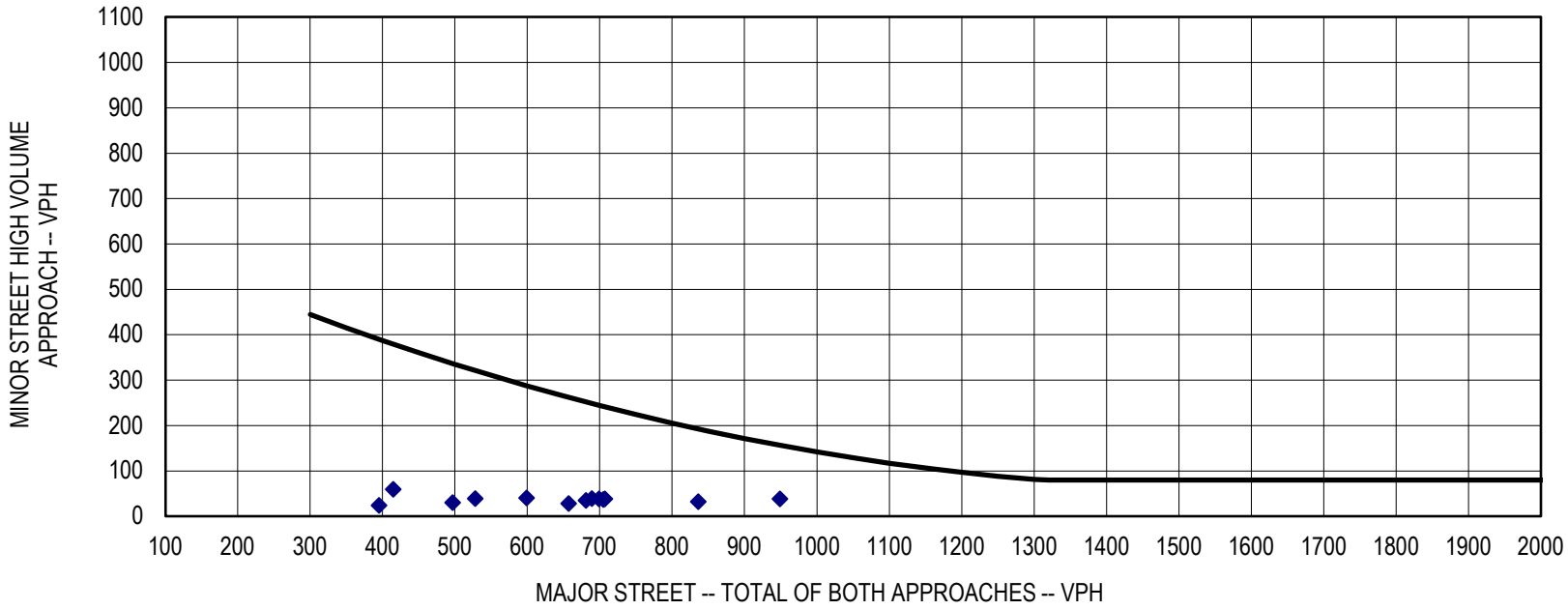
WARRANTS ANALYSIS

2022

CSAH 5/US 14 WB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Warrants Analysis: Warrant 2

WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME



Number of Hours Satisfying Requirements:	0

Notes: 1. 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

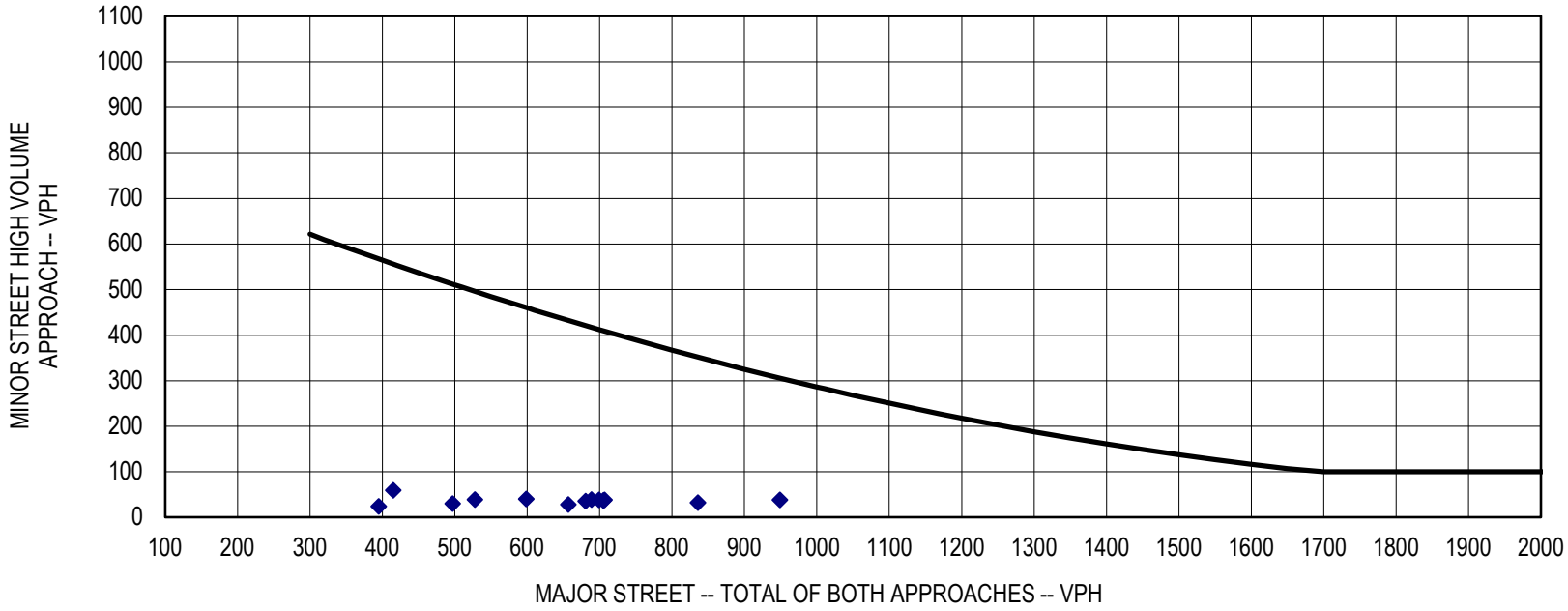
WARRANTS ANALYSIS

2022

CSAH 5/US 14 WB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Warrants Analysis: Warrant 3

WARRANT 3 - PEAK HOUR



Number of Hours Satisfying Requirements:	0

Notes: 1. 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

WARRANTS ANALYSIS

2022

CSAH 5/US 14 EB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Background Information

		Speed (mph)	Lanes	Approach	
Location :	Mankato Mn	30	2 or more	Major Approach 1:	Northbound CSAH 5
Date:	1/6/2023	40	2 or more	Major Approach 3:	Southbound CSAH 5
Analysis Prepared By:	Ashley Sherry	30	1	Minor Approach 2:	Eastbound US 14 EB Ramp
Population Less than 10,000:	No			Minor Approach 4:	
Seventy Percent Factor Used:	No				

Warrants Analysis: Warrants 1A, 1B and 1C

Hour	Major Approach 1	Major Approach 3	Total 1 + 3	Warrant Met 600	Warrant Met 900	Minor Approach 2	Minor Approach 4	Largest Minor App.	Warrant Met 150	Warrant Met 75	Met Same Hours Condition A	Met Same Hours Condition B	Combination A	Combination B	MWSA (C) 300	MWSA (C) 200
6 - 7 AM	118	149	267			170	0	170	X	X						
7 - 8 AM	181	222	403			156	0	156	X	X					X	
8 - 9 AM	200	251	451			133	0	133		X					X	
9 - 10 AM	158	196	354			104	0	104		X					X	
10 - 11 AM	165	224	389			105	0	105		X					X	
11 - 12 AM	206	281	487			133	0	133		X			X		X	
12 - 1 PM	237	319	556			130	0	130		X			X		X	
1 - 2 PM	199	296	495			145	0	145		X			X		X	
2 - 3 PM	195	286	481			134	0	134		X			X		X	
3 - 4 PM	237	354	591			154	0	154	X	X			X		X	
4 - 5 PM	297	437	734	X		128	0	128		X			X	X	X	
5 - 6 PM	210	356	566			84	0	84		X					X	
6 - 7 PM	152	169	321			55	0	55							X	
7 - 8 PM	0	0	0			0	0	0								
8 - 9 PM	0	0	0			0	0	0								
9 - 10 PM	0	0	0			0	0	0								
10 - 11 PM	0	0	0			0	0	0								
											0	0	6	1	0	

Warrant Summary

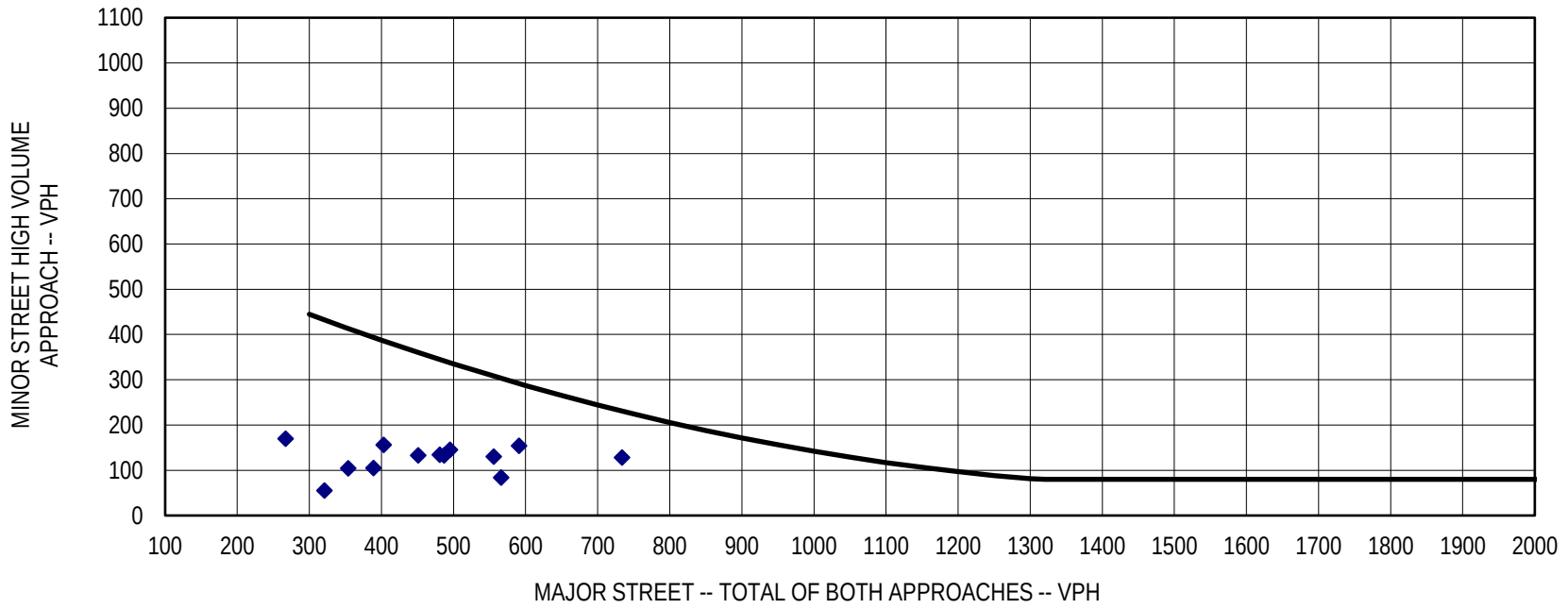
Warrant and Description		Hours Met	Hours Required	Met/Not Met
Warrant 1A:	Minimum Vehicular Volume	0	8	Not Met
Warrant 1B:	Interruption of Continuous Traffic	0	8	Not Met
Warrant 1C:	Combination of Warrants	1	8	Not Met
Warrant 2:	Four-Hour Vehicular Volume	0	4	Not Met
Warrant 3B:	Peak Hour	0	1	Not Met
MWSA (C):	Multiway Stop Applications Condition C	0	8	Not Met

WARRANTS ANALYSIS 2022

CSAH 5/US 14 EB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Warrants Analysis: Warrant 2

WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME



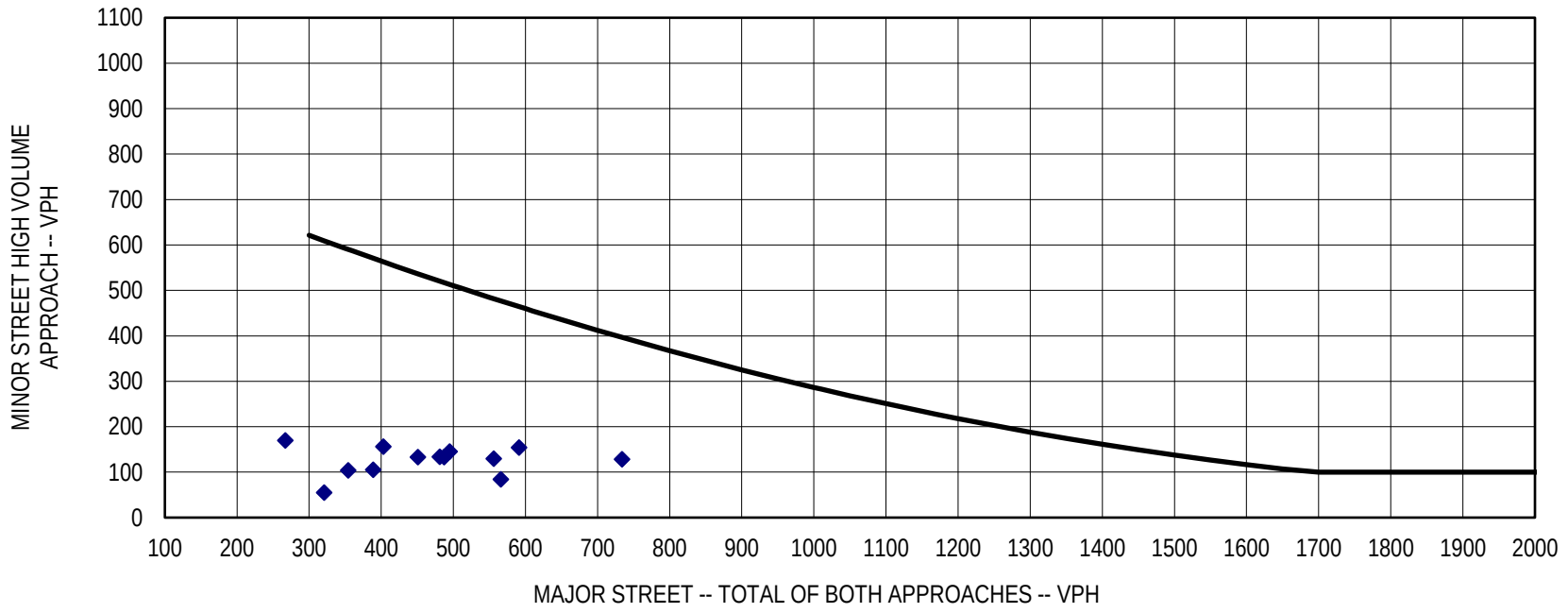
Number of Hours Satisfying Requirements:	0

Notes: 1. 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

WARRANTS ANALYSIS 2022

CSAH 5/US 14 EB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Warrants Analysis: Warrant 3



Number of Hours Satisfying Requirements:	0

Notes: 1. 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Forecast Year 2045 Warrant Analysis

WARRANTS ANALYSIS

2045

CSAH 5/US 14 WB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Background Information

		Speed (mph)	Lanes	Approach	
Location :	Mankato Mn	30	2 or more	Major Approach 1:	Northbound CSAH 5
Date:	1/6/2023	40	2 or more	Major Approach 3:	Southbound CSAH 5
Analysis Prepared By:	Ashley Sherry	30	1	Minor Approach 2:	Westbound US 14 WB Ramp
Population Less than 10,000:	No			Minor Approach 4:	
Seventy Percent Factor Used:	No				

Warrants Analysis: Warrants 1A, 1B and 1C

Hour	Major Approach 1	Major Approach 3	Total 1 + 3	Warrant Met 600	Warrant Met 900	Minor Approach 2	Minor Approach 4	Largest Minor App.	Warrant Met 150	Warrant Met 75	Met Same Hours Condition A	Met Same Hours Condition B	Combination A	Combination B	MWSA (C) 300	MWSA (C) 200
6 - 7 AM	294	216	510			73	0	73							X	
7 - 8 AM	376	360	736	X		49	0	49							X	
8 - 9 AM	366	441	807	X		34	0	34							X	
9 - 10 AM	274	337	611	X		37	0	37							X	
10 - 11 AM	273	376	649	X		48	0	48							X	
11 - 12 AM	366	471	837	X		43	0	43							X	
12 - 1 PM	382	487	869	X		47	0	47							X	
1 - 2 PM	378	468	846	X		48	0	48							X	
2 - 3 PM	369	498	867	X		45	0	45							X	
3 - 4 PM	404	623	1027	X	X	39	0	39							X	
4 - 5 PM	424	742	1166	X	X	47	0	47							X	
5 - 6 PM	284	575	859	X		47	0	47							X	
6 - 7 PM	205	280	485			29	0	29							X	
7 - 8 PM	0	0	0			0	0	0								
8 - 9 PM	0	0	0			0	0	0								
9 - 10 PM	0	0	0			0	0	0								
10 - 11 PM	0	0	0			0	0	0								
											0	0	0	0	0	

Warrant Summary

Warrant and Description		Hours Met	Hours Required	Met/Not Met
Warrant 1A:	Minimum Vehicular Volume	0	8	Not Met
Warrant 1B:	Interruption of Continuous Traffic	0	8	Not Met
Warrant 1C:	Combination of Warrants	0	8	Not Met
Warrant 2:	Four-Hour Vehicular Volume	0	4	Not Met
Warrant 3B:	Peak Hour	0	1	Not Met
MWSA (C):	Multiway Stop Applications Condition C	0	8	Not Met

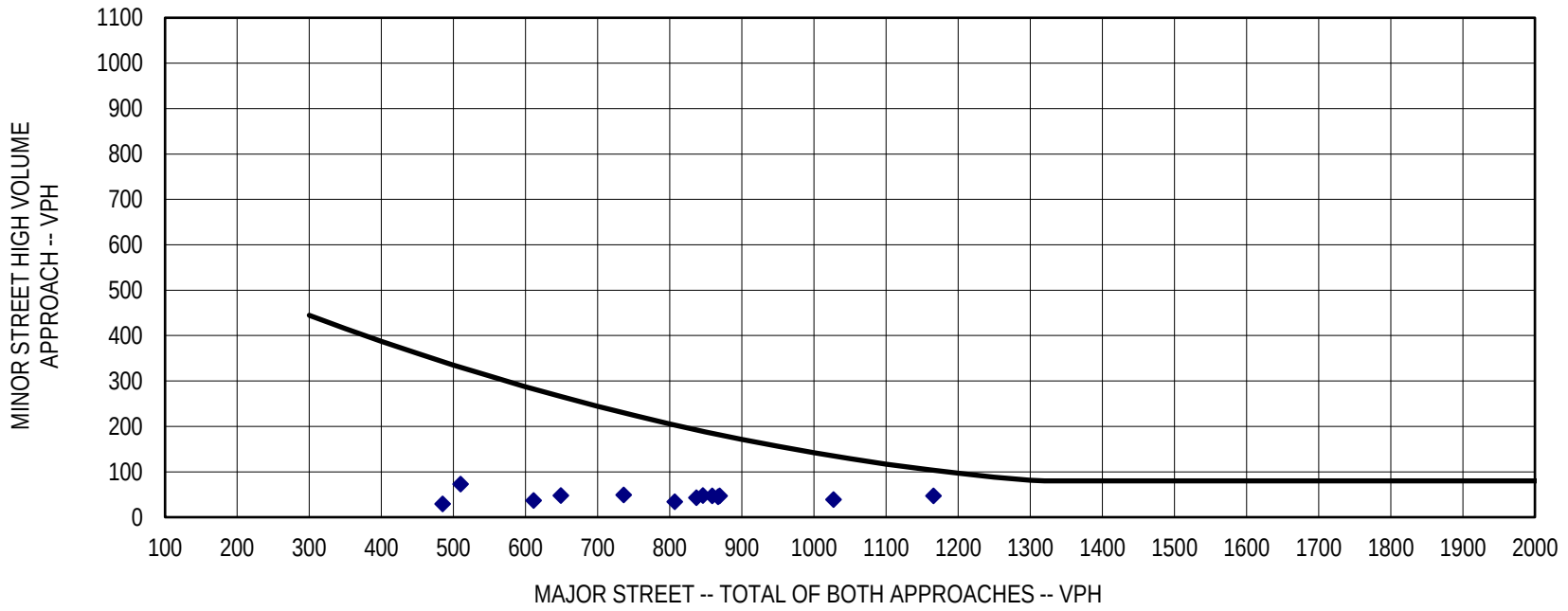
WARRANTS ANALYSIS

2045

CSAH 5/US 14 WB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Warrants Analysis: Warrant 2

WARRANT 2 - FOUR-HOUR VEHICULAR VOLUME



Number of Hours Satisfying Requirements:	0

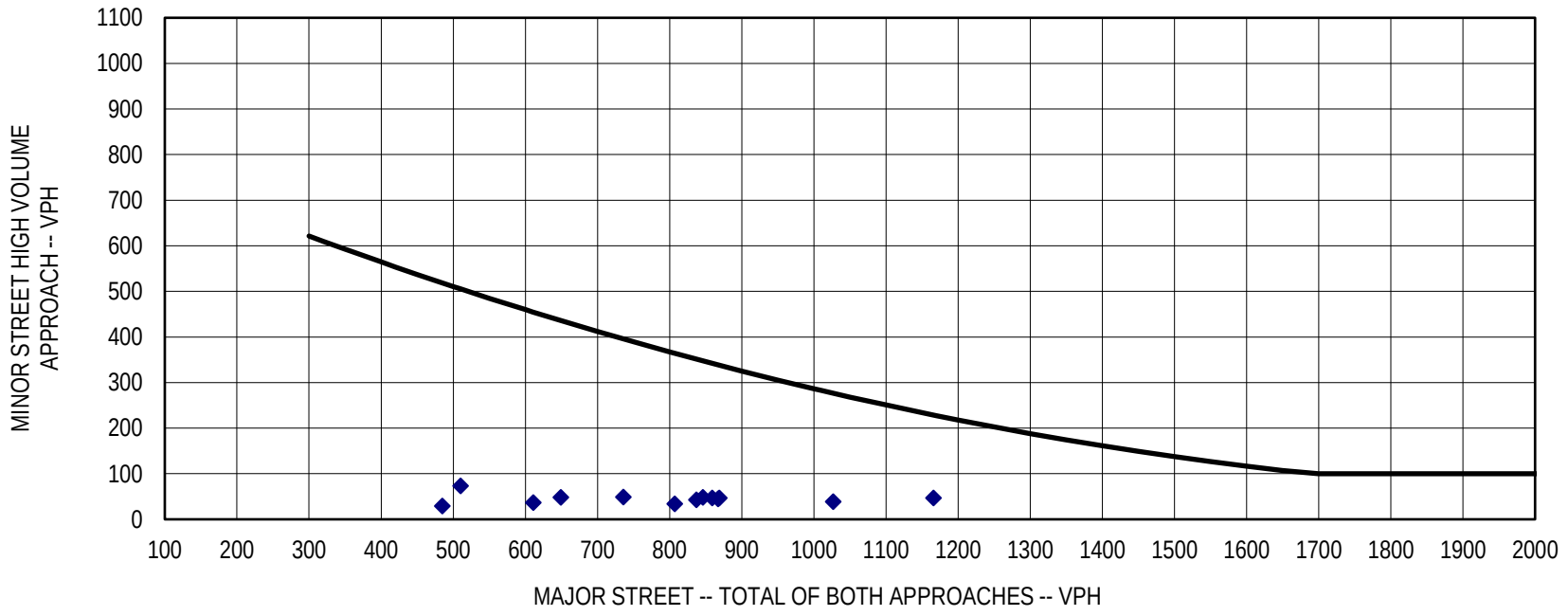
Notes: 1. 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

WARRANTS ANALYSIS

2045

CSAH 5/US 14 WB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Warrants Analysis: Warrant 3



Number of Hours Satisfying Requirements:	0

Notes: 1. 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

WARRANTS ANALYSIS

2045

CSAH 5/US 14 EB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Background Information

		Speed (mph)	Lanes	Approach	
Location :	Mankato Mn	30	2 or more	Major Approach 1:	Northbound CSAH 5
Date:	1/6/2023	30	2 or more	Major Approach 3:	Southbound CSAH 5
Analysis Prepared By:	Ashley Sherry	30	1	Minor Approach 2:	Eastbound US 14 EB Ramp
Population Less than 10,000:	No			Minor Approach 4:	
Seventy Percent Factor Used:	No				

Warrants Analysis: Warrants 1A, 1B and 1C

Hour	Major Approach 1	Major Approach 3	Total 1 + 3	Warrant Met 600	Warrant Met 900	Minor Approach 2	Minor Approach 4	Largest Minor App.	Warrant Met 150	Warrant Met 75	Met Same Hours Condition A	Met Same Hours Condition B	Combination A	Combination B	MWSA (C) 300	MWSA (C) 200
6 - 7 AM	145	183	328			209	0	209	X	X					X	X
7 - 8 AM	222	273	495			192	0	192	X	X			X		X	
8 - 9 AM	246	308	554			163	0	163	X	X			X		X	
9 - 10 AM	194	241	435			128	0	128		X					X	
10 - 11 AM	203	275	478			129	0	129		X					X	
11 - 12 AM	253	345	598			163	0	163	X	X			X		X	
12 - 1 PM	291	392	683	X		160	0	160	X	X	X		X		X	
1 - 2 PM	245	364	609	X		178	0	178	X	X	X		X		X	
2 - 3 PM	240	351	591			165	0	165	X	X			X		X	
3 - 4 PM	291	435	726	X		189	0	189	X	X	X		X	X	X	
4 - 5 PM	365	537	902	X	X	157	0	157	X	X	X	X	X	X	X	
5 - 6 PM	258	437	695	X		103	0	103		X					X	
6 - 7 PM	187	208	395			68	0	68							X	
7 - 8 PM	0	0	0			0	0	0								
8 - 9 PM	0	0	0			0	0	0								
9 - 10 PM	0	0	0			0	0	0								
10 - 11 PM	0	0	0			0	0	0								
											4	1	8	2	1	

Warrant Summary

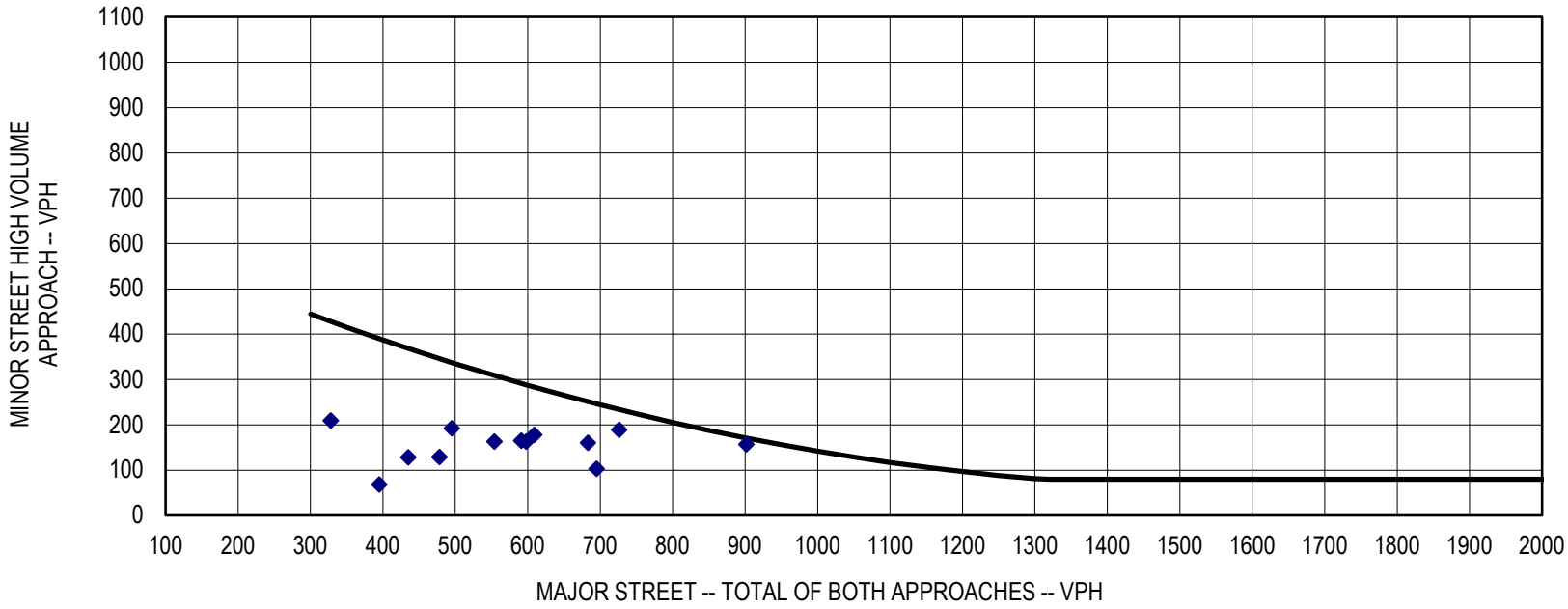
Warrant and Description		Hours Met	Hours Required	Met/Not Met
Warrant 1A:	Minimum Vehicular Volume	4	8	Not Met
Warrant 1B:	Interruption of Continuous Traffic	1	8	Not Met
Warrant 1C:	Combination of Warrants	2	8	Not Met
Warrant 2:	Four-Hour Vehicular Volume	0	4	Not Met
Warrant 3B:	Peak Hour	0	1	Not Met
MWSA (C):	Multiway Stop Applications Condition C	1	8	Not Met

WARRANTS ANALYSIS

2045

CSAH 5/US 14 EB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Warrants Analysis: Warrant 2



Number of Hours Satisfying Requirements:	0

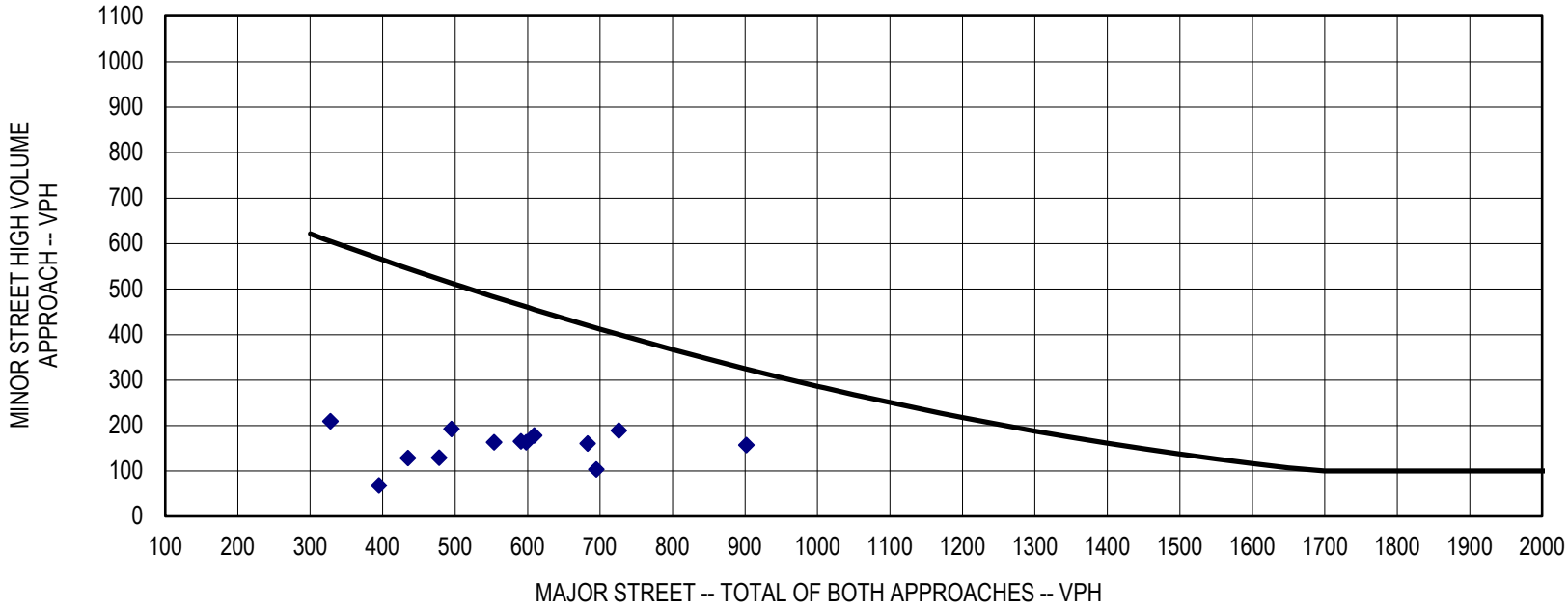
Notes: 1. 115 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 80 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

WARRANTS ANALYSIS

2045

CSAH 5/US 14 EB Ramps
CSAH 5 (Third Ave) Corridor Study
Mankato Mn

Warrants Analysis: Warrant 3



Number of Hours Satisfying Requirements:	0

Notes: 1. 150 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACH WITH TWO OR MORE LANES AND 100 VPH APPLIES AS THE LOWER THRESHOLD VOLUME FOR A MINOR STREET APPROACHING WITH ONE LANE.

Benefit-Cost Analysis

SRF Consulting Group, Inc

TABLE B/C: BENEFIT-COST SUMMARY - AWSC Scenario
US 14 and CSAH 5 - Mankato, MN - AWSC

SRF PROJECT NUMBER:	15202
PROJECT NAME:	US 14 and CSAH 5 EB Ramp ICE Report
B/C ANALYSIS FIRST YEAR OF BENEFIT:	2026
B/C ANALYSIS FINAL YEAR OF ANALYSIS:	2045

BENEFIT-COST ANALYSIS
SUMMARY RESULTS

PRESENT VALUE OF ITEMIZED BENEFITS (mil. $)	
VMT Savings	$0.00
VHT Savings	$2.07
Accident Reduction Benefits	$3.21
PRESENT VALUE OF TOTAL BENEFITS (mil. $)	$5.28

PRESENT VALUE OF ITEMIZED COSTS (mil. $)	
Capital Cost Differential	$0.00
Maintenance Cost Differential	$0.03
Remaining Capital Value Differential [(a)]	$0.00
PRESENT VALUE OF TOTAL COSTS (mil. $)	$0.03

Net Cost of Project (mil. $)	$0.03
Present Value of Benefits (mil. $)	$5.28
Net Present Value (mil. $)	$5.25
BENEFIT/COST RATIO:	153.81

TABLE B/C: BENEFIT-COST SUMMARY - AWSC Scenario
US 14 and CSAH 5 - Mankato, MN - AWSC

SRF PROJECT NUMBER:	15202
PROJECT NAME:	US 14 and CSAH 5 WB Ramp ICE Report
B/C ANALYSIS FIRST YEAR OF BENEFIT:	2026
B/C ANALYSIS FINAL YEAR OF ANALYSIS:	2045

BENEFIT-COST ANALYSIS
SUMMARY RESULTS

PRESENT VALUE OF ITEMIZED BENEFITS (mil. $)	
VMT Savings	$0.00
VHT Savings	-$0.70
Accident Reduction Benefits	$0.76
PRESENT VALUE OF TOTAL BENEFITS (mil. $)	$0.06

PRESENT VALUE OF ITEMIZED COSTS (mil. $)	
Capital Cost Differential	$0.00
Maintenance Cost Differential	$0.03
Remaining Capital Value Differential [(a)]	$0.00
PRESENT VALUE OF TOTAL COSTS (mil. $)	$0.03

Net Cost of Project (mil. $)	$0.03
Present Value of Benefits (mil. $)	$0.06
Net Present Value (mil. $)	$0.03
BENEFIT/COST RATIO:	1.74

TABLE B/C: BENEFIT-COST SUMMARY - Roundabout Scenario
US 14 and CSAH 5 - Mankato, MN - Roundabout

SRF PROJECT NUMBER:	15202
PROJECT NAME:	US 14 and CSAH 5 EB Ramp ICE Report
B/C ANALYSIS FIRST YEAR OF BENEFIT:	2026
B/C ANALYSIS FINAL YEAR OF ANALYSIS:	2045

BENEFIT-COST ANALYSIS

SUMMARY RESULTS

PRESENT VALUE OF ITEMIZED BENEFITS (mil. $)	
VMT Savings	$0.00
VHT Savings	$2.13
Accident Reduction Benefits	$3.39
PRESENT VALUE OF TOTAL BENEFITS (mil. $)	$5.51

PRESENT VALUE OF ITEMIZED COSTS (mil. $)	
Capital Cost Differential	$2.50
Maintenance Cost Differential	$0.03
Remaining Capital Value Differential [(a)]	$0.47
PRESENT VALUE OF TOTAL COSTS (mil. $)	$2.07

Net Cost of Project (mil. $)	$2.07
Present Value of Benefits (mil. $)	$5.51
Net Present Value (mil. $)	$3.44
BENEFIT/COST RATIO:	2.66

TABLE B/C: BENEFIT-COST SUMMARY - Roundabout Scenario
US 14 and CSAH 5 - Mankato, MN - Roundabout

SRF PROJECT NUMBER:	15202
PROJECT NAME:	US 14 and CSAH 5 WB Ramp ICE Report
B/C ANALYSIS FIRST YEAR OF BENEFIT:	2026
B/C ANALYSIS FINAL YEAR OF ANALYSIS:	2045

BENEFIT-COST ANALYSIS
SUMMARY RESULTS

PRESENT VALUE OF ITEMIZED BENEFITS (mil. $)	
VMT Savings	$0.00
VHT Savings	-$1.90
Accident Reduction Benefits	$0.55
PRESENT VALUE OF TOTAL BENEFITS (mil. $)	-$1.35

PRESENT VALUE OF ITEMIZED COSTS (mil. $)	
Capital Cost Differential	$2.50
Maintenance Cost Differential	$0.03
Remaining Capital Value Differential [(a)]	$0.47
PRESENT VALUE OF TOTAL COSTS (mil. $)	$2.07

Net Cost of Project (mil. $)	$2.07
Present Value of Benefits (mil. $)	-$1.35
Net Present Value (mil. $)	-$3.42
BENEFIT/COST RATIO:	-0.65