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Riverfront Drive and CSAH 16 (Stoltzman Road)

INTERSECTION CONTROL EVALUATION

FINAL REPORT

Prepared for:

Mankato Area Planning Organization (MAPO)
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11/27/2024

4000147

Intersection Control Evaluation for Riverfront Drive and CSAH 16 (Stoltzman Road)

Mankato, Blue Earth County, Minnesota

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.

Name	Registration No.	Date
	#47068	11/27/2024

APPROVED

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City of Mankato Engineer — Date

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1. Introduction

The Mankato Area Planning Organization (MAPO) in conjunction with Blue Earth County and the City of Mankato have identified the need to conduct an Intersection Control Evaluation (ICE) for the Riverfront Drive and CSAH 16 (Stoltzman Road) intersection in Mankato, MN. The purpose of this study is to identify the appropriate traffic control and optimal geometrics for existing and forecast conditions that is consistent with the County and City's transportation systems and MAPO Long Range Transportation Plan (LRTP).

1.1 DESCRIPTION OF LOCATION

The intersection of Riverfront Drive and CSAH 16 (Stoltzman Road) is located in the City of Mankato, MN (see **Figure 1).** The Mankato West High School campus located in the southwest quadrant of the intersection. Land use surrounding the intersection is a mix of commercial, residential, parkland, and light industrial.

1.2 PROJECT MANAGEMENT TEAM

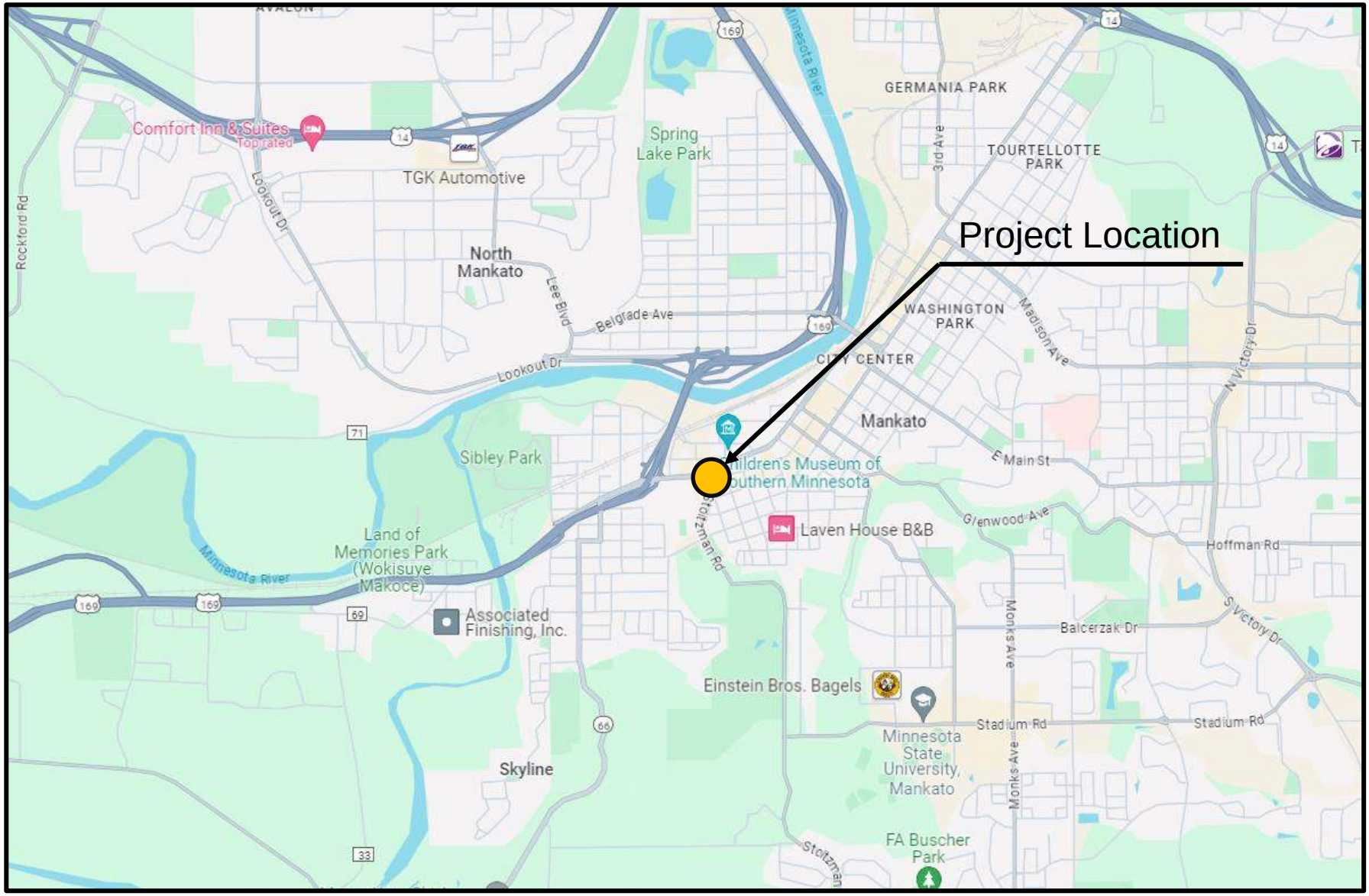
The Project Management Team (PMT) met a total of four times throughout the duration of the project to present and discuss progress of the study. PMT meetings occurred on March 14th, May 19th, August 14th, and October 11th of 2024. The PMT included members from MAPO, Blue Earth County, the City of Mankato, and the consultant team, Alliant Engineering, Inc. The PMT consisted of the following members:

- Chris Talamantez, Mankato / North Mankato Area Planning Organization (MAPO)
- Shawn Schloesser, Mankato / North Mankato Area Planning Organization (MAPO)
- Ryan Thilges, County Engineer, Blue Earth County
- Jeff Johnson, Director of Public Works, City of Mankato
- Sydney DePrenger, City of Mankato
- Scott Poska, Alliant Engineering

1.3 ELEMENTS OF EVALUATION

The following elements are included in this ICE:

- Existing Conditions (Section 2)
- Traffic Volumes (Section 3)
- Alternatives Analysis (Section 4)
- Recommendations (Section 5)



Project Location

Riverfront Drive & CSAH 16 (Stoltzman Road) ICE
Mankato, Minnesota

Figure 1

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Project # 400-0147

2. Existing Conditions

The following sections document the existing conditions analysis completed for the Riverfront Drive and CSAH 16 (Stoltzman Road) intersection.

2.1 ROADWAY AND TRAFFIC CONTROL CHARACTERISTICS

The existing roadway characteristics are summarized below:

- **Riverfront Drive**: According to MAPO's 2045 Long Range Transportation Plan, Riverfront Drive is classified as a *Minor Arterial* roadway and consists of a four-lane divided cross-section. The Average Annual Daily Traffic (AADT) on the west leg is 16,500 and the AADT on the east leg is 13,000. Riverfront Drive has dedicated eastbound and westbound left and right-turn lanes at the intersection with CSAH 16 (Stoltzman Road). Due to the number of turn lanes at the intersection with CSAH 16 (Stoltzman Road), the pedestrian crossing width is over 90 feet. Existing sidewalk facilities are located on both the north and south sides of Riverfront Drive. The posted speed limit is 30 MPH.
- **CSAH 16 (Stoltzman Road)**: CSAH 16 (Stoltzman Road) is the south leg of the intersection and is classified as a *Minor Arterial* roadway, consisting of a four-lane undivided cross-section with a striped median and two-way center left turn lane extending south of Riverfront to the High School entrance. Stolzman Road has an AADT of 10,400. At the intersection with Riverfront Drive, the CSAH 16 (Stoltzman Road) northbound approach has a dedicated left-turn lane, shared through/left-turn lane, and dedicated right-turn lane. Due to the number of lanes on the south leg of the intersection, the pedestrian crossing width is approximately 80 feet. Existing sidewalk facilities are located on the east side of the road. The posted speed limit is 30 MPH. The north leg of the intersection serves as a private access to several businesses. The southbound approach consists of a left-turn lane, a through lane, and a right-turn lane at the intersection.

The existing intersection characteristics are summarized as follows:

- **Traffic Control:** The intersection is controlled by traffic signal. The traffic signal is coordinated and operates with split phasing on the northbound and southbound approaches due to the shared lane configuration on the northbound approach. It should be noted that the northbound approach signal indications do not comply with MnMUTCD section 4D.4. The eastbound and westbound left-turns are protected/permissive. There are existing pedestrian signal phases on all four legs of the intersection but no pedestrian median refuges or median refuge pushbuttons.
- **Pedestrian Signal:** A pedestrian signal is located approximately 500 feet south of the study intersection near the entrance to Mankato West High School. It should be noted that although there is not existing sidewalk along the west side of CSAH 16 (Stoltzman Road), sidewalk facilities within the Mankato West High School site provide direct access to the study

intersection. This signal is pedestrian actuated and uncoordinated with the Riverfront Drive signal.

- **Access:** The southeast quadrant of the intersection is a Kwik Trip convenience store. The Kwik Trip has two accesses from Riverfront Drive, one of which is located approximately 150 feet south of the study intersection. Because of the concrete median on the south leg of the intersection, this access is a right-in right-out (RIRO). The southern Kwik Trip access is located approximately 300 feet south of the intersection and serves all movements. The southern access also has a short southbound left-turn lane. In addition to the Kwik Trip accesses, there is also an existing alley access and Dairy Queen access within close proximity to the intersection and to the other accesses. The alley access is located approximately 330 feet south of the intersection, and the Dairy Queen access is located approximately 410 feet south of the intersection. All movements are permitted at both accesses.

Key intersection characteristics are depicted in **Figure 2**.

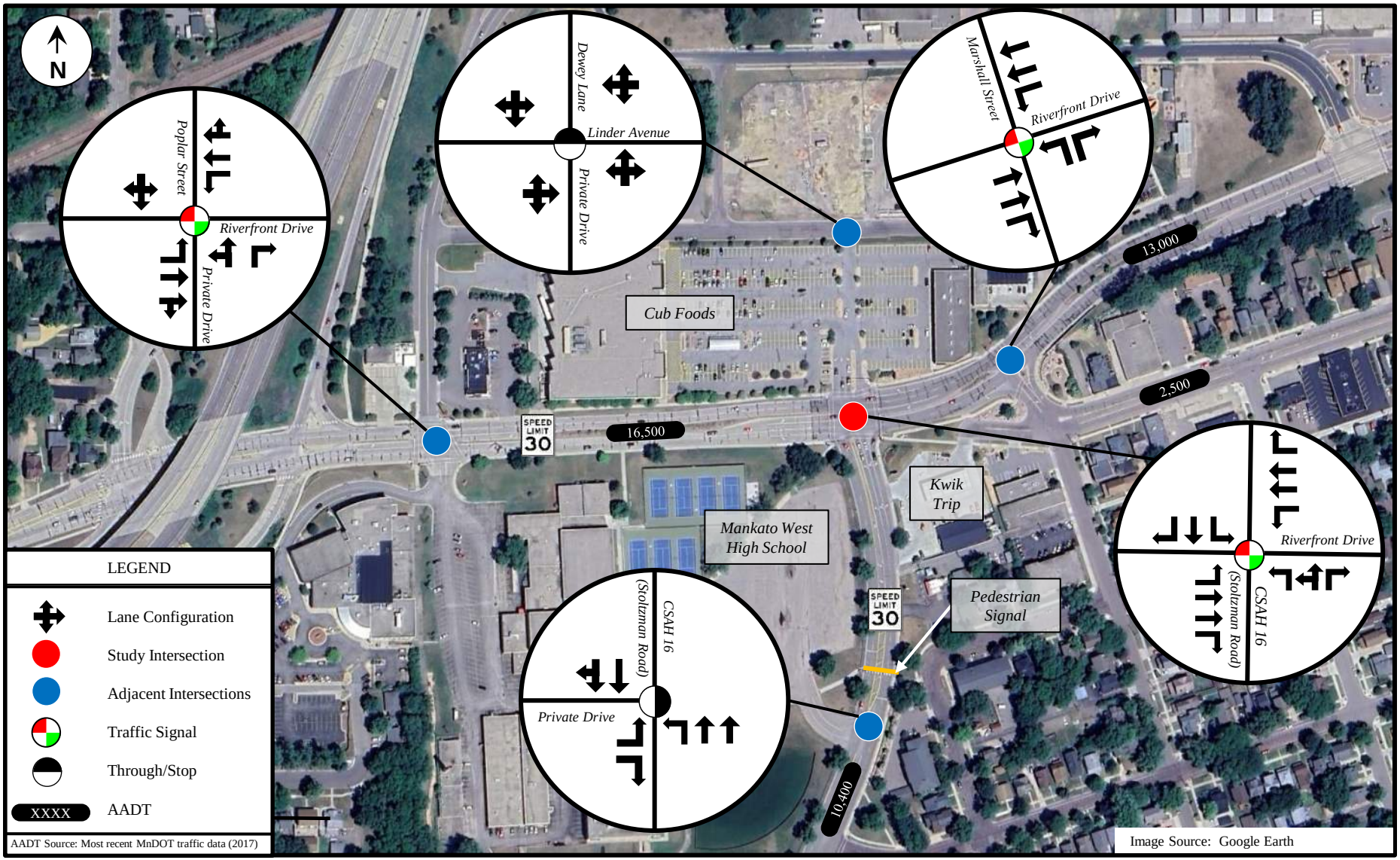
2.2 CRASH EXPERIENCE

Historical crash data from the most recent five years of data available, 2019 through 2023, was obtained from MnDOT's Crash Mapping Analysis Tool (MnCMAT2) platform. Included narratives provided by law enforcement were reviewed to ensure data accuracy. A detailed collision diagram is shown in **Figure 3.** Based on available data, 17 crashes were reported at the intersection during the 5-year analysis period. The crashes are classified into the following types:

- 7 of 17 (41 percent) – Rear End
- 3 of 17 (17 percent) – Run Off Road
- 2 of 17 (12 percent) – Left Turn
- 2 of 17 (12 percent) – Bicycle/Pedestrian
- 1 of 17 (6 percent) – Angle
- 1 of 17 (6 percent) – Right Turn
- 1 of 17 (6 percent) – Sideswipe

The primary crash types for this intersection are rear end crashes. Four of the seven rear end crashes involved eastbound vehicles on Riverfront Drive, two involved northbound vehicles on CSAH 16 (Stoltzman Road), and one involved westbound vehicles on Riverfront Drive.

The bicycle crash involved a northbound right-turning vehicle failing to yield to a bicyclist crossing the south leg of CSAH 16 (Stoltzman Road). The pedestrian crash involved a southbound right-turning vehicle failing to yield to a pedestrian crossing the north leg of the intersection (at the entrance to the commercial area). It should be noted that while there were just 2 pedestrian and bicycle related crashes during the analysis period, local feedback indicated that there are frequent near miss situations between pedestrian and bicycles and vehicles at the intersection.



Existing Conditions

Riverfront Drive & CSAH 16 (Stoltzman Road) ICE
Mankato, Minnesota

Figure 2

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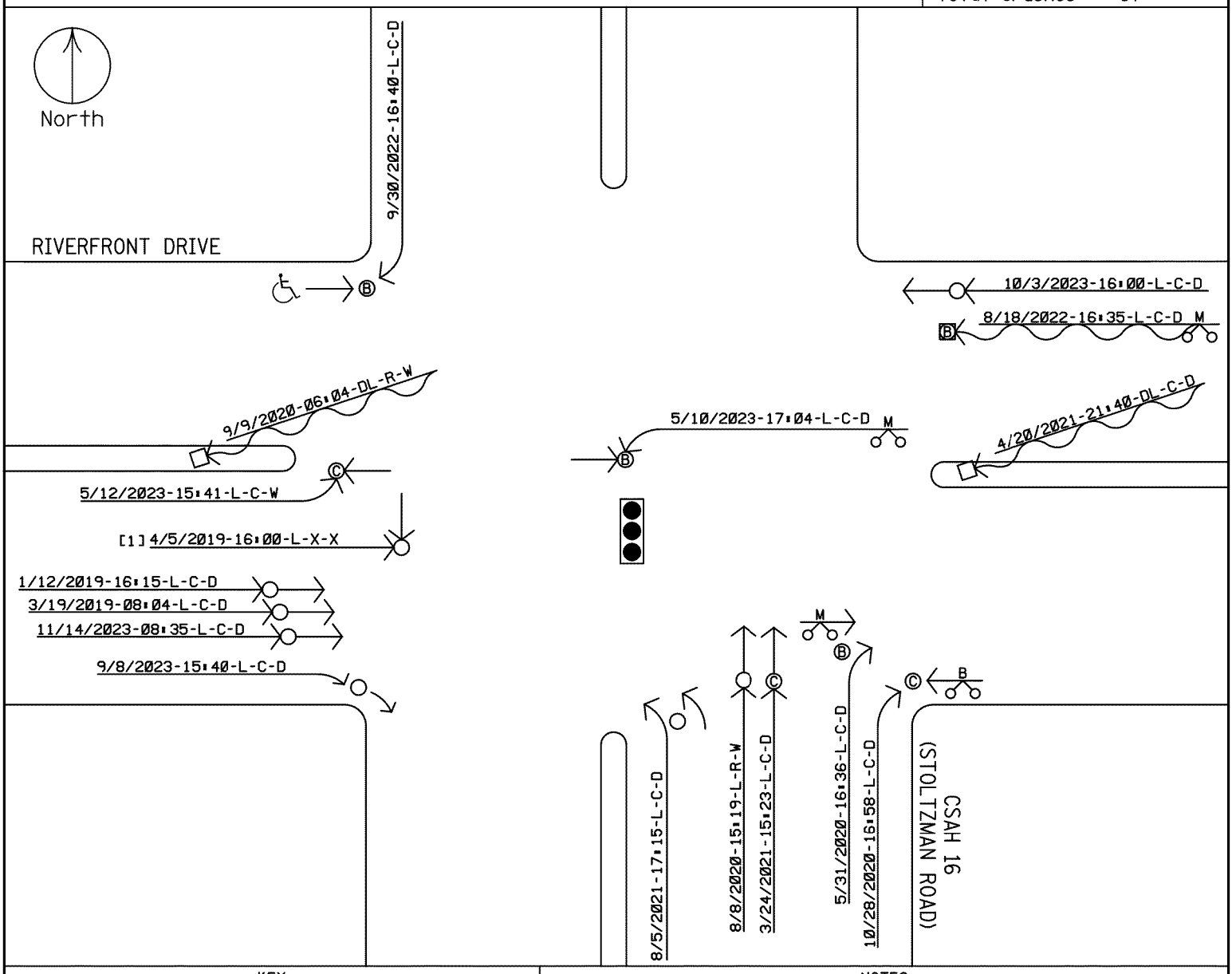
COLLISION DIAGRAM

Location: RIVERFRONT DRIVE & CSAH 16 (STOLTZMAN ROAD)

Time Period: 2019-2023 Prepared By: EHH Date: 04/16/2024

NOT TO SCALE - CRASH LOCATIONS DEPICTED ARE NOT EXACT.

No. of Reportable Crashes	
Fatal = 0	Injury Total = 7
A Injury = 0	
B Injury = 4	
C Injury = 3	
Property Damage (PDO) =10	
Total Crashes = 17	



KEY

- Vehicle Out of Control
- Vehicle Backing Up
- Vehicle Rollover
- Sideswipe Crash
- Rear End Crash
- Head On Crash
- Fixed Object
- Fatal Crash
- (A) A Injury Crash
- (B) B Injury Crash
- (C) C Injury Crash
- (O) PDO Crash
- Pedestrian
- B Bicycle
- M Motorcycle
- Parked Vehicle
- Left Turn Crash
- Right Turn Crash
- Right Angle Crash

NOTES

[1] EBT RAN RED LIGHT

Light:	Weather:	Surface:
L = Daylight	C = Clear or Cloudy	D = Dry
Dn = Dawn	R = Rain	W = Wet
Du = Dusk	S = Snow or Sleet	S = Snow or Ice
Dl = Dark, Lighted	F = Fog/Smog/Smoke	M = Mud/Dirt/Gravel
Do = Dark, Lights Off	B = Blowing Sand/Dust	Db = Debris
D = Dark, Unlighted	W = Severe Crosswinds	O = Oily
X = Unknown	X = Other or Unknown	X = Other or Unknown

Other Vehicle — Injury Type — [Date]-[Time]-[Light]-[Weather]-[Surface]

Vehicle At-Fault

Riverfront Drive and CSAH 16 (Stoltzman Road) ICE

Figure 3
Collision Diagram

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2.2.1 Crash Rate

History has proven that crashes are a function of exposure. Roadways with higher traffic volumes experience more crashes than similar roadways with lower volumes. Rather than simply documenting the number of crashes that occur at an intersection, the crash rate must be considered. Crash rates normalize different locations with varying traffic volumes, providing a useful tool in comparing the locations with respect to safety. Actual crash rates at specific locations can also be compared to average or typical values for similar intersection types. Intersection crash rates are defined as the number of crashes occurring per million entering vehicles (MEV).

Table 1 summarizes the observed intersection crash rates compared to the statewide average for similar traffic control and roadway types.

Table 1. Crash Rate Summary

Intersection Crash Analysis (2019-2023)		Rate Category	Crash	K/A[5]
Traffic Control	Traffic Signal High Volume	Intersection	0.39	0.00
Total Crashes [1]	17	State Average [3]	0.61	0.96
Total Entering Volume [2]	43,435,000	Critical [4]	0.92	4.02
K/A Crashes[5]	0	Critical Index	0.42	0.00

1: Crash data obtained from MnCMAT2 and detailed crash narratives.

2: Calculated using AADT obtained from MnDOT's Traffic Mapping Application.

3: MnDOT's 2022 Green Sheets were used to determine state average rates.

4: A confidence level of 99.5% was assumed for critical crash rate and 90% assumed for critical K/A rate.

5: K/A are Type K (fatal) and Type A (serious injury) crashes.

The observed 5-year crash rate at the Riverfront Drive and CSAH 16 (Stoltzman Road) intersection (0.39 crashes / MEV) is lower than both the statewide average for a high volume signalized intersection (0.61 crashes / MEV) and the calculated critical crash rate (0.92 crashes / MEV) resulting in a critical crash rate index of 0.42. Therefore, the number of reported crashes is not considered statistically significant.

2.2.2 Intersection Crash Severity

In the 5-year analysis period (2019-2023), four of the 17 total crashes resulted in a minor injury (Type B), three resulted in a possible injury (Type C), and ten resulted in a property damage only crash (Type O). There were no fatal (Type K) or serious injury (Type A) crashes. Crash severities reported at the intersection are depicted in **Figure 4**.

Of the four minor injury crashes, three involved motorcycles and one involved a pedestrian. Of the three possible injury crashes, one involved a bicyclist.

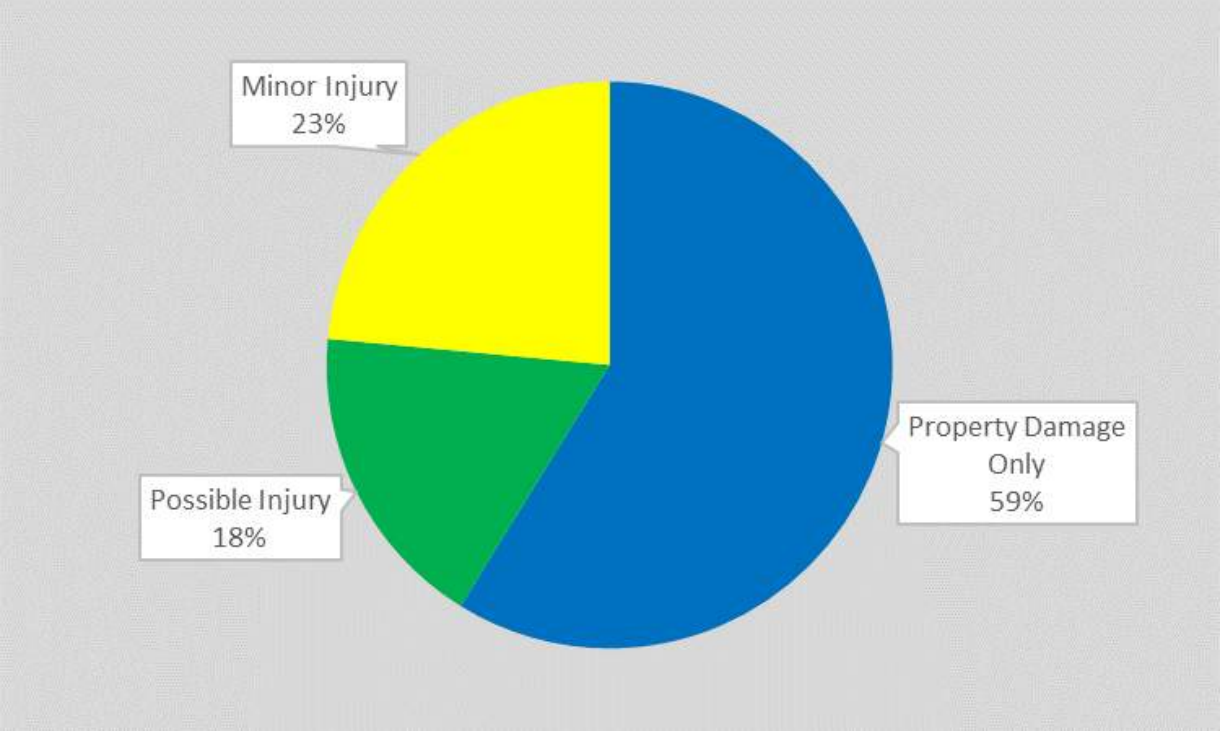


Figure 4. 5-Year Intersection Crash Severities (2019-2023)

With no fatal or serious injury crashes reported, the observed 5-year intersection K/A rate was 0.00. Crash types reported at the intersection are summarized by crash severity in **Figure 5**. A detailed trend analysis is in **Appendix A**.

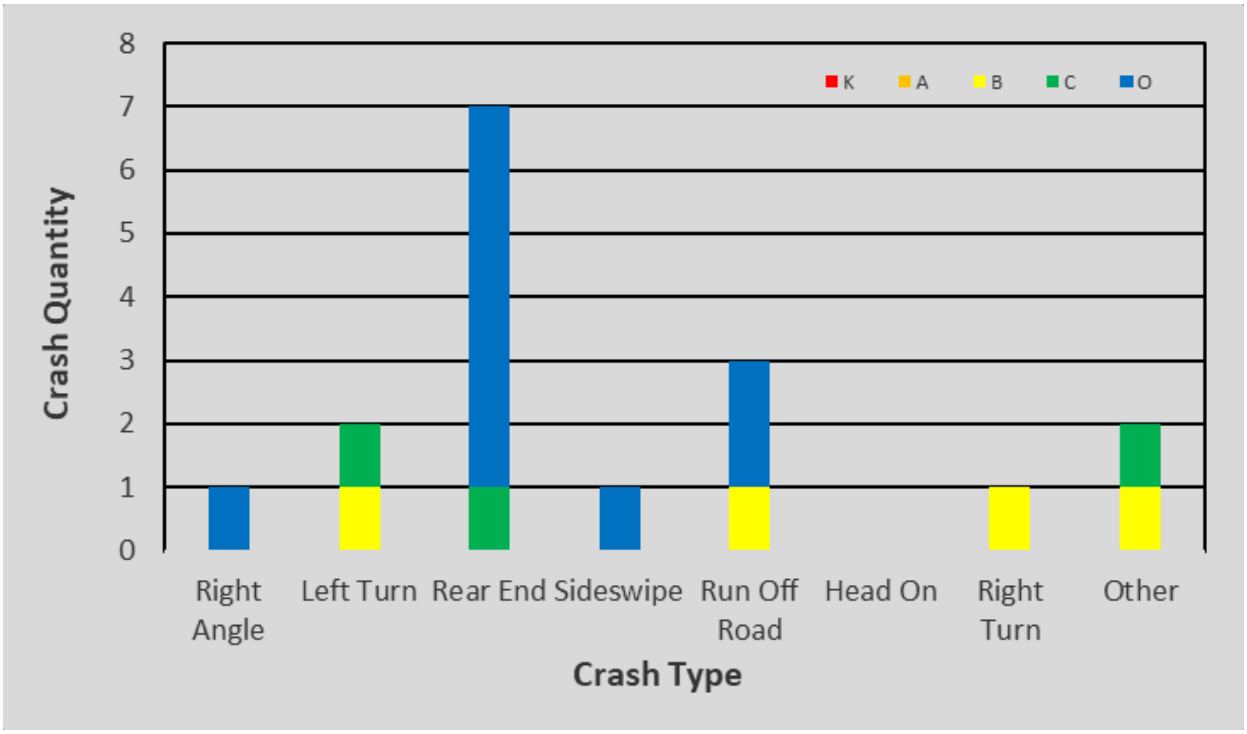


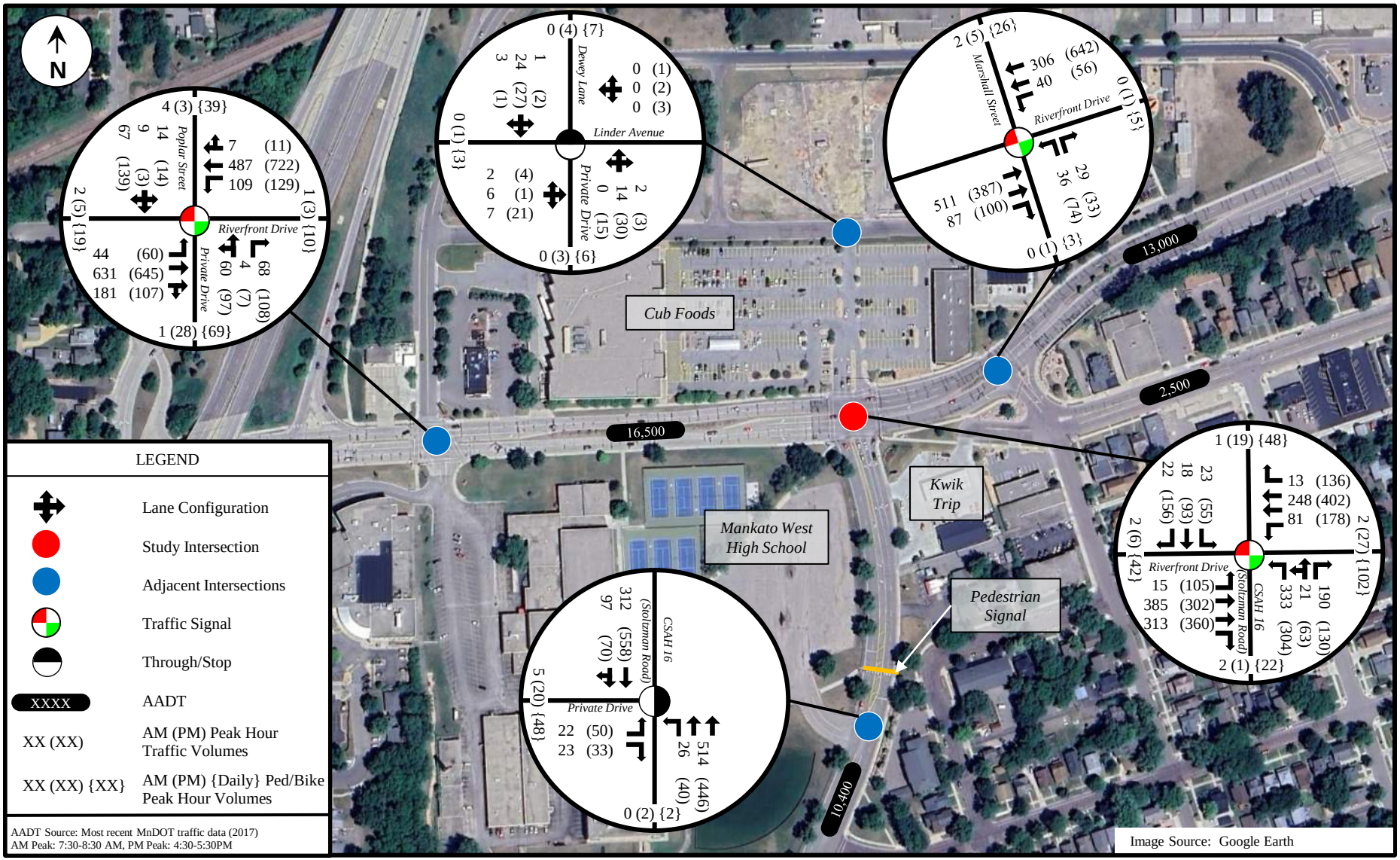
Figure 5. Intersection Crash Types by Severity

3. Traffic Volumes

Without a known project construction year, this ICE evaluated intersection geometric and traffic control needs based on the existing year (2024) and 20-year forecast (2044).

3.1 EXISTING TRAFFIC VOLUMES

Weekday turning movement counts (TMCs) were collected by Alliant Engineering, Inc. on April 23, 2024. The AM, School, and PM peak hours were determined to be 7:30 – 8:30 AM, 3:30 – 4:30 PM, and 4:30 – 5:30 PM, respectively. The school arrival peak coincides with the AM peak hour. The school dismissal peak begins at 3:30 PM and was analyzed separately (referred to as School Peak herein) from the PM peak hour which begins at 4:30 PM. The existing 2024 AM and PM peak hour traffic volumes are shown in **Figure 6**. Existing 2024 School peak hour traffic volumes are shown in **Figure 7**. **Figure 8** presents existing multimodal pedestrian and bicycle volumes and facilities. It should be noted that counts were not collected mid-block on Riverfront between Riverfront Drive and Poplar Drive where pedestrians cross based on local feedback. Detailed turning movement counts are available in **Appendix B**.



Existing Traffic Volumes (AM/PM Peak)

Riverfront Drive & CSAH 16 (Stoltzman Road) ICE
Mankato, Minnesota

Figure 6

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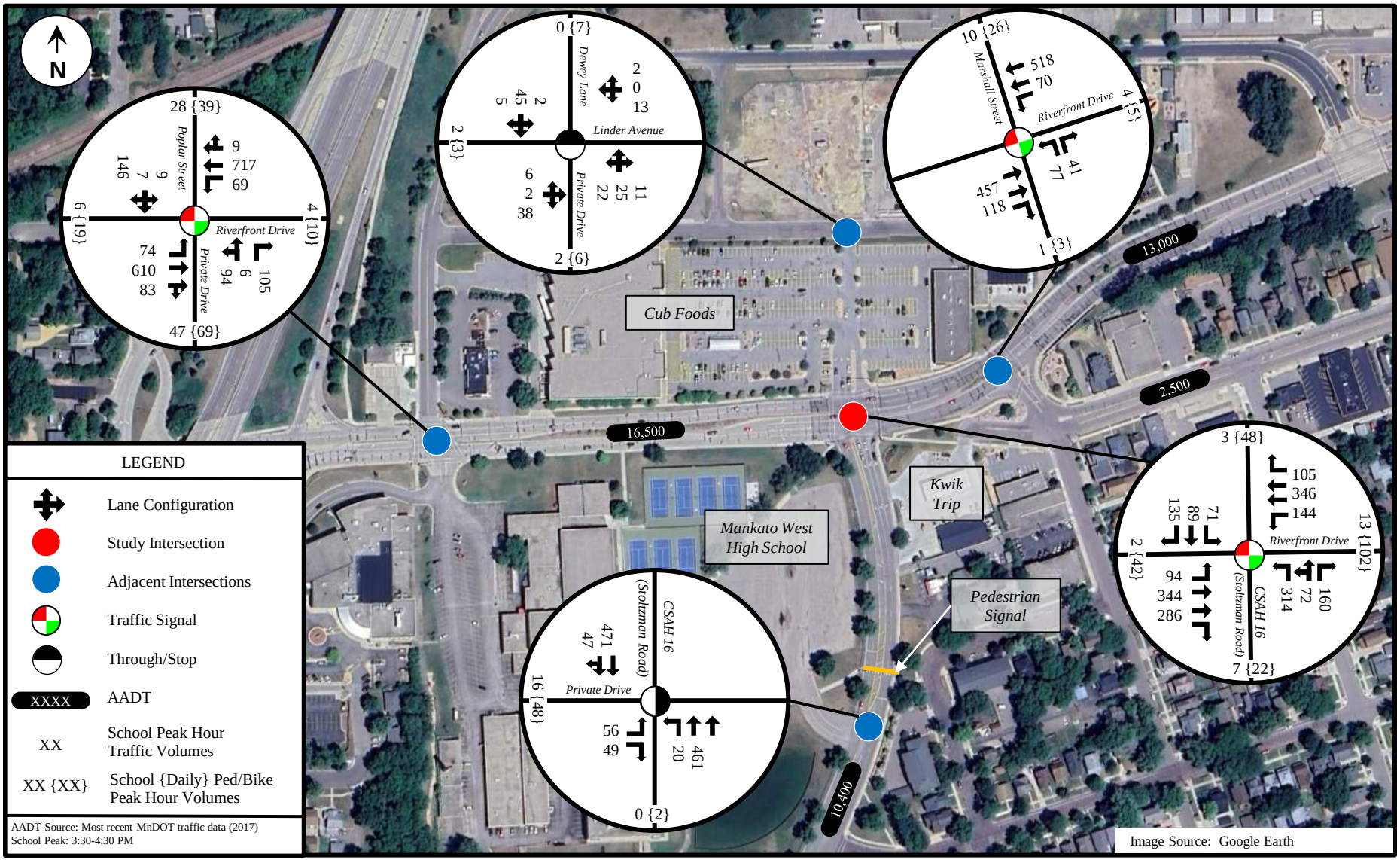

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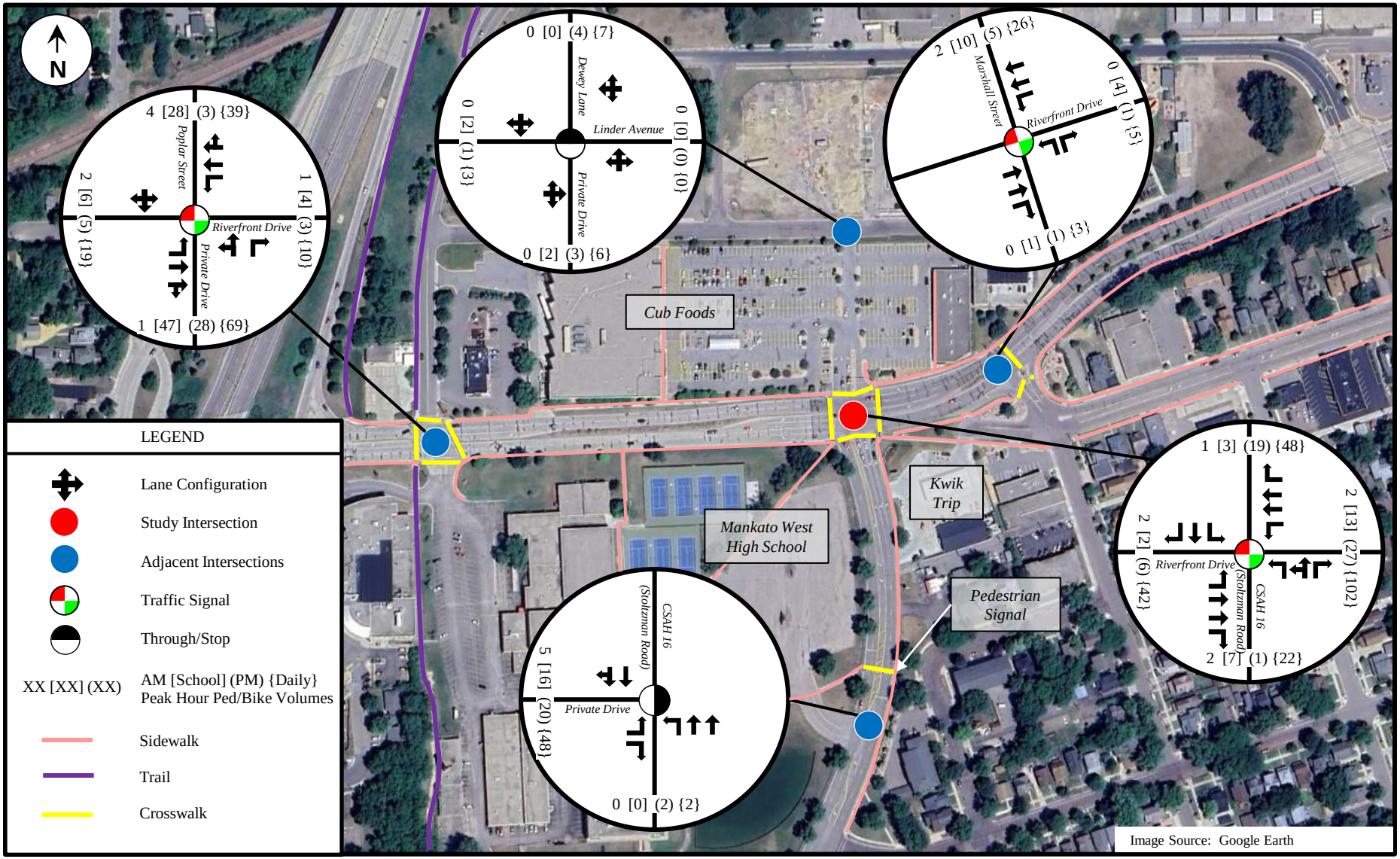
Existing Traffic Volumes (School Peak)

Riverfront Drive & CSAH 16 (Stoltzman Road) ICE
Mankato, Minnesota

Figure 7



Existing Multimodal Volumes (AM/School/PM Peak) and Facilities

Riverfront Drive & CSAH 16 (Stoltzman Road) ICE
Mankato, Minnesota

Figure 8

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Project # 400-0147

3.2 TRAFFIC GROWTH RATES

Historical AADT was obtained from MnDOT's Traffic Mapping Application. Historical AADT data shows traffic volumes increasing on the south leg of CSAH 16 (Stoltzman Road) and the east leg of Riverfront Drive and staying consistent on the west leg of Riverfront Drive.

Historical AADT data was compared to projected growth rates for the intersection identified in MAPO's 2045 Long Range Transportation Plan (LRTP). The LRTP identified projected growth rates for each leg of the intersection ranging from 0.88% to 1.61%. It should also be noted that the CSAH 16 (Stoltzman Road) and Pleasant Street ICE Study completed in 2017 used a 1.0% growth rate for the intersection. Additionally, the Riverfront Drive Corridor Study completed in 2017 recommended a 1.0% traffic growth rate for this section of Riverfront Drive.

Based on a review of the historical volumes, with no planned developments in the area, and discussions with PMT, it was determined that a 0.5% growth rate would be utilized for the Riverfront Drive and CSAH 16 (Stoltzman Road) intersection. The growth rate and historical volume analysis for the south leg of CSAH 16 (Stoltzman Road) is shown in **Figure 9** below.

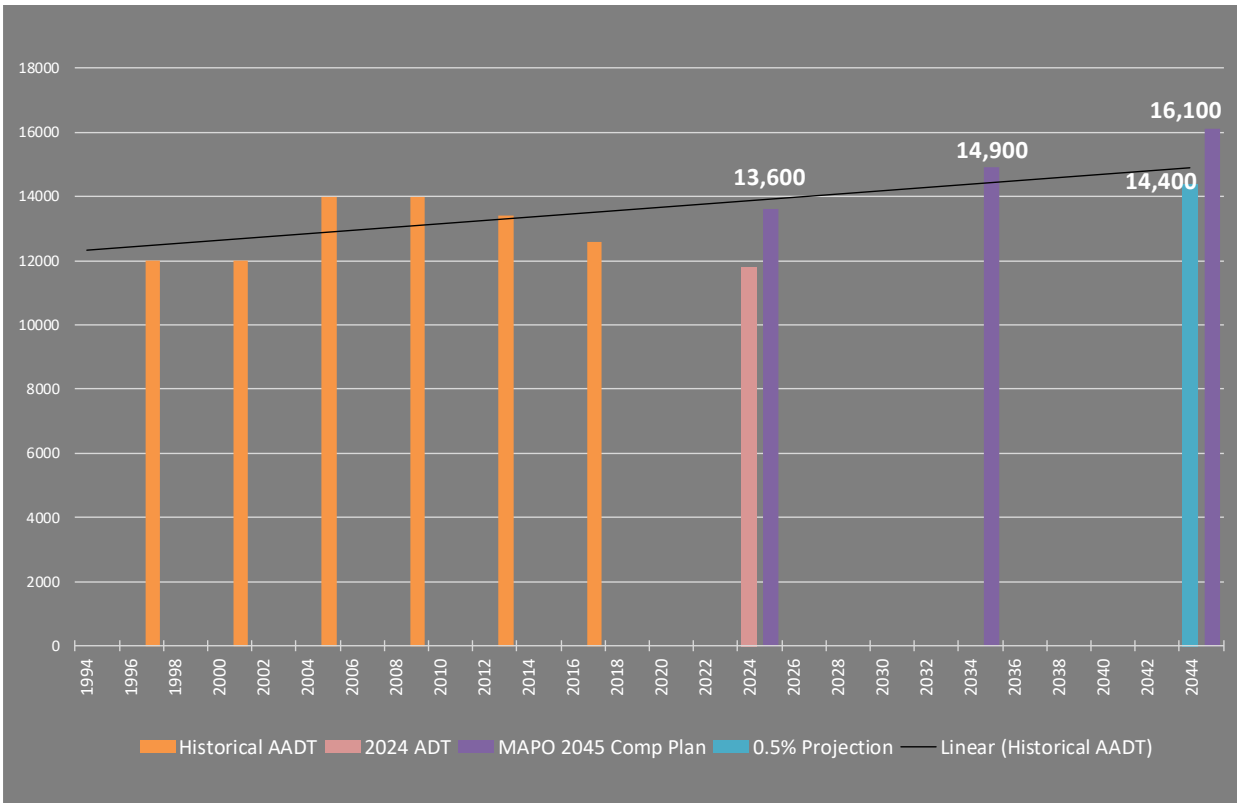


Figure 9. Stoltzman Road South Leg Traffic Growth Rate

3.3 FORECAST PEAK HOUR TRAFFIC VOLUMES

Forecast AM, School, and PM peak hour turning movement volumes for the Riverfront Drive and CSAH 16 (Stoltzman Road) intersection were obtained using a 0.5% growth rate. The resultant forecast year 2044 AM and PM peak hour traffic volumes are shown in **Figure 10.** Forecast year 2044 School peak hour traffic volumes are shown in **Figure 11**.

4. Alternatives Analysis

The goals of the alternatives analysis were to identify engineering considerations, expected traffic operations and safety impacts, and pros and cons of all potential alternatives to determine a recommended alternative for the intersection.

4.1 TRAFFIC CONTROL DEVICES

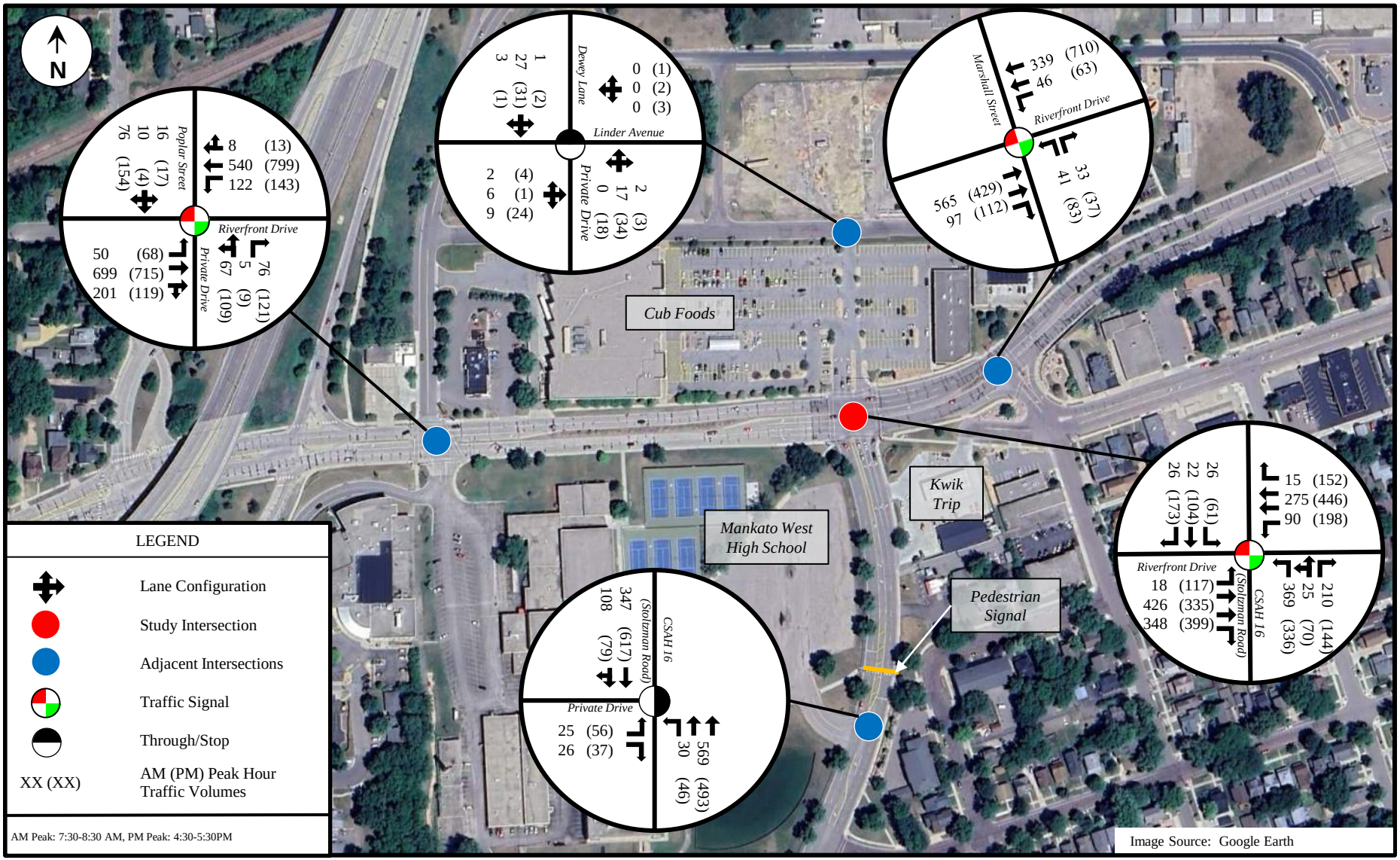
Two forms of traffic control were preliminarily identified for analysis at the Riverfront Drive and CSAH 16 (Stoltzman Road) intersection. Listed below are descriptions of each traffic control alternative.

- **Traffic Signal –** continuation of existing signalized control
- **Roundabout –** this alternative would construct a roundabout at the intersection

4.2 TRAFFIC SIGNAL WARRANT ANALYSIS

A traffic signal warrant analysis was completed for the Riverfront Drive and Stoltzman Road (CSAH 16) intersection in accordance with the August 2024 Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD). The MnMUTCD contains specific engineering standards, or warrants, that define the minimum conditions under which further consideration of a traffic signal is appropriate. These warrants are important for applying consistency in traffic control implementation across intersections throughout the transportation system. In order for a traffic signal to be considered for implementation at the intersection, at least one of the following warrant criteria must be met:

- Warrant 1 – Eight-Hour Vehicular Volume
- Warrant 2 – Four-Hour Vehicular Volume
- Warrant 3 – Peak Hour
- Warrant 4 – Pedestrian Volume
- Warrant 5 – School Crossing
- Warrant 6 – Coordinated Signal Timing
- Warrant 7 – Crash Experience
- Warrant 8 – Roadway Network
- Warrant 9 – Intersection Near a Grade Crossing



Forecast Year 2044 Traffic Volumes (AM/PM Peak)

Riverfront Drive & CSAH 16 (Stoltzman Road) ICE
Mankato, Minnesota

Figure 10

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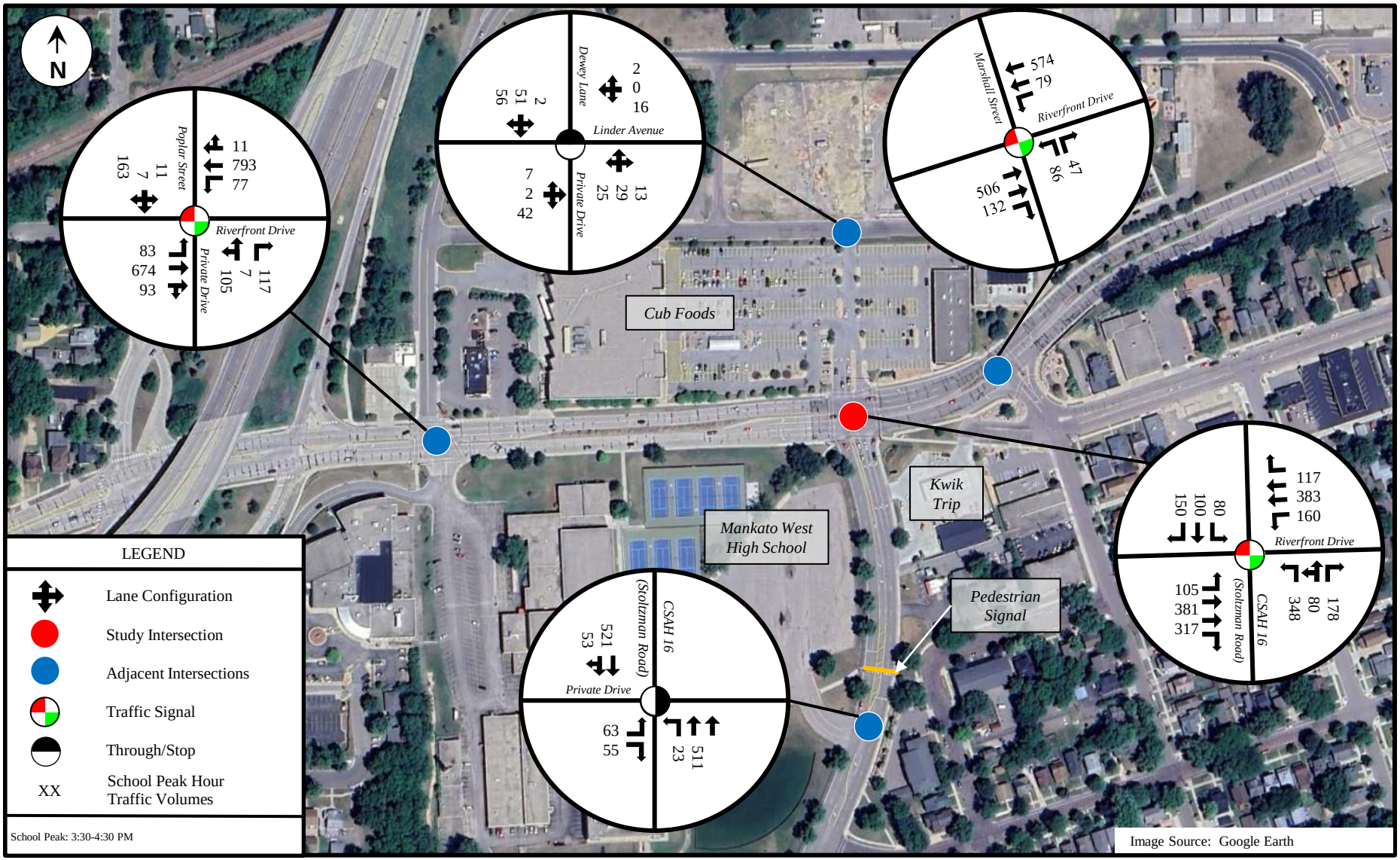
Project # 400-0147



Forecast Year 2044 Traffic Volumes (School Peak)

Riverfront Drive & CSAH 16 (Stoltzman Road) ICE
Mankato, Minnesota

Figure 11

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Warrant 1, Warrant 2, and Warrant 3 were evaluated under existing year 2024 and forecast year 2044 traffic volumes. Warrant 7 was reviewed using historical crash data but determined to not be met due to lack of correctable crashes over a 1 year period. The remaining traffic signal warrants were not applicable at the Riverfront Drive and Stoltzman Road (CSAH 16) intersection, or minimum warrant standards were not met. **Table 2** presents a summary of the MnMUTCD signal warrant analysis results. Right-turn volumes for the minor street approaches were omitted from the warrant analysis based on the recommendations in MnDOT Technical Memorandum 13-050T-02. Results of the signal warrant analysis indicate that Warrant 1, Warrant 2, and Warrant 3 are met for both existing year 2024 and forecast year 2044 traffic volumes. Detailed signal warrant analyses are included in **Appendix C**.

Table 2. Signal Warrant Analysis Summary

Volume Scenario	Warrant 1 - Eight-Hour Vehicular Volumes				Warrant 2 - Four-Hour Vehicular Volumes		Warrant 3 - Peak Hour		Warrant 7 - Crash Experience		
	1A	1B	1C	Met?	Hours	Met?	3B	Met?	7A	7B	Met?
Existing 2024	11	7	12	YES	9	YES	3	YES	1	12	NO
Forecast 2044	11	11	12	YES	10	YES	4	YES	1	12	NO

4.3 ROUNDABOUT CAPACITY ANALYSIS

A planning-level roundabout capacity analysis was completed for the Riverfront Drive and CSAH 16 (Stoltzman Road) intersection under existing year 2024 and forecast year 2044 traffic volumes for peak hour conditions and was conducted in accordance with the Highway Capacity Manual (HCM 2016). The purpose of this analysis was to determine whether a single-lane or multi-lane roundabout would be needed for the intersection under existing and forecast year traffic volumes.

Results of the roundabout capacity analysis show that existing year 2024 traffic volumes are within capacity of a single-lane roundabout. Approximately half of the movements evaluated exceed capacity of a mini-roundabout, particularly in the school and PM peak hours. Results of the roundabout capacity analysis for forecast year 2044 traffic volumes show that one approach (westbound in the PM peak hour) is expected to exceed capacity of a single-lane roundabout, with additional approaches nearing capacity (particularly during the school and PM peak hours). Results of the planning-level roundabout capacity analysis for forecast year 2044 traffic volumes are shown in **Figure 12**. Detailed planning-level roundabout capacity analyses are included in **Appendix D**.

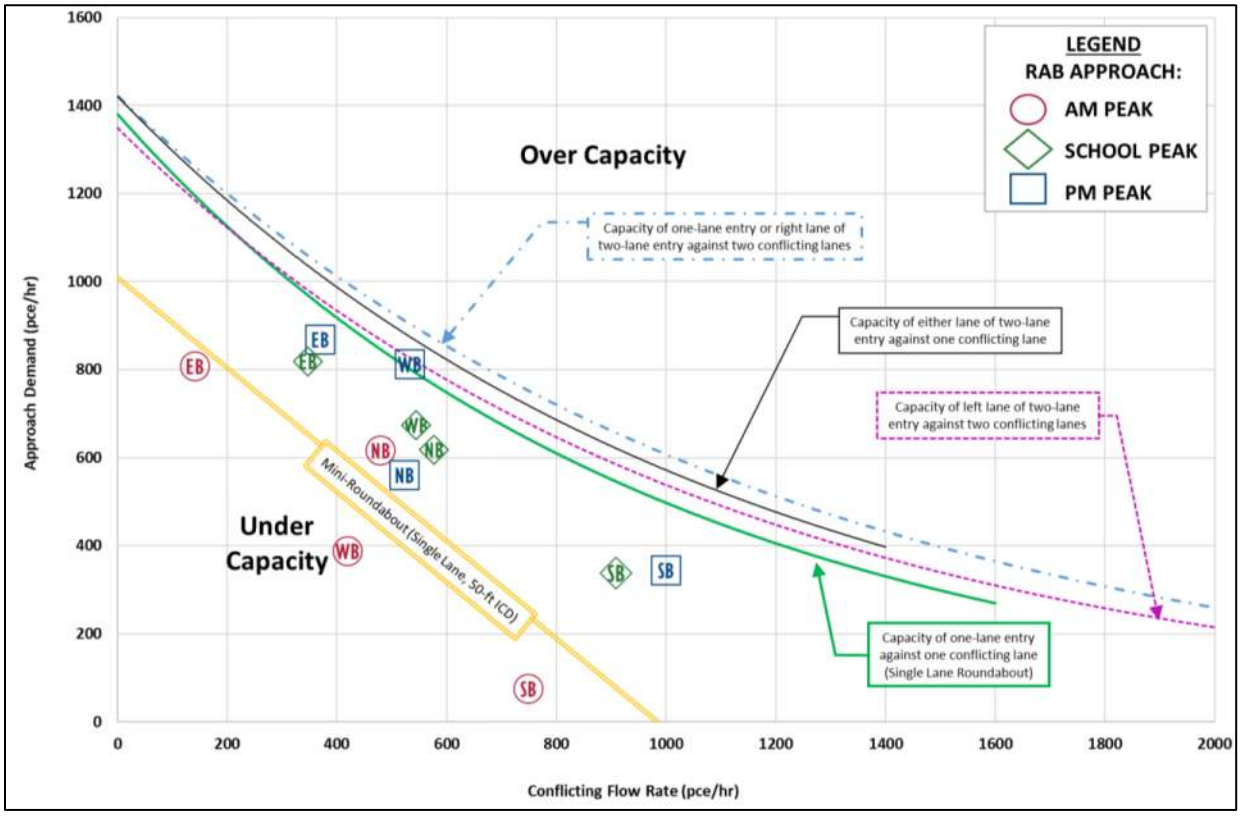

Figure 12. Forecast Year 2044 Planning-Level Roundabout Capacity Analysis

4.4 ALTERNATIVES FOR DETAILED ANALYSIS

Based on results of the preliminary alternatives analysis and discussions with the PMT and review of the 2017 Riverfront Corridor Study, the following alternatives were identified for detailed evaluation, with Alternative 0 serving as the baseline No Build condition:

- **Alternative 0 (No Build)** – Under this alternative, the existing signalized control and lane configurations would remain unchanged.
- **Alternative 1** – This alternative constructs a multi-lane roundabout with two lanes entering and exiting on the east, west, and south legs and a single lane entering and exiting on the north leg. This alternative closely resembles Option 1-2B from the 2017 Riverfront Drive Corridor Study and was revised based on forecasted traffic demands.
- **Alternative 2** – Traffic control would remain as a traffic signal but would be converted to an 8-phase signal (remove existing split phase). Flashing Yellow Arrow (FYA) would be implemented for all left-turn movements. The northbound lane configuration would be converted to one left-turn lane, one through lane, and a right-turn lane.
- **Alternative 3** – Traffic control would remain as a traffic signal but would be converted to an 8-phase signal (remove existing split phase). Flashing Yellow Arrow (FYA) would be implemented for all left turn movements. The northbound lane configuration would be converted to two left-turn lanes, a through lane, and a right-turn lane with only one southbound receiving lane. Additionally, a southbound right-turn lane would be constructed at the High School entrance. The crosswalk on the south leg of the intersection would be straightened with the relocation of the median. This alternative resembles Option 1-1A from the 2017 Riverfront Drive Corridor Study with dual northbound left-turn lanes and was revised based on forecasted traffic demands.
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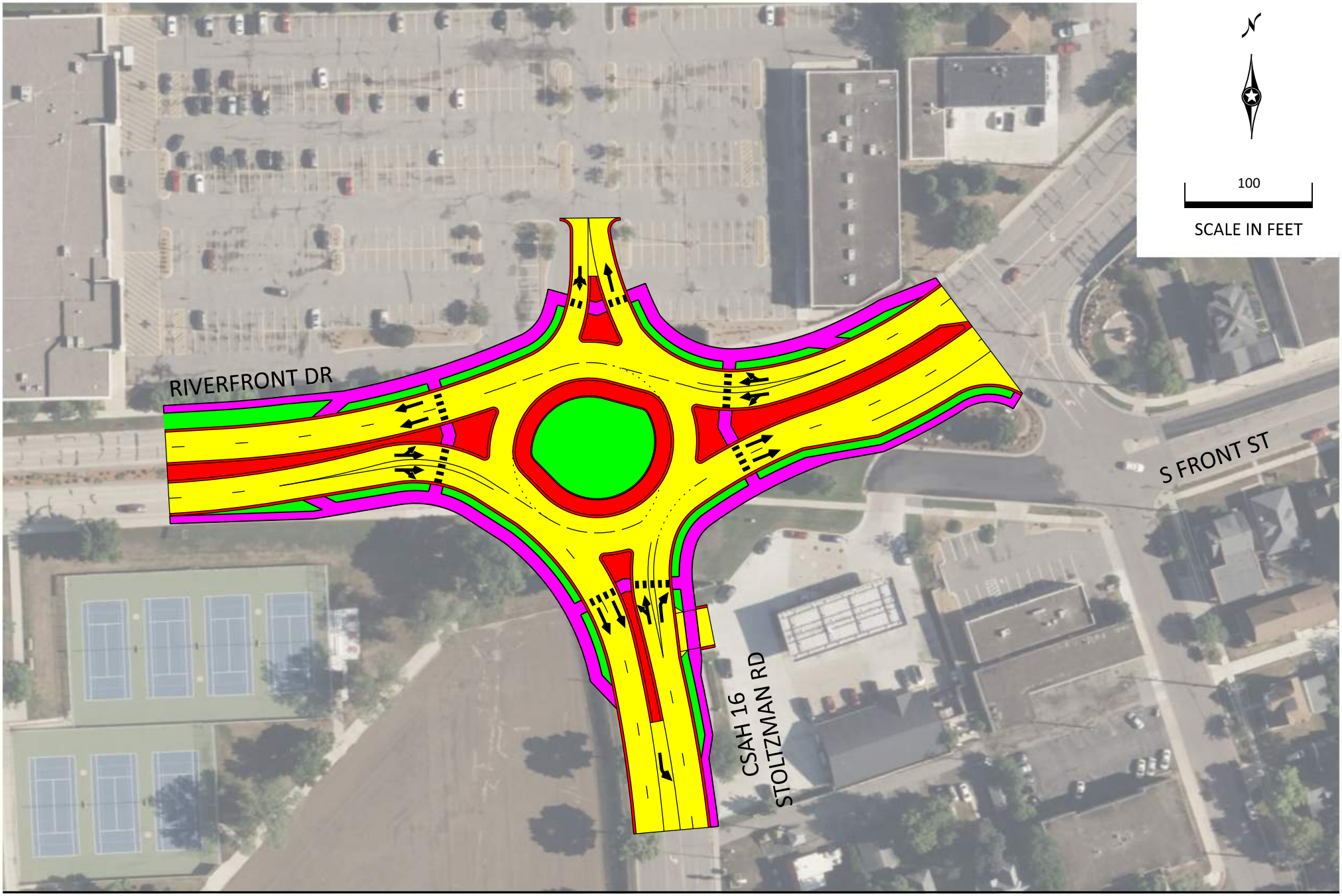
Conceptual layouts of Alternative 1, Alternative 2, and Alternative 3 are shown in **Figure 13**, **Figure 14**, and **Figure 15**, respectively.



Riverfront Drive and CSAH 16 (Stoltzman Road) ICE

Figure 13
Alternative 1 Concept Layout

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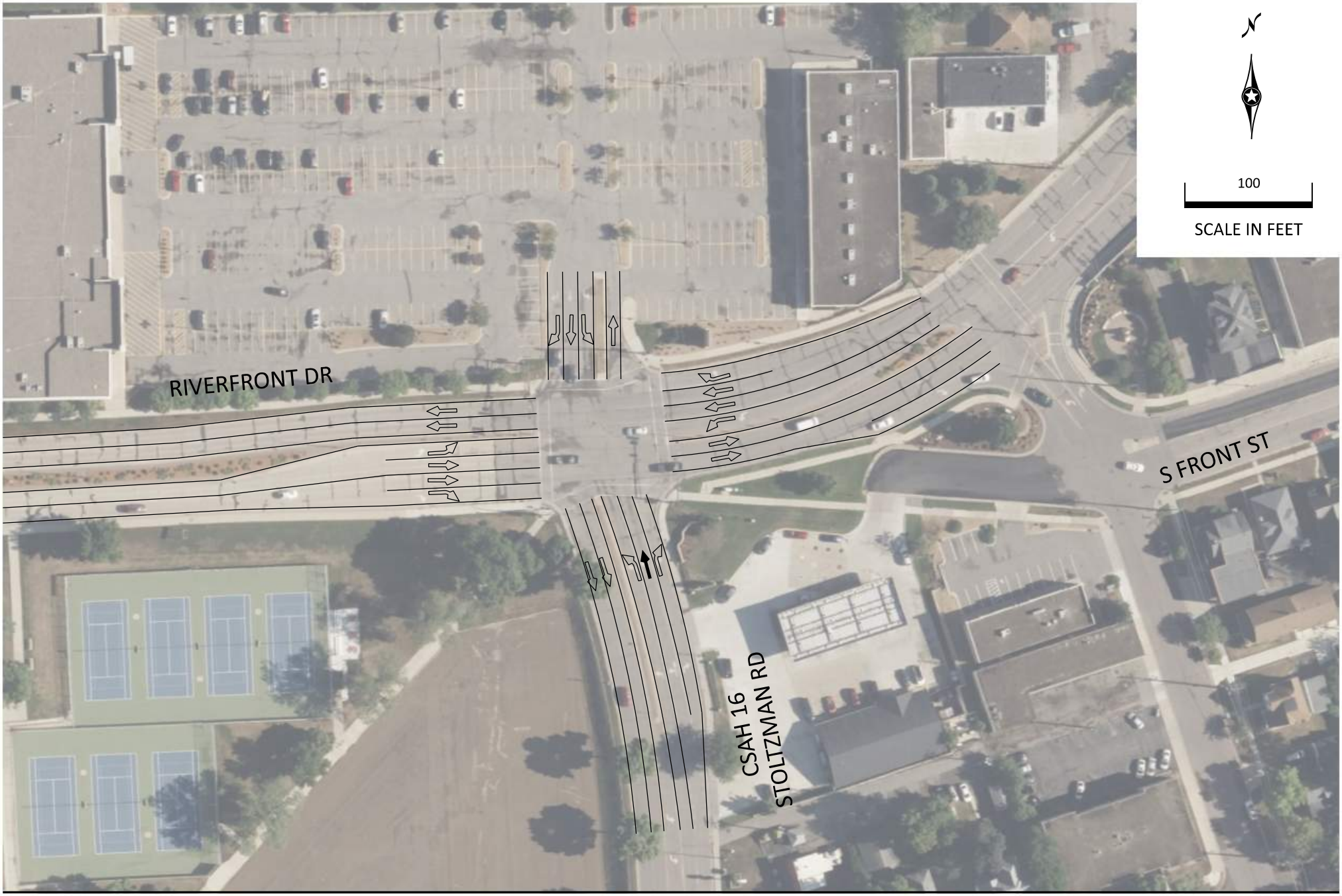

Riverfront Drive and CSAH 16 (Stoltzman Road) ICE

Figure 14
Alternative 2 Concept Layout

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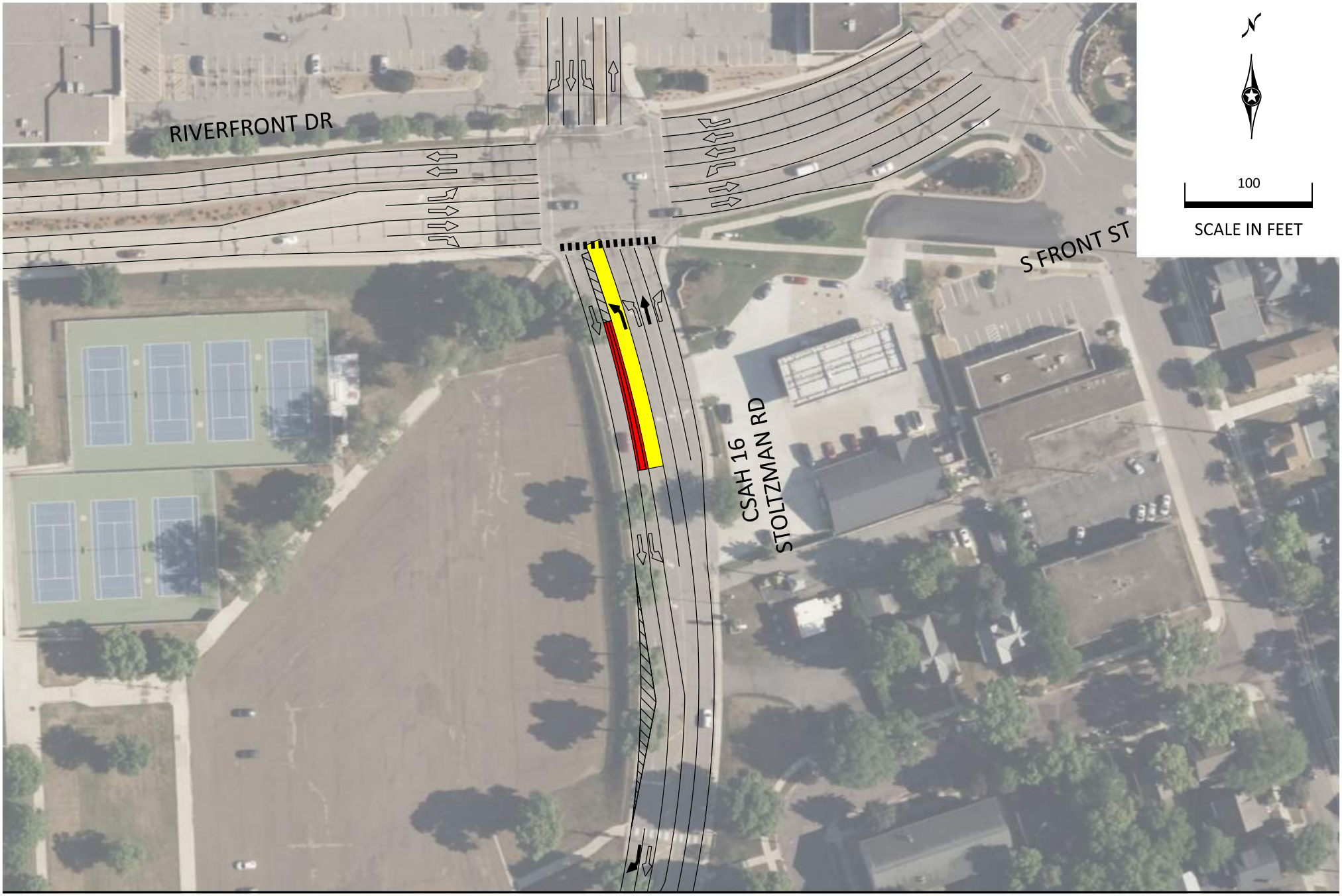

Riverfront Drive and CSAH 16 (Stoltzman Road) ICE

Figure 15
Alternative 3 Concept Layout

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4.5 SAFETY ANALYSIS

A detailed safety analysis was completed to help understand the anticipated safety improvement with each alternative. The safety analysis investigates the expected change in or elimination of crash types, evaluates the anticipated injury rate distribution, and computes a monetary annual crash cost for each alternative.

Future crashes for Alternative 1 were estimated using values given in the MnDOT Roundabout Study (Revised 2021). The crash rate and injury rate distributions for a hybrid (2x1) roundabout were applied to crash values for Alternative 1. An excerpt from the MnDOT Roundabout Study can be found in **Appendix E.**

Future crashes for Alternative 2 and Alternative 3 were estimated using a Crash Modification Factor (CMF) from the CMF Clearinghouse website. CMF ID 7696 for *change 5-section P/P left-turn to flashing yellow arrow P/P left-turn* was applied to both Alternative 2 and Alternative 3. The minor differences between Alternative 2 and Alternative 3 could not be equated to a difference in safety with the CMFs available. Therefore, Alternative 2 and Alternative 3 are expected to have the same safety operations. Further information on CMF ID 7696 is included in **Appendix F**. **Table 3** below summarizes the results of the safety analysis.

Table 3. Safety Analysis Summary

Alternative	Traffic Control	Estimated Crash Rate per MEV	Estimated Injury Rate	Estimated Crash Cost Per Year	Estimated 20-Year Safety Benefit
Alternative 0 (No Build)	Signal	0.39	41.2%	$6,800,000	-
Alternative 1	Roundabout	0.76	18.5%	$6,000,000	$790,000
Alternative 2	Signal	0.38	40.0%	$6,550,000	$250,000
Alternative 3	Signal	0.38	40.0%	$6,550,000	$250,000

4.5.1 Pedestrian and Bicyclist Safety at Urban Traffic Signals versus Roundabouts

MnDOT's Traffic Safety Evaluation of Pedestrians and Bicyclists at Roundabouts in Minnesota, published in 2022, performed a comparative analysis of pedestrian and bicycle crashes at urban traffic signals versus roundabouts with similar characteristics. The analysis was based on crash data from a five-year study period, 2017 through 2021, and evaluated the total number of crashes as well as crash rate (frequency of crashes). Results of the analysis showed that both the total number of crashes and crash rate for pedestrian and bicycle Type A (serious injury) as well as pedestrian and bicycle combined Type K (fatal) and Type A (serious injury) crashes are higher at urban signalized intersections than at multi-lane roundabouts. Overall, the total number of

pedestrian/bicycle crashes (of any crash severity type) is slightly higher at urban signalized intersections than at multi-lane roundabouts. Excerpts from the Traffic Safety Evaluation of Pedestrians and Bicyclists at Roundabouts in Minnesota (2022) are included in **Appendix G.**

4.5.2 Safety Analysis Conclusions

Conclusions of the safety analysis include the following:

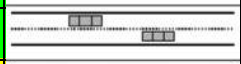
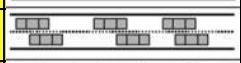
- All of the alternatives provide a reduction in injury rate from the No Build. The roundabout alternative (Alternative 1) is expected to have the lowest injury rate of the build alternatives.
- Alternative 2 and Alternative 3 will result in a reduced crash rate compared to the No Build.
- Alternative 2 and Alternative 3 are expected to have the same safety improvement compared to the No Build.
- Although roundabouts have been proven to decrease the number of injury crashes at an intersection, statewide averages show that roundabouts increase the total number of crashes but the crashes are lower in severity.
- Urban traffic signals have been found to have a higher number of K/A pedestrian/bicycle crashes and crash rate than multi-lane roundabouts (MnDOT's *Traffic Safety Evaluation of Pedestrians and Bicyclists at Roundabouts in Minnesota,* 2022).
- Urban traffic signals have been found to have a slightly higher pedestrian/bicycle total number of crashes than multi-lane roundabouts (MnDOT's *Traffic Safety Evaluation of Pedestrians and Bicyclists at Roundabouts in Minnesota,* 2022).

4.6 TRAFFIC OPERATIONS ANALYSIS

A traffic operations analysis was completed for each alternative using the forecast year 2044 peak hour traffic volumes. All alternatives were analyzed using Synchro/SimTraffic with the exception of Alternative 1 (Multi-Lane Roundabout). Alternative 1 was analyzed using HCS7 instead of Synchro/SimTraffic because Synchro/SimTraffic is not an accepted roundabout analysis tool. The purpose of this analysis is to evaluate and compare the performance of each alternative. In addition, the traffic operations analysis provides context to the need for intersection improvements based on intersection capacity.

Operations 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 average delay per vehicle, which correspond to the delay threshold values shown in **Table 4**.

Table 4. Level of Service Criteria

Level of Service		Description	Delay per Vehicle (seconds)	
			Signalized Intersection	Unsignalized Intersection
A		**Free Flow:** Low volumes and no delays.	**0 - 10**	**0 - 10**
B		**Stable Flow:** Speeds restricted by travel conditions, minor delays.	**> 10 - 20**	**> 10 - 15**
C		**Stable Flow:** Speeds and maneuverability closely controlled due to higher volumes.	**> 20 - 35**	**> 15 - 25**
D		**Stable Flow:** Speeds considerably affected by change in operating conditions. High density traffic restricts maneuverability, volume near capacity.	**> 35 - 55**	**> 25 - 35**
E		**Unstable Flow:** Low speeds, considerable delay, volume at or slightly over capacity.	**> 55 - 80**	**> 35 - 50**
F		**Forced Flow:** Very low speeds, volume exceed capacity, long delays with stop and go traffic.	**> 80**	**> 50**

Source: Highway Capacity Manual, 7th Edition, Transportation Research Board, Exhibits 19-8, 20-2, 21-8, 22-8.

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. The LOS C/D/E boundary for overall operations is generally considered an acceptable threshold for operating conditions in greater Minnesota. For side-street stop-controlled intersections, a key measure of operational effectiveness is the side-street LOS. Long delays and poor LOS can occur on side-street approaches even if the overall intersection is functioning well, making side-street LOS a valuable design criterion.

After LOS, the second component of the operations analysis is a study of vehicular queuing, or the lineup of vehicles waiting to pass through an intersection. An intersection can operate with an acceptable LOS, but if queues from the intersection block entrances to turn lanes or adjacent driveways, unsafe operation conditions could result. The 95th percentile queue, or the length of queue with only a five percent probability of being exceeded during an analysis period, is considered the standard for design purposes.

Results of the existing traffic operations analysis are shown in **Table 5**.

Table 5. Measures of Effectiveness Summary - Existing Conditions (2024)

Alternative	AM Peak Hour		School Peak Hour		PM Peak Hour	
	LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)
Existing Conditions	B / D	17.8 / 36.6	B / C	18.6 / 24.2	B / C	18.1 / 32.3

Overall Intersection LOS / Worst Approach LOS
Overall Intersection Delay / Worst Approach Delay

The intersection currently operates at overall intersection LOS B in the AM, School, and PM peak hours with worst approach LOS C-D. The worst approach for the AM peak hour is southbound with LOS D. It should be noted that southbound volumes are very low compared to the other intersection approaches. Under the School and PM peak hours, the worst approach is northbound with LOS C. It should be noted that the northbound approach experiences congestion during the AM and PM peak hours.

Results for the forecast year 2044 for each alternative are shown in **Table 6**. All alternatives are expected to operate with an acceptable level of service into the forecast year with overall intersection LOS B under School and PM peak hour volumes, and LOS A-C under AM peak hour volumes. Flashing Yellow Arrow (FYA) which is included in both Alternative 2 and Alternative 3 provides flexibility in left-turn phasing throughout the day which is expected to improve operations, especially during off-peak times. For the peak hour analysis for this study, Alternative 2 was evaluated with northbound protected-permissive left-turn phasing due to the proposed single left-turn lane and number of expected gaps in opposing traffic. Alternative 3 was analyzed with northbound protected only left-turn phasing as dual left-turn lanes typically operate protected only under high volume demand times to minimize driver confusion and crash risk. As a result, the left-turn movement and overall intersection delays are similar between Alternatives 2 and 3.

Table 6. Measures of Effectiveness Summary - Forecast Year 2044

Alternative	Traffic Control	AM Peak Hour		School Peak Hour		PM Peak Hour	
		LOS	Delay (s)	LOS	Delay (s)	LOS	Delay (s)
Alternative 0: No Build	Traffic Signal	B / D	18.9 / 37.6	B / C	19.6 / 24.1	B / C	18.8 / 31.1
Alternative 1	Roundabout	A / B	7.7 / 10.3	B / C	11.5 / 17.7	B / C	12.5 / 22.5
Alternative 2	Traffic Signal	C / D	20.8 / 36.6	B / C	18.2 / 20.9	B / C	18.3 / 24.4
Alternative 3	Traffic Signal	B / D	18.6 / 38.7	B / C	19.4 / 24.1	B / C	18.8 / 25.8

Overall Intersection LOS / Worst Approach LOS
Overall Intersection Delay / Worst Approach Delay

In addition to delay and LOS, northbound and westbound 95th percentile queues were also analyzed for each of the alternatives under forecast year 2044 traffic volumes. Results of the queueing analysis are shown in **Table 7** and **Table 8**, respectively.

Table 7. Northbound 95th Percentile Queues - Forecast Year 2044

Alternative	Traffic Control	AM Peak		School Peak		PM Peak	
		NBL	NBR	NBL	NBR	NBL	NBR
Alternative 0: No Build	Traffic Signal	222	147	201	107	193	78
Alternative 1	Roundabout	85	26	125	23	97	18
Alternative 2	Traffic Signal	462	128	246	87	290	77
Alternative 3	Traffic Signal	203	116	177	89	308	75

NBL=northbound left, NBR=northbound right

Results of the northbound queueing analysis show that the roundabout alternative (Alternative 1) is expected to have the shortest queueing distances for the northbound approach of all the alternatives, including the No Build. Alternative 2 is expected to result in a significant increase in queue for the northbound left-turn lane. This result is expected because Alternative 2 decreases the northbound left-turn lane storage by reducing the number of left-turn lanes from two to one. Alternative 3 is expected to have northbound 95th percentile queues comparable to the No Build.

Table 8. Westbound 95th Percentile Queues - Forecast Year 2044

Alternative	Traffic Control	AM Peak		School Peak		PM Peak	
		WBL	WBR	WBL	WBR	WBL	WBR
Alternative 0: No Build	Traffic Signal	81	12	117	49	148	50
Alternative 1	Roundabout	21	26	53	66	74	94
Alternative 2	Traffic Signal	83	16	108	51	129	51
Alternative 3	Traffic Signal	89	12	133	50	133	47

WBL=westbound left, WBR=westbound right

Results of the westbound queueing analysis show that 95th percentile queues do not exceed the available distance between CSAH 16 (Stoltzman Road) and Marshall Street to the east under any of the alternatives. Westbound queues from the Riverfront Drive and CSAH 16 (Stoltzman Road) intersection are not anticipated to spill back to the Marshall Street intersection under any of the proposed alternatives.

Key findings of the operations analysis are listed below:

- All alternatives are expected to operate with acceptable operations (overall intersection LOS A-C) under forecast year 2044 AM, School, and PM peak hour traffic volumes.
- Alternative 1 (Multi-Lane Roundabout) is expected to have the best operations and shortest northbound 95th percentile queues of all the alternatives including the No Build.

- Flashing Yellow Arrow (FYA) is included in both Alternative 2 and Alternative 3, which provides flexibility in left-turn phasing throughout the day and is expected to improve operations, especially during off-peak times.
- Alternative 2 was evaluated with northbound protected-permissive left-turn phasing due to the proposed single left-turn lane and number of expected gaps in opposing traffic. Alternative 3 was analyzed with northbound protected only left-turn phasing as dual left-turn lanes typically operate protected only under high volume demand times to minimize driver confusion and crash risk. As a result, the left-turn movement and overall intersection delays are similar between Alternatives 2 and 3.
- Alternative 2 is expected to have a significant increase in queue for the northbound left-turn lane as a result of reducing the number of left-turn lanes from two to one.
- Alternative 3 is expected to have northbound 95th percentile queues comparable to the No Build.
- Westbound queues from the Riverfront Drive and CSAH 16 (Stoltzman Road) intersection are not anticipated to spill back to the Marshall Street intersection under any of the proposed alternatives.

Detailed measures of effectiveness are included in **Appendix H.**

4.7 CONSTRUCTION COST ESTIMATES

High-level construction cost estimates were generated for the intersection alternatives based on a review of the intersection area, previous project experience, and concept-level preliminary layouts. Construction cost estimates are summarized in **Table 9**. These include a 30 percent contingency to account for risk or any unknowns that may not be identified without more detailed engineering. Professional fees for design and construction services as well as potential right of way costs were not included in the construction cost estimates.

Further preliminary engineering is necessary to refine the construction cost estimate to accurately account for actual construction limits, grading, wetland impacts, drainage, and other design considerations. The cost estimates shown are only intended to be used for the purpose of relative comparison within this ICE report.

Table 9. Construction Cost Estimate Summary

Alternative	Construction Cost Estimate (2024 Dollars)
Alternative 0 (No Build)	-
Alternative 1	$2,650,000
Alternative 2	$80,000
Alternative 3	$185,000

4.8 BENEFIT/COST ANALYSIS

An economic benefit/cost analysis was completed in accordance with the MnDOT Office of Investment Management, Benefit/Cost Analysis for Transportation Projects procedures, and assumes a 20-year analysis period. The benefit/cost ratio is a comparison between the estimated traffic operations and safety benefit for the intersection alternatives, the estimated construction cost, and any expected operational and maintenance cost over this period (e.g., lighting, street signs). The highest benefit/cost ratio represents the most economical solution. Benefit/cost ratios less than 1.0 may not be considered an economically viable alternative; however, they may be worth considering as a proactive long-term solution. The economic benefit/cost analyses for the intersection alternatives are summarized in **Table 10** and provided in detail in **Appendix I**.

Table 10. Benefit/Cost Analysis Summary

	Alternative 1	Alternative 2	Alternative 3
Total Traffic Operation Benefit	$ 15,669,249	$ (1,244,561)	$ 1,192,863
Total Safety Benefit	$ 783,515	$ 251,198	$ 251,198
Total Cost[1]	$ 1,911,147	$ 104,771	$ 181,306
Benefit to Cost Ratio	**8.6**	**-9.5**	**8.0**

[1] Total cost is a 20-year estimate (2024-2044) that includes the discounted construction cost plus professional fees minus the remaining capital value at the end of the analysis period.

4.9 PUBLIC ENGAGEMENT

Public engagement was an important element of this ICE. Alliant developed a project survey in early summer 2024 that was hosted on the mnmapo.org website. The survey included questions about existing intersection deficiencies and concerns and provided an opportunity to give specific feedback on conceptual improvement alternatives.

The project team hosted an open house on July 22, 2024 at the Childrens Museum. Alliant prepared a series of informational boards to present an overview of the study and ICE process, existing safety conditions, existing traffic operation conditions, and potential alternatives. Survey questions and responses, open house boards, and open house notes and feedback are included in **Appendix J**.

On October 1, 2024, MAPO conducted a project pop up at Kwik Trip immediately adjacent to the intersection. The pop-up included an overview of the project and alternatives. Attendees were asked to vote for their preferred alternative. The leading alternative was Alternative 1 with 58% of votes, followed by Alternative 3 with 22% of votes. Alternatives 2 and 0 each received 10% of votes.

4.10 ALTERNATIVES EVALUATION MATRIX

A comparison matrix summarizing the key decision factors with respect to the project goals is provided in **Table 11**. The key decision factors include:

- **Pros and Cons** – Qualitative assessment of key advantages and disadvantages of the intersection alternatives
- **Safety Evaluation** – Assessment of expected impact on motorist safety and the degree to which existing safety deficiency is improved
- **Traffic Operations Evaluation** – Documentation of anticipated future traffic operations
- **Economic Evaluation** – Construction cost estimates and benefit/cost ratios

4.11 STAKEHOLDER INFORMATION MEETINGS

Keeping key stakeholders informed throughout the study process was an important element of this ICE. The project team met with several key stakeholders throughout the duration of the project to give an overview of the study, the ICE process, review existing conditions, and to present preliminary alternative findings and results. The meetings and their dates are listed below.

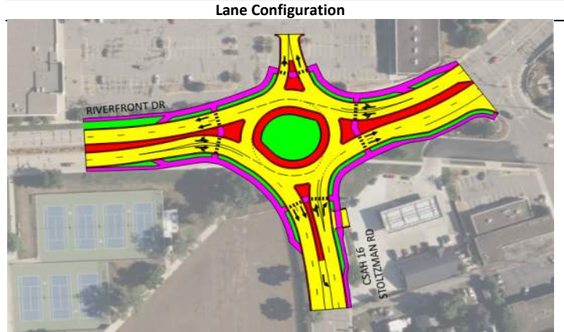
- MAPO Technical Advisory Committee Meeting – Mankato / North Mankato Area Planning Organization
  - May 5th, 2024
  - October 17th, 2024
- County Board Meeting – Blue Earth County
  - October 29th, 2024
- City Council Meeting – City of Mankato
  - November 4th, 2024
- MAPO Policy Board Meeting – Mankato / North Mankato Area Planning Organization
  - November 7th, 2024

Table 11. Alternatives Evaluation Matrix- Riverfront Drive and Stoltzman Road

Alternative 0: No Build

Lane Configuration	Characteristics	Pros and Cons	Traffic Operations Analysis	Safety Analysis	Benefit Summary
	The "No Build" alternative carries the current geometry and traffic control (traffic signal) forward.	**Pros:** 1. No construction cost 2. Familiar traffic control for the intersection 3. No R/W acquisition needed **Cons:** 1. No improvement to traffic safety or traffic operations 2. No improvement to non-motorized user facilities	**Existing Operations:** **2024 Intersection Delay (LOS) / Worst Approach Delay (LOS):** AM: 17.8 (B) / 36.6 (D) School: 18.6 (B) / 24.2 (C) PM: 18.1 (B) / 32.3 (C) **2044 Intersection Delay (LOS) / Worst Approach Delay (LOS):** AM: 18.9 (B) / 37.6 (D) School: 19.6 (B) / 24.1 (C) PM: 18.8 (B) / 31.1 (C)	**Fully or partially addressed known safety issues:** None **Unaddressed known safety issues:** 1. Rear end crashes (7 of 17 crashes) 2. Run-Off-Road crashes (3 of 17 crashes) 3. Multimodal Crashes (2 of 17 crashes) 4. Left-Turn crashes (2 of 17 crashes) **Potential new safety issues:** None **Existing Crash Rate: 0.39 crashes / MEV** **Existing Injury Rate: 41.2%**	**20-Year Operational Benefit:** N/A **20-Year Safety Benefit:** N/A **Estimated Construction Cost:** N/A **Benefit/Cost Ratio:** N/A

Alternative 1: Multi-Lane Roundabout

Lane Configuration	Characteristics	Pros and Cons	Traffic Operations Analysis	Safety Analysis	Benefit Summary
	Multi-lane roundabout with two lanes entering and exiting on the east, west, and south legs and a single lane entering and exiting on the north leg.	**Pros:** 1. Angle and left-turn crashes are effectively eliminated 2. Greatest reduction in injury rate of all alternatives 3. Best expected operations of all alternatives 4. Two-stage pedestrian crossing allows pedestrians to focus on crossing one direction of vehicular travel at a time 5. Provides traffic calming **Cons:** 1. ROW aquisition needed 2. Rear-end and sideswipe type crashes are expected to increase 3. High construction cost and full reconstruction required 4. Snow removal and maintenance concerns 5. Special design for truck turning movements 6. Multuple circulating lanes may cause confusion for drivers	**Expected Operations:** **2024 Intersection Delay (LOS) / Worst Approach Delay (LOS) :** AM: 6.8 (A) / 8.7 (A) School: 9.4 (A) / 13.3 (B) PM: 10.0 (A) / 15.8 (C) **2044 Intersection/Worst Approach:** AM: 7.7 (A) / 10.3 (B) School: 11.5 (B) / 17.7 (C) PM: 12.5 (B) / 22.5 (C)	**Fully or partially addressed known safety issues:** 1. Multimodal Crashes (2 of 17 crashes) 2. Left-Turn crashes (2 of 17 crashes) **Unaddressed known safety issues:** 1. Rear end crashes (7 of 17 crashes) 2. Run-Off-Road crashes (3 of 17 crashes) **Potential new safety issues:** 1. Frequency of rear-end and sideswipe type crashes is expected to increase **Expected Crash Rate: 0.76 crashes / MEV** **Expected Injury Rate: 18.5%**	**20-Year Operational Benefit:** **$15,669,249** **20-Year Safety Benefit:** **$783,515** **Estimated Total Cost:** **$2,650,000** **Benefit/Cost Ratio:** **8.6**

Alternative 2: Single NB left turn lane

Lane Configuration	Characteristics	Pros and Cons	Traffic Operations Analysis	Safety Analysis	Benefit Summary
	Traffic control would remain as a traffic signal, but would be converted to an 8-phase signal (remove split phasing). Flashing Yellow Arrow (FYA) would be implemented for all left turn movements. Northbound lane configuration would be converted to one left-turn lane, one through lane, and a right-turn lane.	**Pros:** 1. Does not require reconstruction 2. Driver familiarity 3. No R/W acquisition needed 4. Elimination of split phasing improves operational efficiency 5. FYA left-turn signal phasing allows for variable left-turn phasing by time of day **Cons:** 1. No improvements to multimodal safety or usability 2. Ongoing operation, maintenance, and electricity costs 3. Reducing the number of northbound left-turn lanes from 2 to 1 increases overall delay at the intersection, resulting in negative operational benefit	**Expected Operations:** **2024 Intersection Delay (LOS) / Worst Approach Delay (LOS):** AM: 18.9 (B) / 38.4 (D) School: 17.3 (B) / 22.7 (C) PM: 17.4 (B) / 26.1 (C) **2044 Intersection Delay (LOS) / Worst Approach Delay (LOS):** AM: 20.8 (C) / 36.6 (D) School: 18.2 (B) / 20.9 (C) PM: 18.3 (B) / 24.4 (C)	**Fully or partially addressed known safety issues:** 1. Left-Turn crashes (2 of 17 crashes) **Unaddressed known safety issues:** 1. Rear end crashes (7 of 17 crashes) 2. Run-Off-Road crashes (3 of 17 crashes) 3. Multimodal Crashes (2 of 17 crashes) **Potential new safety issues:** None **Expected Crash Rate: 0.38 crashes / MEV** **Expected Injury Rate: 40.0%**	**20-Year Operational Benefit:** **-$1,244,561** **20-Year Safety Benefit:** **$251,198** **Estimated Total Cost:** **$80,000** **Benefit/Cost Ratio:** **-9.5**

Table 11. Alternatives Evaluation Matrix- Riverfront Drive and Stoltzman Road

Alternative 3: Dual NB left turn lanes

Lane Configuration	Characteristics	Pros and Cons	Traffic Operations Analysis	Safety Analysis	Benefit Summary
	Traffic control would remain as a traffic signal, but would be converted to an 8-phase signal (remove split phasing). Flashing Yellow Arrow (FYA) would be implemented for all left turn movements. The northbound lane configuration would be converted to two left-turn lanes, a though lane, and a right-turn lane with only one southbound receiving lane. Additionally, a southbound right-turn lane would be constructed at the High School entrance.	**Pros:** 1. Does not require reconstruction 2. Driver familiarity 3. No R/W acquisition needed 4. Elimination of split phasing improves operational efficiency 5. Flashing Yellow Arrow (FYA) left-turn signal phasing allows for variable left-turn phasing by time of day 6. Allows for a dedicated southbound left-turn lane into Kwik Trip and a dedicated southbound right-turn lane to the High School parking lot access 7. The combination of two dedicated northbound left-turn lanes and FYA left-turn operations improves operations over the No Build 8. Reconstructed median allows for realigned pedestrian crossing **Cons:** 1. Other than the realigned crosswalk, no other improvements to multimodal safety or usability 2. Ongoing operation, maintenance, and electricity costs	**Expected Operations:** **2024 Intersection Delay (LOS) / Worst Approach Delay (LOS):** AM: 18.1 (B) / 38.7 (D) School: 17.9 (B) / 23.7 (C) PM: 18.1 (B) / 31.4 (C) **2044 Intersection Delay (LOS) / Worst Approach Delay (LOS):** AM: 18.6 (B) / 38.7 (D) School: 19.4 (B) / 24.1 (C) PM: 18.8 (B) / 25.8 (C)	**Fully or partially addressed known safety issues:** 1. Left-Turn crashes (2 of 17 crashes) **Unaddressed known safety issues:** 1. Rear end crashes (7 of 17 crashes) 2. Run-Off-Road crashes (3 of 17 crashes) 3. Multimodal Crashes (2 of 17 crashes) **Potential new safety issues:** None **Expected Crash Rate: 0.38 crashes / MEV** **Expected Injury Rate: 40.0%**	**20-Year Operational Benefit:** **$1,192,863** **20-Year Safety Benefit:** **$251,198** **Estimated Total Cost:** **$185,000** **Benefit/Cost Ratio:** **8.0**

5. Conclusions and Recommendations

The selection of the preferred alternative for the Riverfront Drive and CSAH 16 (Stoltzman Road) intersection is made based upon discussions with the PMT, results of the intersection operations and safety analyses, results of the benefit/cost analysis, input from the public, input from stakeholder groups including the City of Mankato, Blue Earth County, and the MAPO Policy Board, and consideration of the key decision factors presented in the evaluation matrix. Based on the information presented in this ICE, Alternative 1 (Multi-Lane Roundabout) is recommended to be constructed at the intersection.

Constructing Alternative 1 (Multi-Lane Roundabout) may increase the frequency of rear-end and sideswipe crashes, however, these crash types are typically of lesser severity than angle crashes. Overall, the roundabout alternative is expected to decrease the frequency of higher severity crashes. Furthermore, a roundabout will provide additional pedestrian safety over Alternatives 0, 2, and 3 by reducing the total crossing width, allowing for a two-stage crossing, and slowing vehicles entering the intersection. Pedestrian safety could be enhanced in Alternative 1 with rectangular rapid flashing beacons (RRFB) at the pedestrian crossings on each approach to the roundabout as well as the removal of one of the southbound Stoltzman Road departure lanes, which would reduce the pedestrian crossing distance of that approach. Operationally, Alternative 1 (Multi-Lane Roundabout) is expected to operate with considerably less delay and the shortest northbound 95th percentile queues of all the alternatives including the No Build. Although Alternative 1 has the highest cost, it also has the highest projected safety benefit resulting in the greatest benefit to cost ratio.

Alternative 3 (dual left turn lanes) provides a lower cost improvement option for the intersection which would maximize northbound left-turn lane capacity and straighten the crosswalk on the south leg of the intersection. Pedestrian safety could be enhanced in Alternative 3 with a review of the pedestrian clearance times and potential deployment of leading pedestrian interval (LPI) and pedestrian call on omit flashing yellow arrow (POOFYA). This alternative comes at a significantly lower cost than Alternative 1 but much smaller overall intersection delay and safety improvement.

A detailed pedestrian assessment of the Riverfront Drive and Stoltzman Road area should be completed as part of the design process for intersection improvements. The assessment should consider refinements to the selected alternative design and operation of the intersection. Pedestrian safety could be enhanced in Alternative 1 with rectangular rapid flashing beacons (RRFB) at the pedestrian crossings on each approach to the roundabout as well as the removal of one of the southbound Stoltzman Road departure lanes, which would reduce the pedestrian crossing distance of that approach. Pedestrian safety could be enhanced in Alternatives 2 and 3 with a review of the pedestrian clearance times and potential deployment of leading pedestrian interval (LPI) and pedestrian call on omit flashing yellow arrow (POOFYA). Although LPI and POOFYA are expected to

improve pedestrian safety at the intersection, it's expected that both treatments would increase vehicular delay.

Additionally, the Riverfront Drive and Marshall Street intersection should be further evaluated to determine traffic capacity and delay and determine if the selected alternative at Riverfront Drive and CSAH 16 (Stoltzman Road) would negatively impact the Marshall Street intersection due to the proximity. Eastbound approach queues at Marshall Street should be included in the evaluation to determine level of impact of queues back to the Stoltzman Road intersection. The functionality of the Riverfront Drive corridor as a whole should be reviewed and considered as part of the final design of the selected alternative.

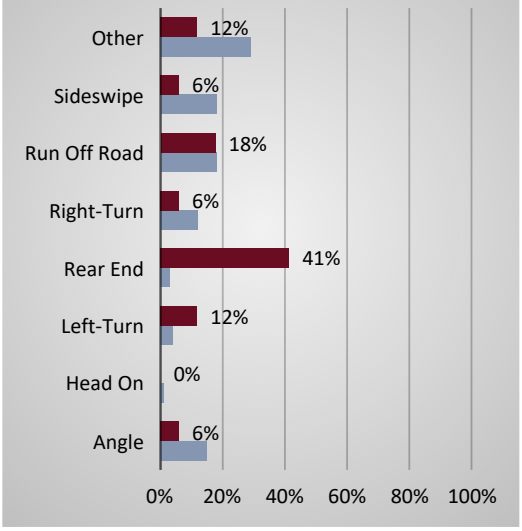
In the near term, the existing northbound approach signal indications should be revised to be compliant with the MnMUTCD.

6. Appendices

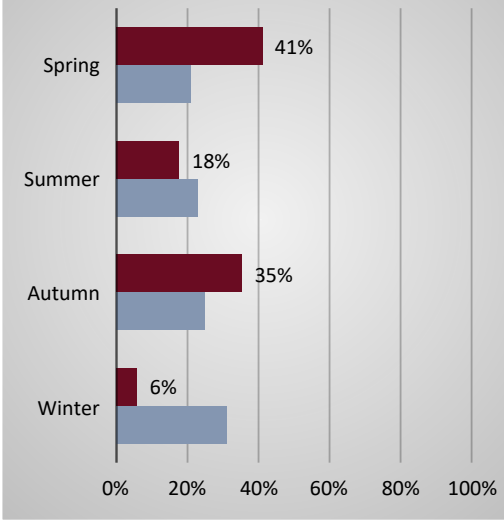
A. Detailed Crash Trend Analysis
B. Turning Movement Counts
C. Traffic Signal Warrant Analyses
D. Planning Level Roundabout Capacity Analysis
E. Excerpt from MnDOT's *A Study of the Traffic Safety at Roundabouts in Minnesota* (2021)
F. CMF ID 7696
G. Excerpt from MnDOT's *Pedestrian User Experience at Roundabouts* (2022)
H. Detailed Measures of Effectiveness
I. Detailed Benefit/Cost Analysis
J. Stakeholder Engagement Materials

Appendix A: Detailed Crash Trend Analysis

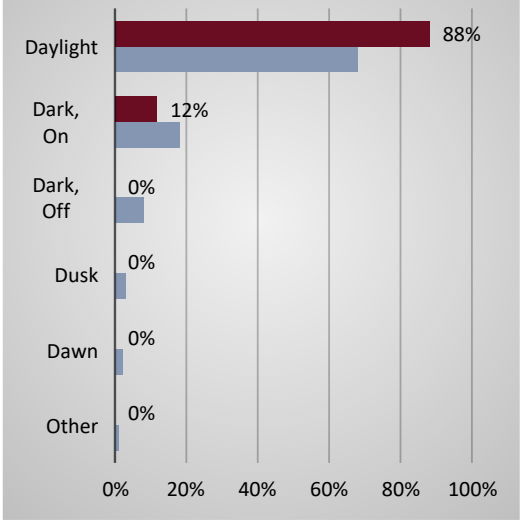
Crash Type[1]



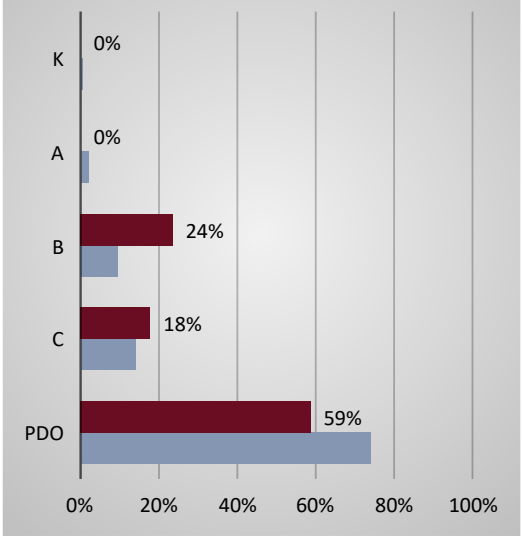
Seasonal Variation



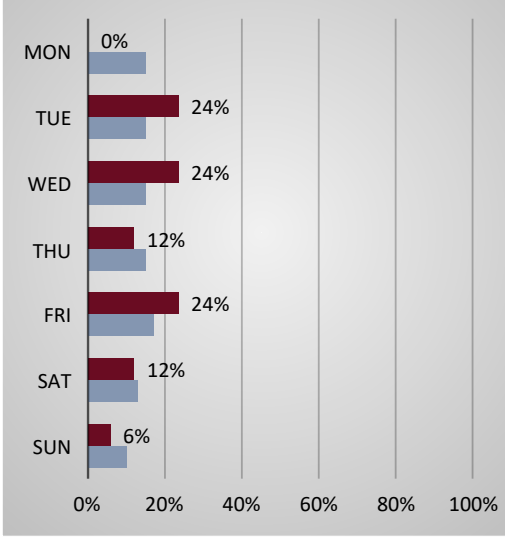
Lighting Conditions



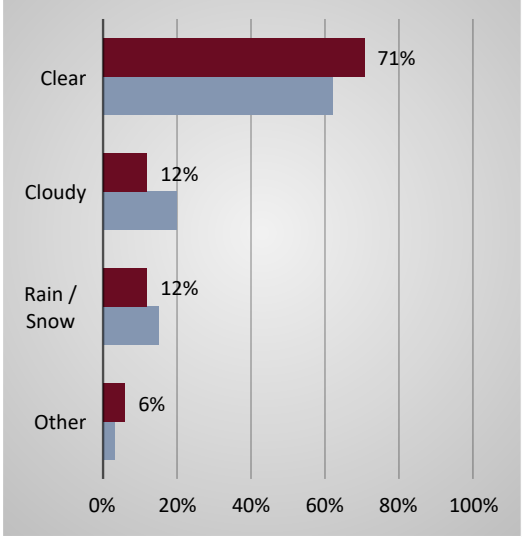
Crash Severity[2]



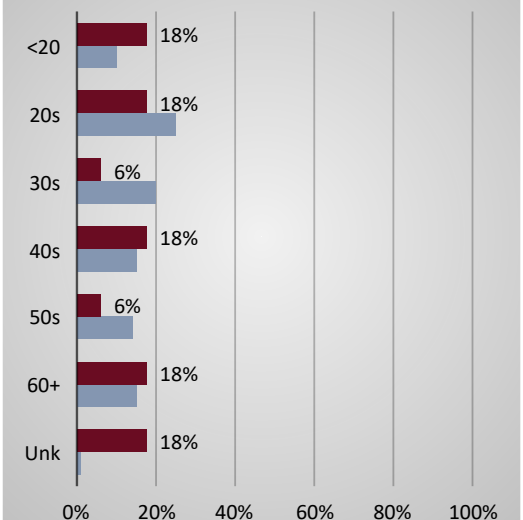
Day of Week



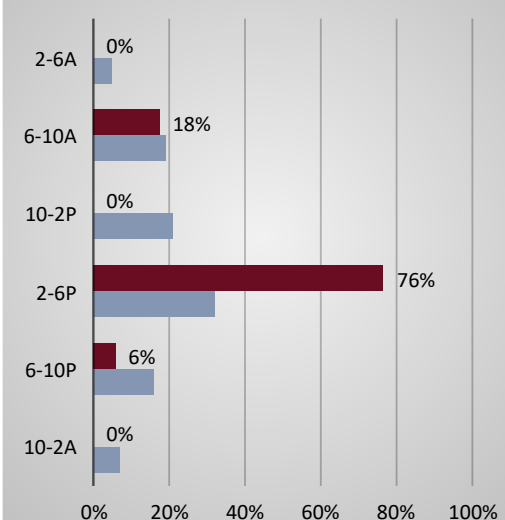
Weather Conditions



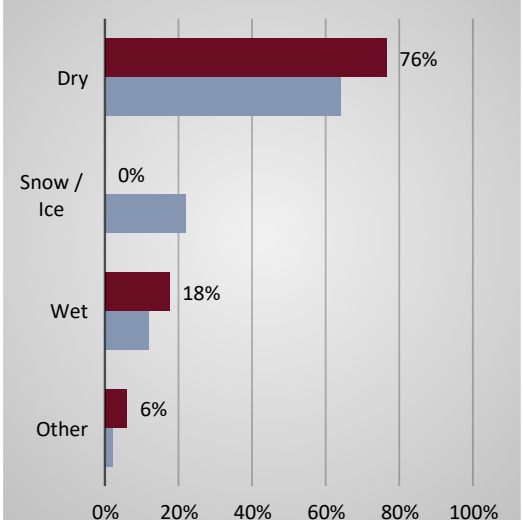
Age Group[3]



Time of Day



Surface Conditions



[1] Baseline Crash Type values were calculated using 2004-2015 data as recorded categories changed starting in 2016.

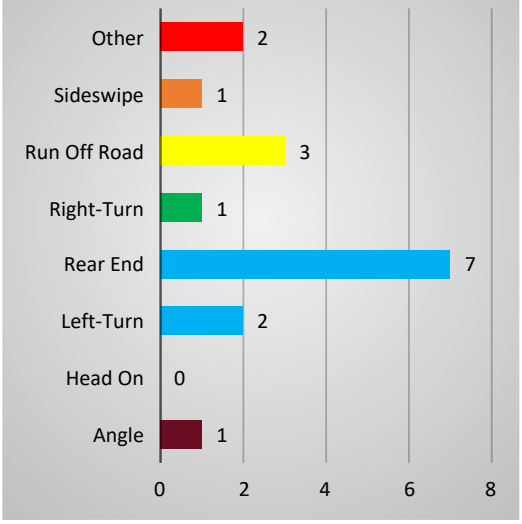
[2] Definitions for Crash Severity were changed starting in 2016, all years (2004-2019) were utilized for baseline values.

[3] Baseline Age Groups include all drivers involved in crashes, whereas intersection-specific ages are listed for at-fault drivers only.

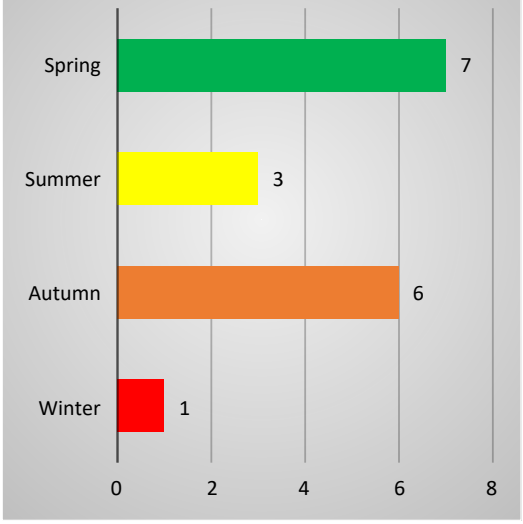
Riverfront Drive & CSAH 16 (Stoltzman Road) - Crash Breakdown

Total Number of Crashes: **17**

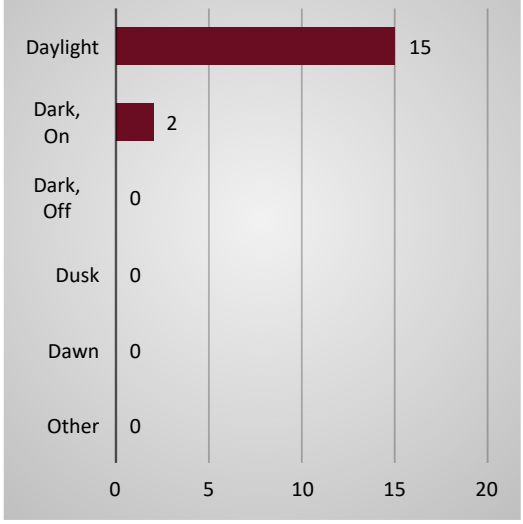
Crash Type



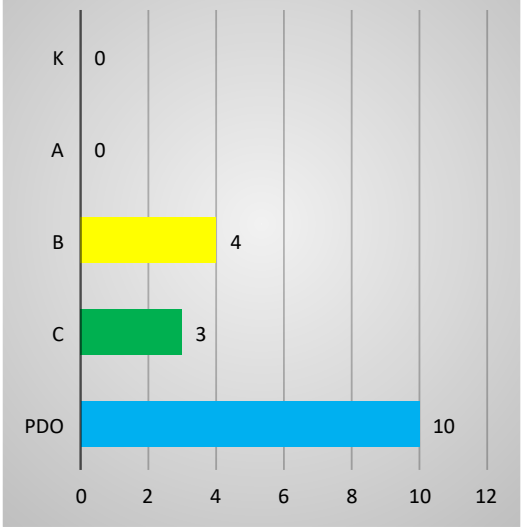
Seasonal Variation



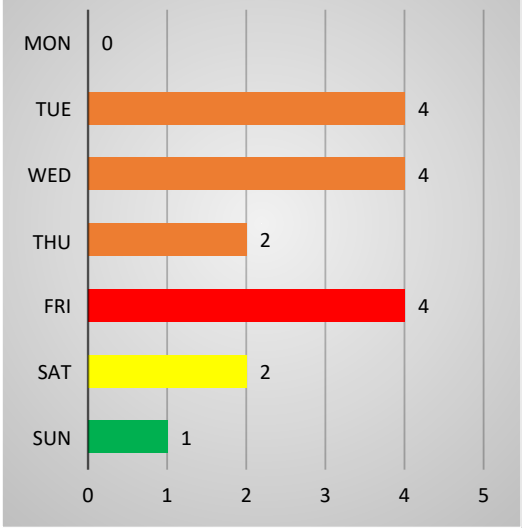
Lighting Conditions



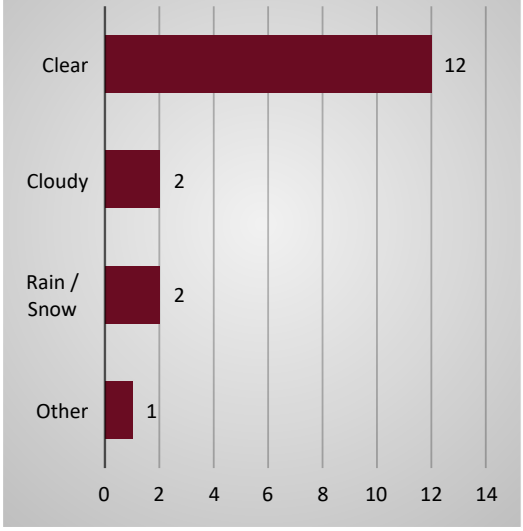
Crash Severity



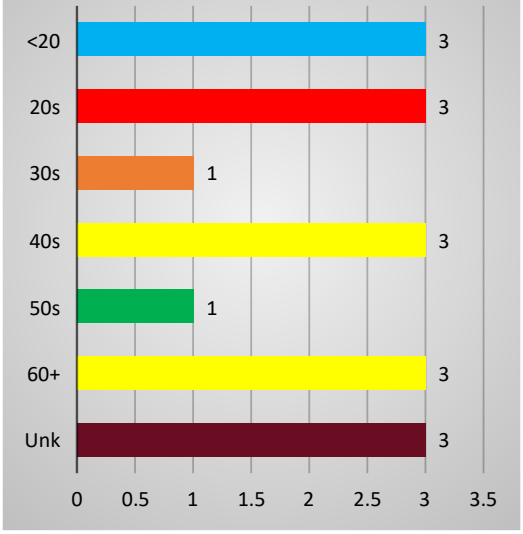
Day of Week



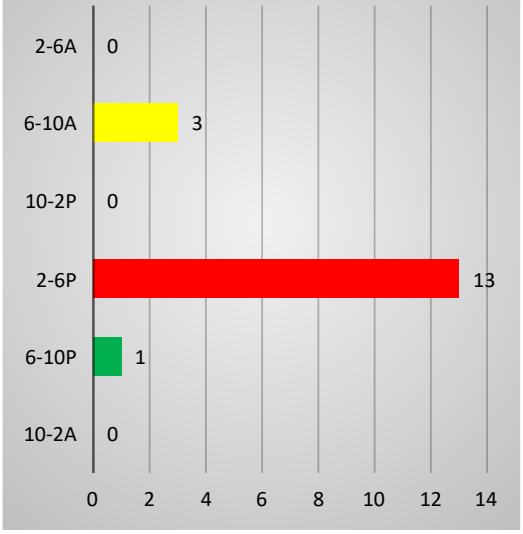
Weather Conditions



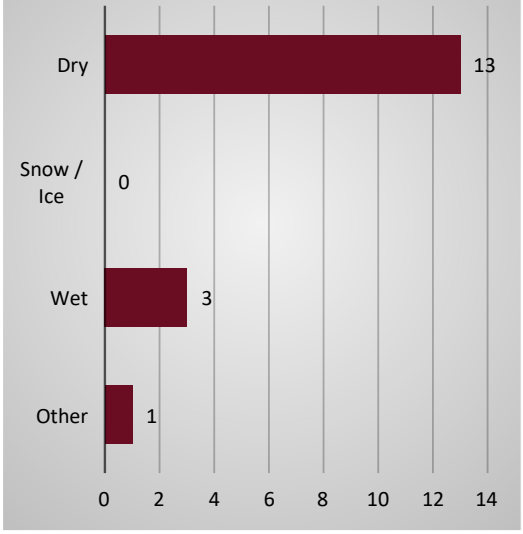
Age Group



Time of Day



Surface Conditions



Note: Known categories in the first two columns, other than Crash Severity, are color-coded highest (red-most frequent) to lowest (dark blue-least frequent) acccording to baseline values pulled from the Minnesota Motor Vehicle Crash Facts (2004-2019) as follows:

For example, typical Seasonal Variation is as follows: Winter (30% - Red), Autumn (25% - Orange), Summer (23% - Yellow), and Spring (22% - Green).

Appendix B: Turning Movement Counts

ALLIANT ENGINEERING, INC.

733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Riverfront Drive & Poplar Street
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 102
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Poplar Street Southbound						Riverfront Drive Westbound						Parking Lot Northbound						Riverfront Drive Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
6:30	--	--	--	10	**10**	--	--	3	82	1	**86**	--	--	1	1	10	**12**	1	--	13	67	8	**88**	--	196	1
6:45	--	--	--	10	**10**	--	--	8	99	--	**107**	--	--	4	--	3	**7**	--	--	17	71	6	**94**	1	218	1
Hour Total	--	--	--	20	**20**	--	--	11	181	1	**193**	--	--	5	1	13	**19**	1	--	30	138	14	**182**	1	414	2
7:00	--	2	--	5	**7**	--	--	8	90	--	**98**	--	--	7	1	9	**17**	--	--	14	73	5	**92**	--	214	--
7:15	--	4	1	13	**18**	--	--	10	102	2	**114**	--	--	7	1	9	**17**	1	--	16	86	7	**109**	--	258	1
7:30	--	2	2	12	**16**	--	1	24	121	1	**147**	1	--	2	1	11	**14**	--	--	12	152	19	**183**	--	360	1
7:45	--	3	1	24	**28**	--	--	35	166	1	**202**	--	--	9	--	16	**25**	--	--	10	183	44	**237**	--	492	--
Hour Total	--	11	4	54	**69**	--	1	77	479	4	**561**	1	--	25	3	45	**73**	1	--	52	494	75	**621**	--	1324	2
8:00	--	8	1	18	**27**	--	--	34	106	3	**143**	1	--	16	--	22	**38**	--	--	8	147	48	**203**	1	411	2
8:15	--	1	5	13	**19**	2	--	17	99	2	**118**	2	--	33	3	18	**54**	--	--	14	146	70	**230**	--	421	4
Hour Total	--	9	6	31	**46**	2	--	51	205	5	**261**	3	--	49	3	40	**92**	--	--	22	293	118	**433**	1	832	6
BREAK	--	--	--	--	**--**	--	--	--	--	--	**--**	--	--	--	--	--	**--**	--	--	--	--	--	**--**	--	--	--
14:00	--	5	--	30	**35**	1	--	24	129	2	**155**	--	--	4	--	6	**10**	2	--	16	95	5	**116**	--	316	3
14:15	--	4	--	24	**28**	3	1	14	133	1	**149**	--	--	9	--	12	**21**	--	--	12	102	7	**121**	1	319	4
14:30	--	1	1	20	**22**	--	--	13	144	--	**157**	1	--	8	1	10	**19**	--	--	13	106	11	**130**	--	328	1
14:45	--	1	2	40	**43**	2	2	14	164	2	**182**	3	--	11	1	20	**32**	--	--	16	111	10	**137**	2	394	7
Hour Total	--	11	3	114	**128**	6	3	65	570	5	**643**	4	--	32	2	48	**82**	2	--	57	414	33	**504**	3	1357	15
15:00	--	3	2	28	**33**	--	1	17	146	3	**167**	--	--	11	2	13	**26**	--	--	10	124	13	**147**	1	373	1
15:15	--	5	2	35	**42**	--	1	21	130	1	**153**	--	--	10	2	21	**33**	2	--	17	118	26	**161**	1	389	3
15:30	--	1	2	39	**42**	3	--	22	154	4	**180**	25	--	36	3	29	**68**	1	--	28	131	35	**194**	1	484	30
15:45	--	2	2	33	**37**	2	1	19	213	3	**236**	--	--	28	1	42	**71**	--	--	14	147	25	**186**	19	530	21
Hour Total	--	11	8	135	**154**	5	3	79	643	11	**736**	25	--	85	8	105	**198**	3	--	69	520	99	**688**	22	1776	55
16:00	--	3	1	42	**46**	1	1	17	172	1	**191**	3	--	24	1	17	**42**	--	--	14	160	10	**184**	14	463	18
16:15	--	3	2	32	**37**	--	--	8	167	1	**176**	--	--	6	1	14	**21**	1	--	18	165	13	**196**	12	430	13
16:30	--	3	3	48	**54**	1	1	24	187	3	**215**	1	--	13	--	6	**19**	--	--	19	153	16	**188**	--	476	2
16:45	--	5	--	28	**33**	3	2	37	191	2	**232**	--	--	15	--	27	**42**	1	1	11	167	38	**217**	7	524	11
Hour Total	--	14	6	150	**170**	5	4	86	717	7	**814**	4	--	58	2	64	**124**	2	1	62	645	77	**785**	33	1893	44
17:00	--	2	--	39	**41**	1	--	41	180	2	**223**	--	--	41	4	43	**88**	--	--	16	176	32	**224**	7	576	8
17:15	--	4	--	24	**28**	--	--	21	155	4	**180**	2	--	28	3	34	**65**	1	--	13	149	21	**183**	2	456	5
17:30	--	6	2	42	**50**	--	--	8	164	1	**173**	--	--	17	4	19	**40**	--	--	14	121	10	**145**	--	408	--
17:45	--	7	--	36	**43**	--	--	11	152	3	**166**	--	--	26	1	19	**46**	--	--	16	116	18	**150**	--	405	--
Hour Total	--	19	2	141	**162**	1	--	81	651	10	**742**	2	--	112	12	115	**239**	1	--	59	562	81	**702**	9	1845	13
Grand Total	--	75	29	645	**749**	19	11	450	3446	43	**3950**	39	--	366	31	430	**827**	10	1	351	3066	497	**3915**	69	9441	137
% of App.	0.0%	10.0%	3.9%	86.1%			0.3%	11.4%	87.2%	1.1%			0.0%	44.3%	3.7%	52.0%			0.0%	9.0%	78.3%	12.7%				
% of Total	0.0%	0.8%	0.3%	6.8%	7.9%	13.9%	0.1%	4.8%	36.5%	0.5%	41.8%	28.5%	0.0%	3.9%	0.3%	4.6%	8.8%	7.3%	0.0%	3.7%	32.5%	5.3%	41.5%	50.4%		
Cars Total	--	72	29	617	**718**	14	11	444	3399	42	**3896**	35	--	354	31	422	**807**	7	1	331	3028	487	**3847**	55	9268	111
Cars % of Movement	0.0%	96.0%	100%	95.7%	95.9%	12.6%	100%	98.7%	98.6%	97.7%	98.6%	31.5%	0.0%	96.7%	100%	98.1%	97.6%	6.3%	100%	94.3%	98.8%	98.0%	98.3%	49.5%	98.2%	
Trucks Total	--	3	--	28	**31**	5	--	6	47	1	**54**	4	--	12	--	8	**20**	3	--	20	38	10	**68**	14	173	26
Trucks % of Movement	0.0%	4.0%	0.0%	4.3%	4.1%	19.2%	0.0%	1.3%	1.4%	2.3%	1.4%	15.4%	0.0%	3.3%	0.0%	1.9%	2.4%	11.5%	0.0%	5.7%	1.2%	2.0%	1.7%	53.8%	1.8%	

ALLIANT ENGINEERING, INC.

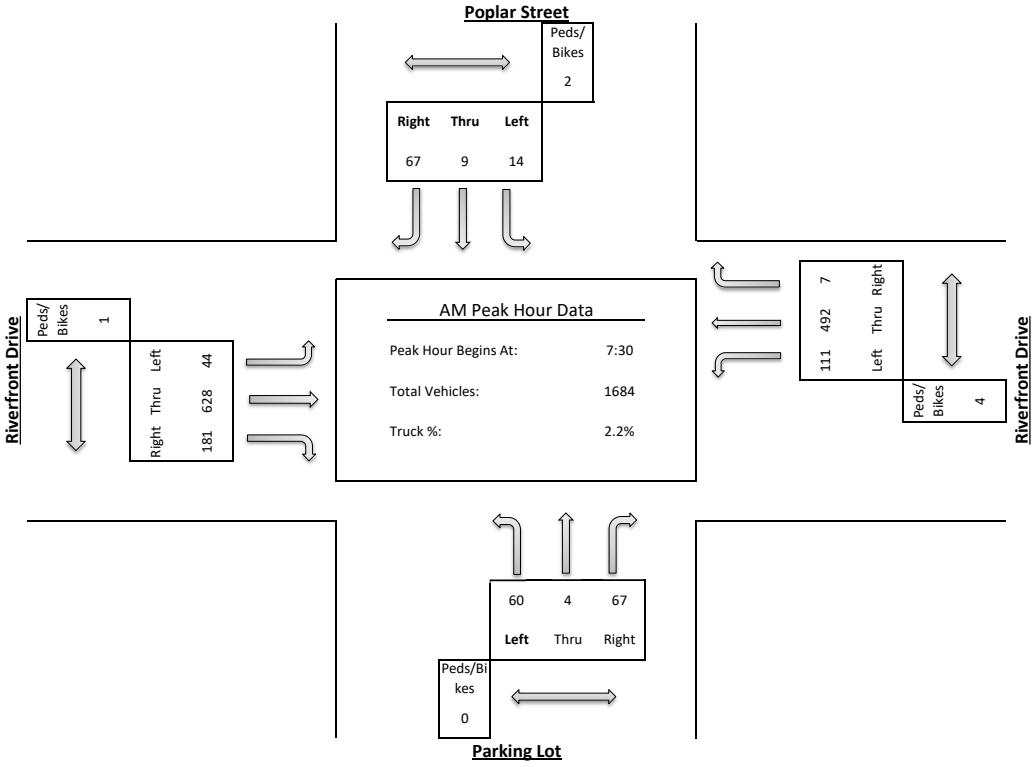
733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Riverfront Drive & Poplar Street
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 102
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Poplar Street Southbound						Riverfront Drive Westbound						Parking Lot Northbound						Riverfront Drive Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
7:30	--	2	2	12	**16**	--	1	24	121	1	**147**	1	--	2	1	11	**14**	--	--	12	152	19	**183**	--	360	1
7:45	--	3	1	24	**28**	--	--	35	166	1	**202**	--	--	9	--	16	**25**	--	--	10	183	44	**237**	--	492	--
8:00	--	8	1	18	**27**	--	--	34	106	3	**143**	1	--	16	--	22	**38**	--	--	8	147	48	**203**	1	411	2
8:15	--	1	5	13	**19**	2	--	17	99	2	**118**	2	--	33	3	18	**54**	--	--	14	146	70	**230**	--	421	4
Hour Total	--	14	9	67	**90**	2	1	110	492	7	**610**	4	--	60	4	67	**131**	--	--	44	628	181	**853**	1	1684	7
% of App.	0.0%	15.6%	10.0%	74.4%			0.2%	18.0%	80.7%	1.1%			0.0%	45.8%	3.1%	51.1%			0.0%	5.2%	73.6%	21.2%				
% of Total	0.0%	0.8%	0.5%	4.0%	5.3%	28.6%	0.1%	6.5%	29.2%	0.4%	36.2%	57.1%	0.0%	3.6%	0.2%	4.0%	7.8%	0.0%	0.0%	2.6%	37.3%	10.7%	50.7%	14.3%		
Cars Total	--	12	9	62	**83**	2	1	109	478	6	**594**	4	--	57	4	66	**127**	--	--	42	623	178	**843**	1	1647	7
Cars % of Movement	0.0%	85.7%	100%	92.5%	92.2%	28.6%	100%	99.1%	97.2%	85.7%	97.4%	57.1%	0.0%	95.0%	100%	98.5%	96.9%	0.0%	0.0%	95.5%	99.2%	98.3%	98.8%	14.3%	97.8%	
Trucks Total	--	2	--	5	**7**	--	--	1	14	1	**16**	--	--	3	--	1	**4**	--	--	2	5	3	**10**	--	37	--
Trucks % of Movement	0.0%	14.3%	0.0%	7.5%	7.8%	--	0.0%	0.9%	2.8%	14.3%	2.6%	--	0.0%	5.0%	0.0%	1.5%	3.1%	--	0.0%	4.5%	0.8%	1.7%	1.2%	--	2.2%	



ALLIANT ENGINEERING, INC.

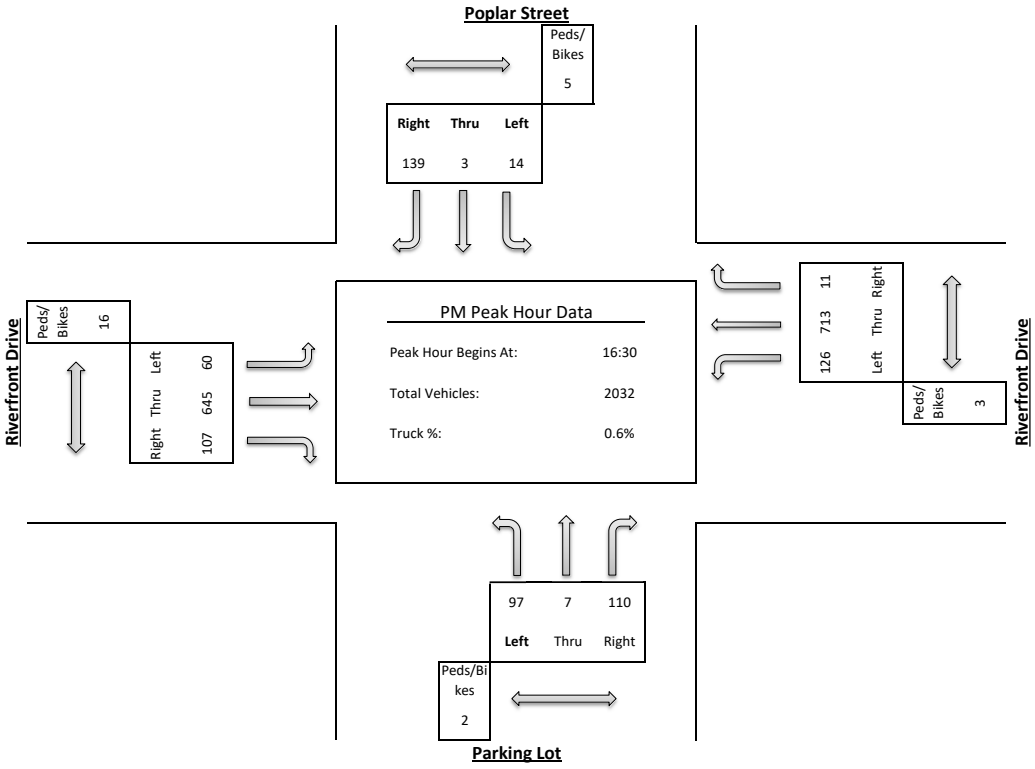
733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Riverfront Drive & Poplar Street
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 102
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Poplar Street Southbound						Riverfront Drive Westbound						Parking Lot Northbound						Riverfront Drive Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
16:30	--	3	3	48	**54**	1	1	24	187	3	**215**	1	--	13	--	6	**19**	--	--	19	153	16	**188**	--	476	2
16:45	--	5	--	28	**33**	3	2	37	191	2	**232**	--	--	15	--	27	**42**	1	1	11	167	38	**217**	7	524	11
17:00	--	2	--	39	**41**	1	--	41	180	2	**223**	--	--	41	4	43	**88**	--	--	16	176	32	**224**	7	576	8
17:15	--	4	--	24	**28**	--	--	21	155	4	**180**	2	--	28	3	34	**65**	1	--	13	149	21	**183**	2	456	5
Hour Total	--	14	3	139	**156**	5	3	123	713	11	**850**	3	--	97	7	110	**214**	2	1	59	645	107	**812**	16	2032	26
% of App.	0.0%	9.0%	1.9%	89.1%			0.4%	14.5%	83.9%	1.3%			0.0%	45.3%	3.3%	51.4%			0.1%	7.3%	79.4%	13.2%				
% of Total	0.0%	0.7%	0.1%	6.8%	7.7%	19.2%	0.1%	6.1%	35.1%	0.5%	41.8%	11.5%	0.0%	4.8%	0.3%	5.4%	10.5%	7.7%	0.0%	2.9%	31.7%	5.3%	40.0%	61.5%		
Cars Total	--	14	3	136	**153**	3	3	123	712	11	**849**	2	--	97	7	109	**213**	2	1	55	642	106	**804**	9	2019	16
Cars % of Movement	0.0%	100%	100%	97.8%	98.1%	18.8%	100%	100%	99.9%	100%	99.9%	12.5%	0.0%	100%	100%	99.1%	99.5%	12.5%	100%	93.2%	99.5%	99.1%	99.0%	56.3%	99.4%	
Trucks Total	--	--	--	3	**3**	2	--	--	1	--	**1**	1	--	--	--	1	**1**	--	--	4	3	1	**8**	7	13	10
Trucks % of Movement	0.0%	0.0%	0.0%	2.2%	1.9%	20.0%	0.0%	0.0%	0.1%	0.0%	0.1%	10.0%	0.0%	0.0%	0.0%	0.9%	0.5%	0.0%	0.0%	6.8%	0.5%	0.9%	1.0%	70.0%	0.6%	



ALLIANT ENGINEERING, INC.

733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Riverfront Drive & Stoltzman Road
Date: 4/23/2024
Duration: 0600-1900

Site Code 103
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Cub Foods Access Southbound						Riverfront Drive Westbound						Stoltzman Road Northbound						Riverfront Drive Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
6:00	--	2	3	--	**5**	--	--	2	12	3	**17**	--	--	35	3	9	**47**	--	--	4	10	12	**26**	--	95	--
6:15	--	5	1	5	**11**	--	--	4	30	4	**38**	1	--	29	1	16	**46**	1	--	6	32	19	**57**	--	152	2
6:30	--	5	2	8	**15**	1	--	5	27	1	**33**	--	--	51	4	14	**69**	1	--	3	47	27	**77**	--	194	2
6:45	--	3	6	7	**16**	5	--	5	30	2	**37**	1	--	69	4	25	**98**	--	--	4	41	27	**72**	--	223	6
Hour Total	--	15	12	20	**47**	6	--	16	99	10	**125**	2	--	184	12	64	**260**	2	--	17	130	85	**232**	--	664	10
7:00	--	3	1	4	**8**	--	--	6	33	1	**40**	--	--	62	5	14	**81**	--	--	3	52	32	**87**	--	216	--
7:15	--	5	4	6	**15**	2	--	9	54	3	**66**	1	--	72	9	43	**124**	1	--	4	51	45	**100**	--	305	4
7:30	--	5	4	5	**14**	--	--	16	57	2	**75**	--	--	70	10	57	**137**	1	1	3	94	62	**160**	--	386	1
7:45	--	8	6	8	**22**	--	--	21	80	2	**103**	--	--	124	4	69	**197**	--	--	2	135	71	**208**	--	530	--
Hour Total	--	21	15	23	**59**	2	--	52	224	8	**284**	1	--	328	28	183	**539**	2	1	12	332	210	**555**	--	1437	5
8:00	--	2	3	5	**10**	--	--	26	66	3	**95**	--	--	66	3	26	**95**	--	--	3	85	90	**178**	--	378	--
8:15	--	8	5	4	**17**	--	--	18	45	6	**69**	--	--	73	4	38	**115**	--	--	6	71	90	**167**	2	368	2
8:30	--	5	7	8	**20**	--	--	20	54	9	**83**	1	--	58	6	33	**97**	4	--	12	80	116	**208**	--	408	5
8:45	--	2	5	4	**11**	--	--	15	40	6	**61**	--	--	62	6	38	**106**	--	--	5	68	52	**125**	1	303	1
Hour Total	--	17	20	21	**58**	--	--	79	205	24	**308**	1	--	259	19	135	**413**	4	--	26	304	348	**678**	3	1457	8
9:00	--	6	6	11	**23**	--	--	15	49	4	**68**	--	--	46	6	31	**83**	1	--	7	62	47	**116**	--	290	1
9:15	--	7	8	8	**23**	--	1	22	45	12	**80**	--	1	44	7	22	**74**	--	--	6	52	54	**112**	--	289	--
9:30	--	6	9	4	**19**	--	--	28	37	8	**73**	1	--	36	2	37	**75**	1	--	6	65	54	**125**	--	292	2
9:45	--	6	2	7	**15**	--	--	16	50	13	**79**	--	1	45	12	30	**88**	--	1	7	79	26	**113**	--	295	--
Hour Total	--	25	25	30	**80**	--	1	81	181	37	**300**	1	2	171	27	120	**320**	2	1	26	258	181	**466**	--	1166	3
10:00	--	14	8	8	**30**	--	--	24	49	21	**94**	--	--	37	9	33	**79**	--	--	12	51	26	**89**	--	292	--
10:15	--	8	4	14	**26**	--	--	20	47	18	**85**	--	--	23	5	21	**49**	--	--	11	60	47	**118**	1	278	1
10:30	--	10	17	10	**37**	--	--	13	66	16	**95**	1	--	42	7	27	**76**	2	--	7	58	69	**134**	--	342	3
10:45	--	14	12	14	**40**	--	--	19	59	13	**91**	--	--	38	3	21	**62**	1	--	16	74	54	**144**	--	337	1
Hour Total	--	46	41	46	**133**	--	--	76	221	68	**365**	1	--	140	24	102	**266**	3	--	46	243	196	**485**	1	1249	5
11:00	--	10	9	16	**35**	1	--	23	55	18	**96**	--	--	45	3	27	**75**	1	--	10	70	35	**115**	--	321	2
11:15	--	13	14	17	**44**	2	--	21	62	13	**96**	--	--	38	11	33	**82**	--	1	20	82	35	**138**	--	360	2
11:30	--	13	16	8	**37**	4	--	28	85	16	**129**	4	--	47	5	30	**82**	14	--	14	71	64	**149**	2	397	24
11:45	--	5	11	15	**31**	6	--	20	60	14	**94**	--	--	48	12	30	**90**	12	--	10	86	44	**140**	2	355	20
Hour Total	--	41	50	56	**147**	13	--	92	262	61	**415**	4	--	178	31	120	**329**	27	1	54	309	178	**542**	4	1433	48
12:00	--	8	7	21	**36**	--	--	29	87	16	**132**	1	--	53	8	32	**93**	3	--	12	76	62	**150**	--	411	4
12:15	--	9	9	21	**39**	--	--	34	69	16	**119**	--	--	46	12	39	**97**	2	--	9	57	37	**103**	--	358	2
12:30	--	12	6	6	**24**	--	--	28	68	20	**116**	1	--	59	8	47	**114**	6	--	6	78	49	**133**	1	387	8
12:45	--	11	6	17	**34**	--	--	25	77	17	**119**	--	--	62	10	43	**115**	2	--	9	51	57	**117**	1	385	3
Hour Total	--	40	28	65	**133**	--	--	116	301	69	**486**	2	--	220	38	161	**419**	13	--	36	262	205	**503**	2	1541	17
13:00	--	10	7	22	**39**	--	--	31	65	17	**113**	--	--	51	5	32	**88**	--	--	16	57	51	**124**	--	364	--
13:15	--	20	14	11	**45**	2	--	24	55	13	**92**	1	--	46	4	37	**87**	2	--	10	55	49	**114**	--	338	5
13:30	--	11	9	11	**31**	1	--	21	48	21	**90**	2	--	53	10	35	**98**	1	--	16	57	36	**109**	--	328	4
13:45	--	13	21	20	**54**	--	--	24	74	21	**119**	--	1	85	19	36	**141**	1	--	14	57	45	**116**	1	430	2
Hour Total	--	54	51	64	**169**	3	--	100	242	72	**414**	3	1	235	38	140	**414**	4	--	56	226	181	**463**	1	1460	11
14:00	--	13	10	22	**45**	3	--	24	76	25	**125**	2	--	56	11	37	**104**	3	--	6	54	45	**105**	2	379	10
14:15	--	11	11	23	**45**	1	--	32	60	17	**109**	--	--	69	17	29	**115**	--	--	14	54	51	**119**	--	388	1
14:30	--	16	12	22	**50**	1	--	34	69	16	**119**	--	--	68	10	54	**132**	1	--	10	56	45	**111**	--	412	2
14:45	--	21	7	20	**48**	--	--	22	76	12	**110**	3	--	83	15	54	**152**	--	--	17	69	48	**134**	--	444	3
Hour Total	--	61	40	87	**188**	5	--	112	281	70	**463**	5	--	276	53	174	**503**	4	--	47	233	189	**469**	2	1623	16
15:00	--	9	13	24	**46**	--	--	38	78	26	**142**	--	--	68	16	38	**122**	--	--	18	65	65	**148**	--	458	--
15:15	--	12	16	16	**44**	--	--	32	72	12	**116**	--	--	71	8	30	**109**	3	--	19	69	48	**136**	--	405	3
15:30	--	22	12	26	**60**	--	--	33	77	26	**136**	--	--	84	18	37	**139**	6	--	15	83	65	**163**	5	498	11
15:45	--	15	23	33	**71**	1	--	27	83	29	**139**	2	--	107	16	41	**164**	--	--	22	100	77	**199**	1	573	4
Hour Total	--	58	64	99	**221**	1	--	130	310	93	**533**	2	--	330	58	146	**534**	9	--	74	317	255	**646**	6	1934	18
16:00	--	19	27	37	**83**	--	--	37	107	35	**179**	1	--	62	20	45	**127**	--	--	29	84	72	**185**	1	574	2
16:15	--	15	27	39	**81**	1	--	47	79	15	**141**	--	--	61	18	37	**116**	4	--	28	77	72	**177**	--	515	5
16:30	--	11	23	35	**69**	2	--	51	108	34	**193**	17	--	86	19	29	**134**	1	--	30	67	68	**165**	--	561	20
16:45	--	14	24	39	**77**	3	--	44	113	24	**181**	2	--	73	16	36	**125**	20	--	24	83	101	**208**	--	591	25
Hour Total	--	59	101	150	**310**	6	--	179	407	108	**694**	20	--	282	73	147	**502**	25	--	111	311	313	**735**	1	2241	52
17:00	--	11	26	44	**81**	--	--	45	111	42	**198**	--	--	76	17	35	**128**	1	--	27	81	102	**210**	1	617	2
17:15	--	19	20	38	**77**	--	--	38	70	36	**144**	--	--	69	11	30	**110**	1	--	24	71	89	**184**	--	515	1
17:30	--	22	24	30	**76**	1	--	42	76	27	**145**	1	--	71	12	22	**105**	2	--	23	76	56	**155**	--	481	4
17:45	--	18	15	30	**63**	--	--	34	63	31	**128**	--	--	79	13	20	**112**	--	--	28	58	47	**133**	--	436	--
Hour Total	--	70	85	142	**297**	1	--	159	320	136	**615**	1	--	295	53	107	**455**	4	--	102	286	294	**682**	1	2049	7
18:00	--	19	15	34	**68**	--	--	28	56	22	**106**	2	--	52	19	29	**100**	--	--	15	57	70	**142**	1	416	3
18:15	--	21	16	18	**55**	2	--	28	59	21	**108**	3	--	56	11	42	**109**	--	--	17	61	48	**126**	--	398	5
18:30	--	11	13	19	**43**	3	--	22	63	22	**107**	--	--	46	11	19	**76**	2	--	17	42	52	**111**	--	337	5
18:45	--	12	12	21	**45**	--	--	26	45	13	**84**	--	--	42	15	15	**72**	1	1	12	41	39	**93**	--	294	1
Hour Total	--	63	56	92	**211**	5	--	104	223	78	**405**	5	--	196	56	105	**357**	3	1	61	201	209	**472**	1	1445	14
Grand Total	--	570	588	895	**2053**	42	1	1296	3276	834	**5407**	48	3	3094	510	1704	**5311**	102	4	668	3412	2844	**6928**	22	19699	214
% of App.	0.0%	27.8%	28.6%	43.6%			0.0%	24.0%	60.6%	15.4%			0.1%	58.3%	9.6%	32.1%			0.1%	9.6%	49.2%	41.1%				
% of Total	0.0%	2.9%	3.0%	4.5%	10.4%	19.6%	0.0%	6.6%	16.6%	4.2%	27.4%	22.4%	0.0%	15.7%	2.6%	8.7%	27.0%	47.7%	0.0%	3.4%	17.3%	14.4%	35.2%	10.3%		
Cars Total	--	563	584	891	**2038**	37	1	1278	3212	815	**5306**	37	3	3037	505	1681	**5226**	89	4	663	3353	2788	**6808**	21	19378	184
Cars % of Movement	0.0%	98.8%	99.3%	99.6%	99.3%	20.1%	100%	98.6%	98.0%	97.7%	98.1%	20.1%	100%	98.2%	99.0%	98.7%	98.4%	48.4%	100%	99.3%	98.3%	98.0%	98.3%	11.4%	98.4%	
Trucks Total	--	7	4	4	**15**	5	--	18	64	19	**101**	11	--	57	5	23	**85**	13	--	5	59	56	**120**	1	321	30
Trucks % of Movement	0.0%	1.2%	0.7%	0.4%	0.7%	16.7%	0.0%	1.4%	2.0%	2.3%	1.9%	36.7%	0.0%	1.8%	1.0%	1.3%	1.6%	43.3%	0.0%	0.7%	1.7%	2.0%	1.7%	3.3%	1.6%	

ALLIANT ENGINEERING, INC.

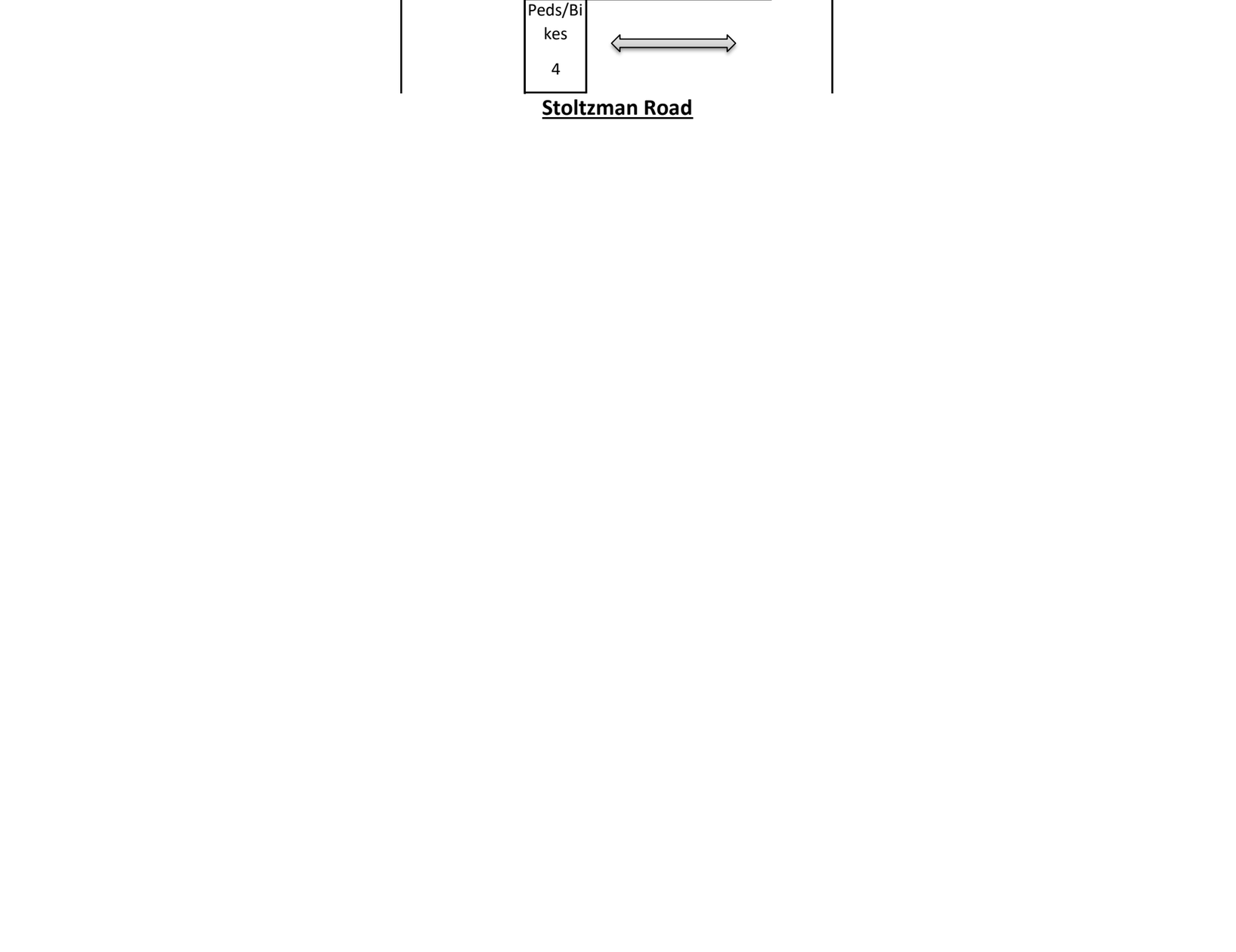
733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Riverfront Drive & Stoltzman Road
Date: 4/23/2024
Duration: 0600-1900

Site Code 103
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Cub Foods Access Southbound						Riverfront Drive Westbound						Stoltzman Road Northbound						Riverfront Drive Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
7:45	--	8	6	8	**22**	--	--	21	80	2	**103**	--	--	124	4	69	**197**	--	--	2	135	71	**208**	--	530	--
8:00	--	2	3	5	**10**	--	--	26	66	3	**95**	--	--	66	3	26	**95**	--	--	3	85	90	**178**	--	378	--
8:15	--	8	5	4	**17**	--	--	18	45	6	**69**	--	--	73	4	38	**115**	--	--	6	71	90	**167**	2	368	2
8:30	--	5	7	8	**20**	--	--	20	54	9	**83**	1	--	58	6	33	**97**	4	--	12	80	116	**208**	--	408	5
Hour Total	--	23	21	25	**69**	--	--	85	245	20	**350**	1	--	321	17	166	**504**	4	--	23	371	367	**761**	2	1684	7
% of App.	0.0%	33.3%	30.4%	36.2%			0.0%	24.3%	70.0%	5.7%			0.0%	63.7%	3.4%	32.9%			0.0%	3.0%	48.8%	48.2%				
% of Total	0.0%	1.4%	1.2%	1.5%	4.1%	0.0%	0.0%	5.0%	14.5%	1.2%	20.8%	14.3%	0.0%	19.1%	1.0%	9.9%	29.9%	57.1%	0.0%	1.4%	22.0%	21.8%	45.2%	28.6%		
Cars Total	--	23	21	25	**69**	--	--	82	238	20	**340**	1	--	311	15	162	**488**	4	--	23	368	355	**746**	2	1643	7
Cars % of Movement	0.0%	100%	100%	100%	100%	0.0%	0.0%	96.5%	97.1%	100%	97.1%	14.3%	0.0%	96.9%	88.2%	97.6%	96.8%	57.1%	0.0%	100%	99.2%	96.7%	98.0%	28.6%	97.6%	
Trucks Total	--	--	--	--	**0**	--	--	3	7	--	**10**	--	--	10	2	4	**16**	--	--	--	3	12	**15**	--	41	--
Trucks % of Movement	0.0%	0.0%	0.0%	0.0%	0.0%	--	0.0%	3.5%	2.9%	0.0%	2.9%	--	0.0%	3.1%	11.8%	2.4%	3.2%	--	0.0%	0.0%	0.8%	3.3%	2.0%	--	2.4%	



ALLIANT ENGINEERING, INC.

733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Riverfront Drive & Stoltzman Road
Date: 4/23/2024
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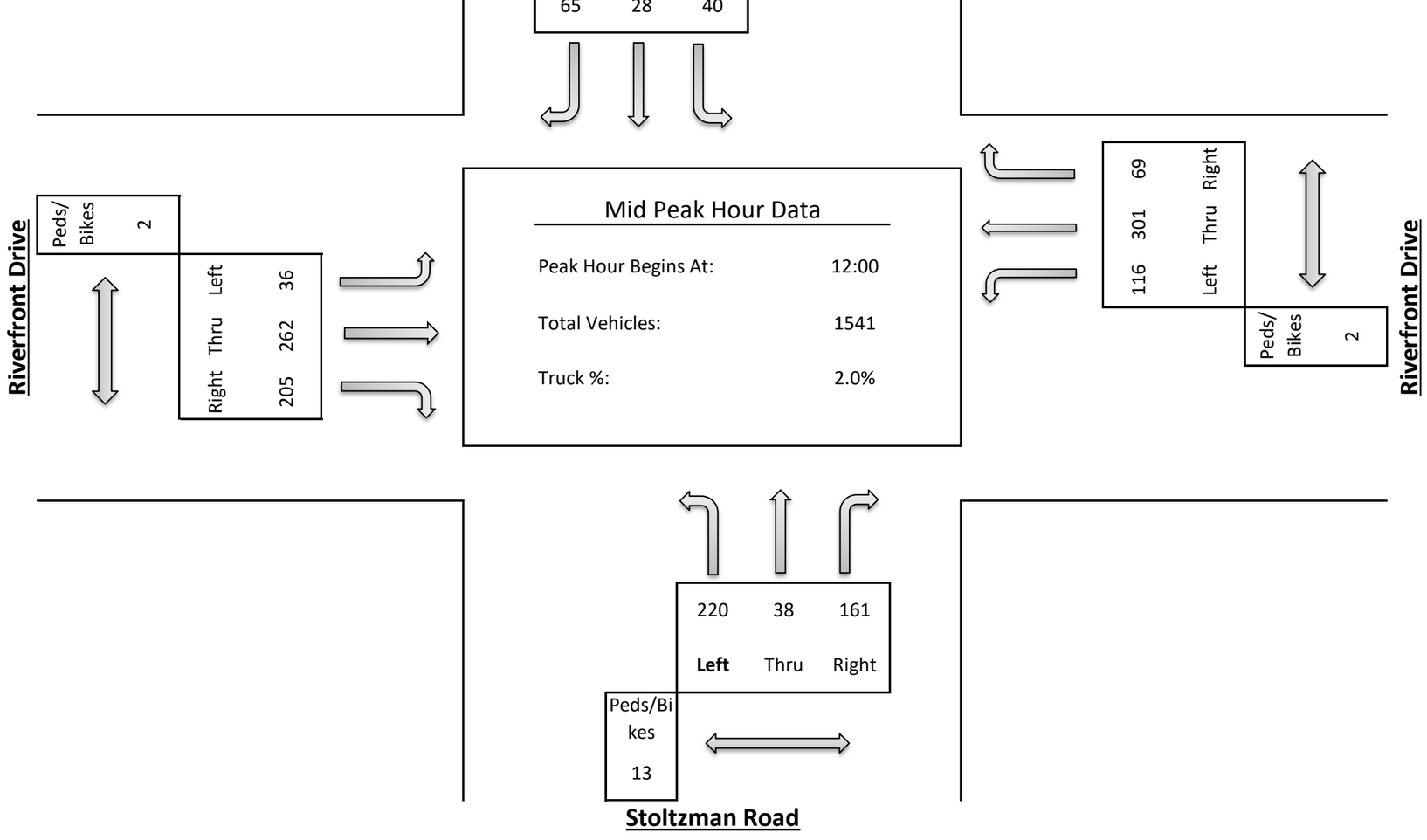
Site Code 103
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Cub Foods Access Southbound						Riverfront Drive Westbound						Stoltzman Road Northbound						Riverfront Drive Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
12:00	--	8	7	21	**36**	--	--	29	87	16	**132**	1	--	53	8	32	**93**	3	--	12	76	62	**150**	--	411	4
12:15	--	9	9	21	**39**	--	--	34	69	16	**119**	--	--	46	12	39	**97**	2	--	9	57	37	**103**	--	358	2
12:30	--	12	6	6	**24**	--	--	28	68	20	**116**	1	--	59	8	47	**114**	6	--	6	78	49	**133**	1	387	8
12:45	--	11	6	17	**34**	--	--	25	77	17	**119**	--	--	62	10	43	**115**	2	--	9	51	57	**117**	1	385	3
Hour Total	--	40	28	65	**133**	--	--	116	301	69	**486**	2	--	220	38	161	**419**	13	--	36	262	205	**503**	2	1541	17
% of App.	0.0%	30.1%	21.1%	48.9%			0.0%	23.9%	61.9%	14.2%			0.0%	52.5%	9.1%	38.4%			0.0%	7.2%	52.1%	40.8%				
% of Total	0.0%	2.6%	1.8%	4.2%	8.6%	0.0%	0.0%	7.5%	19.5%	4.5%	31.5%	11.8%	0.0%	14.3%	2.5%	10.4%	27.2%	76.5%	0.0%	2.3%	17.0%	13.3%	32.6%	11.8%		
Cars Total	--	40	28	64	**132**	--	--	115	295	67	**477**	1	--	215	38	156	**409**	13	--	36	254	202	**492**	2	1510	16
Cars % of Movement	0.0%	100%	100%	98.5%	99.2%	0.0%	0.0%	99.1%	98.0%	97.1%	98.1%	6.3%	0.0%	97.7%	100%	96.9%	97.6%	81.3%	0.0%	100%	96.9%	98.5%	97.8%	12.5%	98.0%	
Trucks Total	--	--	--	1	**1**	--	--	1	6	2	**9**	1	--	5	--	5	**10**	--	--	--	8	3	**11**	--	31	1
Trucks % of Movement	0.0%	0.0%	0.0%	1.5%	0.8%	0.0%	0.0%	0.9%	2.0%	2.9%	1.9%	100.0%	0.0%	2.3%	0.0%	3.1%	2.4%	0.0%	0.0%	0.0%	3.1%	1.5%	2.2%	0.0%	2.0%	



ALLIANT ENGINEERING, INC.

733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Riverfront Drive & Stoltzman Road
Date: 4/23/2024
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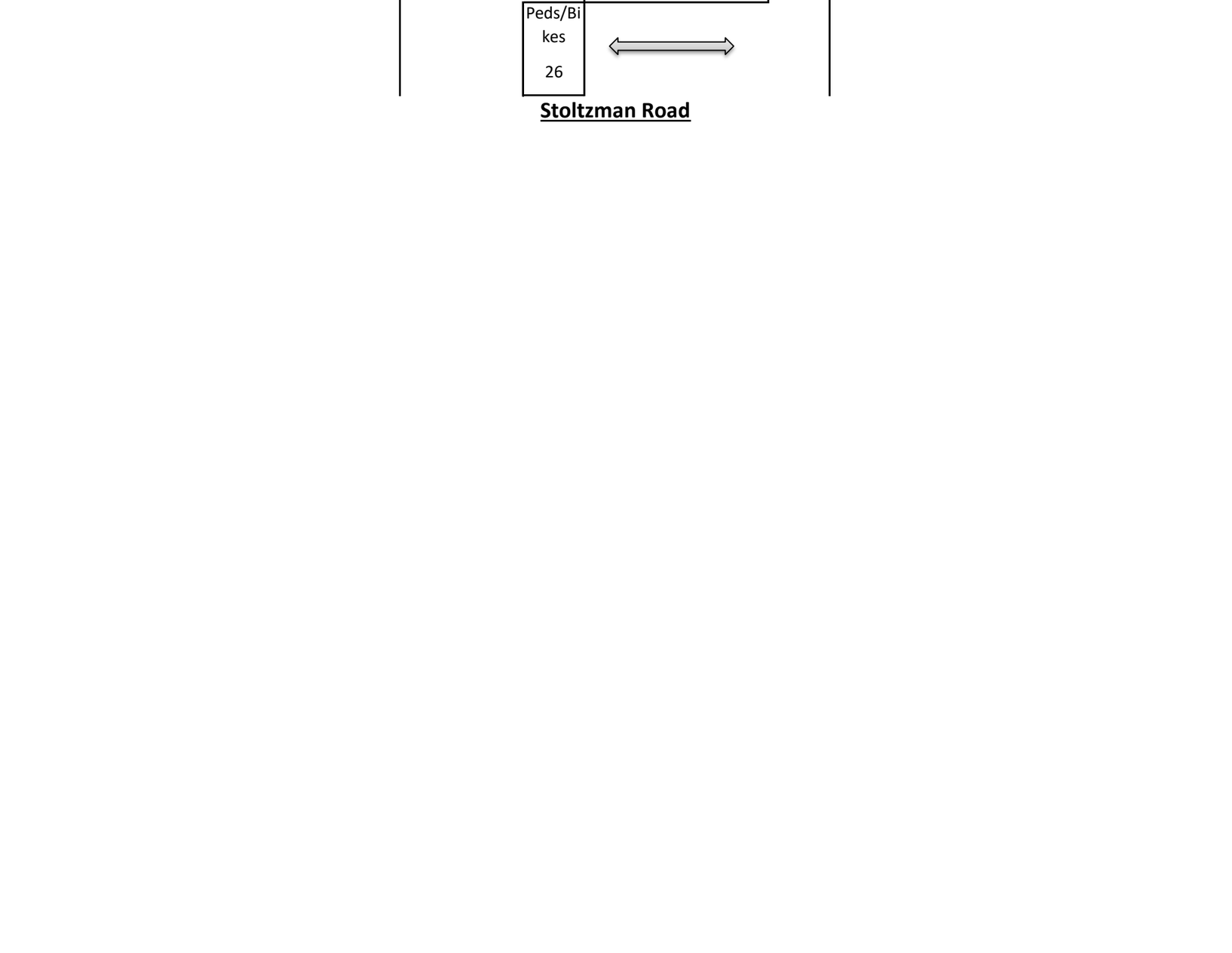
All Vehicles (Cars & Trucks) Printed

	Cub Foods Access Southbound						Riverfront Drive Westbound						Stoltzman Road Northbound						Riverfront Drive Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
16:15	--	15	27	39	**81**	1	--	47	79	15	**141**	--	--	61	18	37	**116**	4	--	28	77	72	**177**	--	515	5
16:30	--	11	23	35	**69**	2	--	51	108	34	**193**	17	--	86	19	29	**134**	1	--	30	67	68	**165**	--	561	20
16:45	--	14	24	39	**77**	3	--	44	113	24	**181**	2	--	73	16	36	**125**	20	--	24	83	101	**208**	--	591	25
17:00	--	11	26	44	**81**	--	--	45	111	42	**198**	--	--	76	17	35	**128**	1	--	27	81	102	**210**	1	617	2
Hour Total	--	51	100	157	**308**	6	--	187	411	115	**713**	19	--	296	70	137	**503**	26	--	109	308	343	**760**	1	2284	52
% of App.	0.0%	16.6%	32.5%	51.0%			0.0%	26.2%	57.6%	16.1%			0.0%	58.8%	13.9%	27.2%			0.0%	14.3%	40.5%	45.1%				
% of Total	0.0%	2.2%	4.4%	6.9%	13.5%	11.5%	0.0%	8.2%	18.0%	5.0%	31.2%	36.5%	0.0%	13.0%	3.1%	6.0%	22.0%	50.0%	0.0%	4.8%	13.5%	15.0%	33.3%	1.9%		
Cars Total	--	51	100	157	**308**	4	--	187	411	113	**711**	18	--	295	70	136	**501**	22	--	109	307	338	**754**	1	2274	45
Cars % of Movement	0.0%	100%	100%	100%	100%	8.9%	0.0%	100%	100%	98.3%	99.7%	40.0%	0.0%	99.7%	100%	99.3%	99.6%	48.9%	0.0%	100%	99.7%	98.5%	99.2%	2.2%	99.6%	
Trucks Total	--	--	--	--	**0**	2	--	--	--	2	**2**	1	--	1	--	1	**2**	4	--	--	1	5	**6**	--	10	7
Trucks % of Movement	0.0%	0.0%	0.0%	0.0%	0.0%	28.6%	0.0%	0.0%	0.0%	1.7%	0.3%	14.3%	0.0%	0.3%	0.0%	0.7%	0.4%	57.1%	0.0%	0.0%	0.3%	1.5%	0.8%	0.0%	0.4%	



ALLIANT ENGINEERING, INC.

733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Riverfront Drive & Marshall Street
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 104
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Marshall Street Southbound						Riverfront Drive Westbound						Marshall Street Northbound						Riverfront Drive Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
6:30	--	--	--	--	**0**	--	--	3	30	--	**33**	--	--	3	--	10	**13**	--	--	--	53	10	**63**	--	109	--
6:45	--	--	--	--	**0**	--	--	4	33	--	**37**	2	--	5	--	15	**20**	--	--	--	58	10	**68**	--	125	2
Hour Total	--	--	--	--	**--**	--	--	7	63	--	**70**	2	--	8	--	25	**33**	--	--	--	111	20	**131**	--	234	2
7:00	--	--	--	--	**0**	--	--	3	33	--	**36**	--	--	7	--	4	**11**	--	--	--	55	12	**67**	--	114	--
7:15	--	--	--	--	**0**	--	--	6	62	--	**68**	1	--	6	--	8	**14**	--	--	--	90	9	**99**	--	181	1
7:30	--	--	--	--	**0**	--	--	7	66	--	**73**	--	--	8	--	9	**17**	--	--	--	140	15	**155**	--	245	--
7:45	--	--	--	--	**0**	--	--	12	94	--	**106**	--	--	11	--	9	**20**	--	--	--	181	24	**205**	--	331	--
Hour Total	--	--	--	--	**--**	--	--	28	255	--	**283**	1	--	32	--	30	**62**	--	--	--	466	60	**526**	--	871	1
8:00	--	--	--	--	**0**	--	--	13	82	--	**95**	--	--	12	--	5	**17**	--	--	--	85	25	**110**	--	222	--
8:15	--	--	--	--	**0**	--	--	8	67	--	**75**	1	--	5	--	6	**11**	--	--	--	93	20	**113**	--	199	1
Hour Total	--	--	--	--	**--**	--	--	21	149	--	**170**	1	--	17	--	11	**28**	--	--	--	178	45	**223**	--	421	1
BREAK	--	--	--	--	**--**	--	--	--	--	--	**--**	--	--	--	--	--	**--**	--	--	--	--	--	**--**	--	--	--
14:00	--	--	--	--	**0**	--	--	9	110	--	**119**	1	--	18	--	11	**29**	--	--	--	85	19	**104**	--	252	1
14:15	--	--	--	--	**0**	--	--	9	93	--	**102**	2	--	16	--	12	**28**	--	--	--	75	17	**92**	--	222	2
14:30	--	--	--	--	**0**	--	--	13	107	--	**120**	2	--	15	--	6	**21**	--	--	--	98	29	**127**	--	268	2
14:45	--	--	--	--	**0**	--	--	10	96	--	**106**	--	--	16	--	6	**22**	--	--	--	110	28	**138**	--	266	--
Hour Total	--	--	--	--	**--**	--	--	41	406	--	**447**	5	--	65	--	35	**100**	--	--	--	368	93	**461**	--	1008	5
15:00	--	--	--	--	**0**	--	--	8	113	--	**121**	2	--	29	--	7	**36**	--	--	--	92	20	**112**	--	269	2
15:15	--	--	--	--	**0**	--	--	14	97	--	**111**	--	--	15	--	7	**22**	--	--	--	94	22	**116**	--	249	--
15:30	--	--	--	--	**0**	--	--	22	126	--	**148**	3	--	19	--	15	**34**	--	--	--	122	22	**144**	--	326	3
15:45	--	--	--	--	**0**	--	--	14	114	--	**128**	3	--	26	--	16	**42**	3	--	--	130	27	**157**	1	327	7
Hour Total	--	--	--	--	**--**	--	--	58	450	--	**508**	8	--	89	--	45	**134**	3	--	--	438	91	**529**	1	1171	12
16:00	--	--	--	--	**0**	--	--	24	163	--	**187**	2	--	19	--	3	**22**	1	--	--	112	32	**144**	--	353	3
16:15	--	--	--	--	**0**	--	--	10	135	--	**145**	2	--	15	--	7	**22**	--	--	--	97	37	**134**	--	301	2
16:30	--	--	--	--	**0**	--	--	9	173	--	**182**	1	--	27	--	10	**37**	--	--	--	92	16	**108**	1	327	2
16:45	--	--	--	--	**0**	--	--	12	150	--	**162**	1	--	11	--	10	**21**	1	--	--	104	23	**127**	--	310	2
Hour Total	--	--	--	--	**--**	--	--	55	621	--	**676**	6	--	72	--	30	**102**	2	--	--	405	108	**513**	1	1291	9
17:00	--	--	--	--	**0**	--	1	17	167	--	**185**	--	--	25	--	7	**32**	--	--	--	95	31	**126**	--	343	--
17:15	--	--	--	--	**0**	--	--	17	137	--	**154**	1	--	10	--	6	**16**	--	--	--	96	30	**126**	--	296	1
17:30	--	--	--	--	**0**	--	--	10	122	--	**132**	1	--	16	--	10	**26**	--	--	--	94	24	**118**	--	276	1
17:45	--	--	--	--	**0**	--	--	8	113	--	**121**	1	--	14	--	5	**19**	--	--	--	83	17	**100**	1	240	2
Hour Total	--	--	--	--	**--**	--	1	52	539	--	**592**	3	--	65	--	28	**93**	--	--	--	368	102	**470**	1	1155	4
Grand Total	--	--	--	--	**0**	--	1	262	2483	--	**2746**	26	--	348	--	204	**552**	5	--	--	2334	519	**2853**	3	6151	34
% of App.	0.0%	0.0%	0.0%	0.0%			0.0%	9.5%	90.4%	0.0%			0.0%	63.0%	0.0%	37.0%			0.0%	0.0%	81.8%	18.2%				
% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.3%	40.4%	0.0%	44.6%	76.5%	0.0%	5.7%	0.0%	3.3%	9.0%	14.7%	0.0%	0.0%	37.9%	8.4%	46.4%	8.8%		
Cars Total	--	--	--	--	**0**	--	1	261	2454	--	**2716**	18	--	337	--	203	**540**	4	--	--	2303	517	**2820**	3	6076	25
Cars % of Movement	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%	99.6%	98.8%	0.0%	98.9%	72.0%	0.0%	96.8%	0.0%	99.5%	97.8%	16.0%	0.0%	0.0%	98.7%	99.6%	98.8%	12.0%	98.8%	
Trucks Total	--	--	--	--	**0**	--	--	1	29	--	**30**	8	--	11	--	1	**12**	1	--	--	31	2	**33**	--	75	9
Trucks % of Movement	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	1.2%	0.0%	1.1%	88.9%	0.0%	3.2%	0.0%	0.5%	2.2%	11.1%	0.0%	0.0%	1.3%	0.4%	1.2%	0.0%	1.2%	

ALLIANT ENGINEERING, INC.

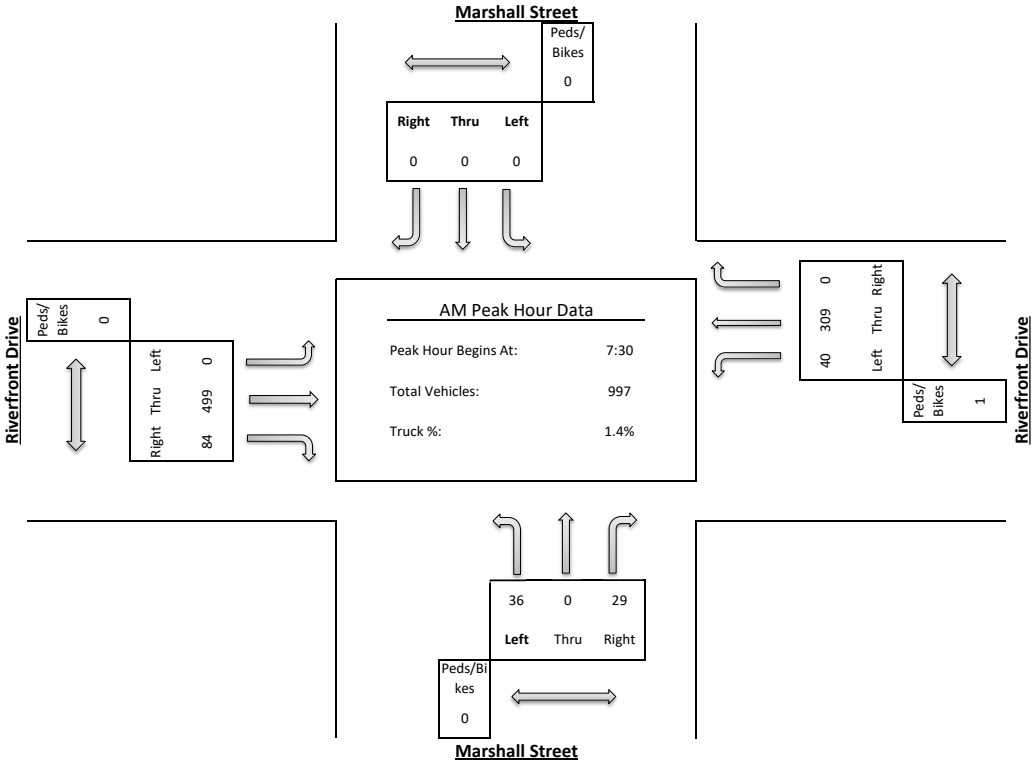
733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Riverfront Drive & Marshall Street
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 104
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Marshall Street Southbound						Riverfront Drive Westbound						Marshall Street Northbound						Riverfront Drive Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
7:30	--	--	--	--	**0**	--	--	7	66	--	**73**	--	--	8	--	9	**17**	--	--	--	140	15	**155**	--	245	--
7:45	--	--	--	--	**0**	--	--	12	94	--	**106**	--	--	11	--	9	**20**	--	--	--	181	24	**205**	--	331	--
8:00	--	--	--	--	**0**	--	--	13	82	--	**95**	--	--	12	--	5	**17**	--	--	--	85	25	**110**	--	222	--
8:15	--	--	--	--	**0**	--	--	8	67	--	**75**	1	--	5	--	6	**11**	--	--	--	93	20	**113**	--	199	1
Hour Total	--	--	--	--	**--**	--	--	40	309	--	**349**	1	--	36	--	29	**65**	--	--	--	499	84	**583**	--	997	1
% of App.	0.0%	0.0%	0.0%	0.0%			0.0%	11.5%	88.5%	0.0%			0.0%	55.4%	0.0%	44.6%			0.0%	0.0%	85.6%	14.4%				
% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.0%	31.0%	0.0%	35.0%	100.0%	0.0%	3.6%	0.0%	2.9%	6.5%	0.0%	0.0%	0.0%	50.1%	8.4%	58.5%	0.0%		
Cars Total	--	--	--	--	**0**	--	--	40	300	--	**340**	--	--	36	--	29	**65**	--	--	--	494	84	**578**	--	983	--
Cars % of Movement	0.0%	0.0%	0.0%	0.0%	0.0%	--	0.0%	100%	97.1%	0.0%	97.4%	--	0.0%	100%	0.0%	100%	100%	--	0.0%	0.0%	99.0%	100%	99.1%	--	98.6%	
Trucks Total	--	--	--	--	**0**	--	--	--	9	--	**9**	1	--	--	--	--	**0**	--	--	--	5	--	**5**	--	14	1
Trucks % of Movement	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	0.0%	2.6%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.0%	0.0%	0.9%	0.0%	1.4%	



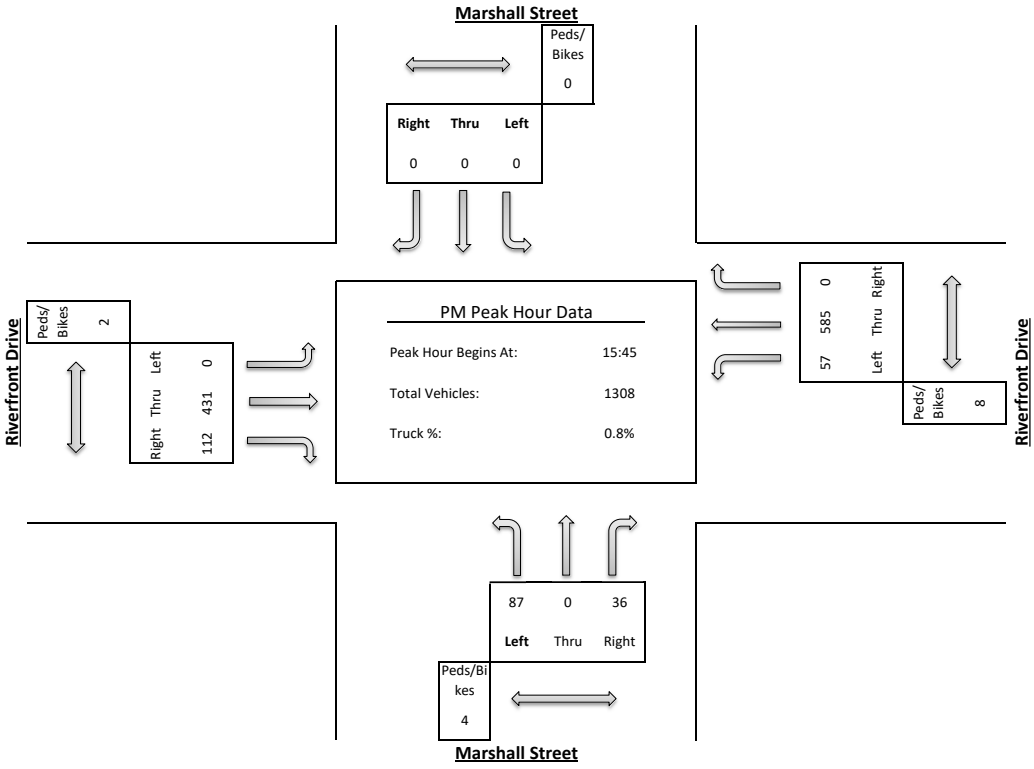
ALLIANT ENGINEERING, INC.
733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Riverfront Drive & Marshall Street
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 104
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Marshall Street Southbound						Riverfront Drive Westbound						Marshall Street Northbound						Riverfront Drive Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
15:45	--	--	--	--	**0**	--	--	14	114	--	**128**	3	--	26	--	16	**42**	3	--	--	130	27	**157**	1	327	7
16:00	--	--	--	--	**0**	--	--	24	163	--	**187**	2	--	19	--	3	**22**	1	--	--	112	32	**144**	--	353	3
16:15	--	--	--	--	**0**	--	--	10	135	--	**145**	2	--	15	--	7	**22**	--	--	--	97	37	**134**	--	301	2
16:30	--	--	--	--	**0**	--	--	9	173	--	**182**	1	--	27	--	10	**37**	--	--	--	92	16	**108**	1	327	2
Hour Total	--	--	--	--	**--**	--	--	57	585	--	**642**	8	--	87	--	36	**123**	4	--	--	431	112	**543**	2	1308	14
% of App.	0.0%	0.0%	0.0%	0.0%			0.0%	8.9%	91.1%	0.0%			0.0%	70.7%	0.0%	29.3%			0.0%	0.0%	79.4%	20.6%				
% of Total	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	4.4%	44.7%	0.0%	49.1%	57.1%	0.0%	6.7%	0.0%	2.8%	9.4%	28.6%	0.0%	0.0%	33.0%	8.6%	41.5%	14.3%		
Cars Total	--	--	--	--	**0**	--	--	57	582	--	**639**	5	--	85	--	36	**121**	3	--	--	426	112	**538**	2	1298	10
Cars % of Movement	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%	99.5%	0.0%	99.5%	50.0%	0.0%	97.7%	0.0%	100%	98.4%	30.0%	0.0%	0.0%	98.8%	100%	99.1%	20.0%	99.2%	
Trucks Total	--	--	--	--	**0**	--	--	--	3	--	**3**	3	--	2	--	--	**2**	1	--	--	5	--	**5**	--	10	4
Trucks % of Movement	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.0%	0.5%	75.0%	0.0%	2.3%	0.0%	0.0%	1.6%	25.0%	0.0%	0.0%	1.2%	0.0%	0.9%	0.0%	0.8%	



ALLIANT ENGINEERING, INC.

733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Stoltzman Road & Mankato West Highschool
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 200
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Stoltzman Road Southbound						Mankato West Highschool Westbound						Stoltzman Road Northbound						N/A Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
6:30	--	--	30	2	**32**	--	--	--	--	--	**0**	--	--	--	69	--	**69**	--	--	--	--	--	**0**	--	101	--
6:45	--	--	33	3	**36**	--	--	--	--	--	**0**	--	--	--	92	--	**92**	--	--	3	--	2	**5**	--	133	--
Hour Total	--	--	63	5	**68**	--	--	--	--	--	**--**	--	--	--	161	--	**161**	--	--	3	--	2	**5**	--	234	--
7:00	--	--	37	--	**37**	--	--	--	--	--	**0**	--	--	--	84	--	**84**	--	--	--	--	--	**0**	--	121	--
7:15	--	--	56	--	**56**	1	--	--	--	--	**0**	--	--	--	120	--	**120**	--	--	--	--	--	**0**	--	176	1
7:30	--	--	81	5	**86**	--	--	--	--	--	**0**	--	--	3	147	--	**150**	--	--	6	--	1	**7**	--	243	--
7:45	--	--	81	19	**100**	2	--	--	--	--	**0**	--	--	5	182	--	**187**	--	--	2	--	3	**5**	--	292	2
Hour Total	--	--	255	24	**279**	3	--	--	--	--	**--**	--	--	8	533	--	**541**	--	--	8	--	4	**12**	--	832	3
8:00	--	--	89	29	**118**	--	--	--	--	--	**0**	--	--	7	92	--	**99**	--	--	3	--	2	**5**	--	222	--
8:15	--	--	61	44	**105**	2	--	--	--	--	**0**	--	--	11	93	--	**104**	--	--	11	--	17	**28**	--	237	2
Hour Total	--	--	150	73	**223**	2	--	--	--	--	**--**	--	--	18	185	--	**203**	--	--	14	--	19	**33**	--	459	2
BREAK	--	--	--	--	**0**	--	--	--	--	--	**0**	--	--	--	--	--	**0**	--	--	--	--	--	**0**	--	--	--
14:00	--	--	76	5	**81**	--	--	--	--	--	**0**	--	--	6	87	--	**93**	--	--	8	--	8	**16**	--	190	--
14:15	--	--	80	5	**85**	--	--	--	--	--	**0**	--	--	2	106	--	**108**	--	--	1	--	1	**2**	--	195	--
14:30	--	--	86	7	**93**	--	--	--	--	--	**0**	--	--	2	124	--	**126**	--	--	12	--	1	**13**	--	232	--
14:45	--	--	69	5	**74**	1	--	--	--	--	**0**	--	--	1	107	--	**108**	--	--	30	--	15	**45**	--	227	1
Hour Total	--	--	311	22	**333**	1	--	--	--	--	**--**	--	--	11	424	--	**435**	--	--	51	--	25	**76**	--	844	1
15:00	--	--	99	10	**109**	2	--	--	--	--	**0**	--	--	2	107	--	**109**	--	--	16	--	8	**24**	--	242	2
15:15	--	--	86	10	**96**	2	--	--	--	--	**0**	--	--	6	101	--	**107**	--	--	7	--	2	**9**	--	212	2
15:30	--	--	86	21	**107**	14	--	--	--	--	**0**	--	--	12	115	--	**127**	--	--	36	--	34	**70**	--	304	14
15:45	--	--	112	10	**122**	--	--	--	--	--	**0**	--	--	6	127	--	**133**	--	--	15	--	13	**28**	--	283	--
Hour Total	--	--	383	51	**434**	18	--	--	--	--	**--**	--	--	26	450	--	**476**	--	--	74	--	57	**131**	--	1041	18
16:00	--	--	129	4	**133**	--	--	--	--	--	**0**	--	--	1	108	--	**109**	--	--	3	--	2	**5**	--	247	--
16:15	--	--	144	12	**156**	--	--	--	--	--	**0**	--	--	1	111	--	**112**	--	--	2	--	--	**2**	--	270	--
16:30	--	--	129	12	**141**	2	--	--	--	--	**0**	--	--	9	131	--	**140**	--	--	4	--	2	**6**	--	287	2
16:45	--	--	133	32	**165**	7	--	--	--	--	**0**	--	--	12	122	--	**134**	--	--	7	--	6	**13**	2	312	9
Hour Total	--	--	535	60	**595**	9	--	--	--	--	**--**	--	--	23	472	--	**495**	--	--	16	--	10	**26**	2	1116	11
17:00	--	--	153	16	**169**	5	--	--	--	--	**0**	--	--	13	107	--	**120**	--	--	21	--	18	**39**	--	328	5
17:15	--	--	143	10	**153**	6	--	--	--	--	**0**	--	--	6	86	--	**92**	--	--	18	--	7	**25**	--	270	6
17:30	--	--	112	9	**121**	--	--	--	--	--	**0**	--	--	1	85	--	**86**	--	--	15	--	4	**19**	--	226	--
17:45	--	--	96	1	**97**	4	--	--	--	--	**0**	--	--	1	95	--	**96**	--	--	7	--	2	**9**	--	202	4
Hour Total	--	--	504	36	**540**	15	--	--	--	--	**--**	--	--	21	373	--	**394**	--	--	61	--	31	**92**	--	1026	15
Grand Total	--	--	2201	271	**2472**	48	--	--	--	--	**0**	--	--	107	2598	--	**2705**	--	--	227	--	148	**375**	2	5552	50
% of App.	0.0%	0.0%	89.0%	11.0%			0.0%	0.0%	0.0%	0.0%			0.0%	4.0%	96.0%	0.0%			0.0%	60.5%	0.0%	39.5%				
% of Total	0.0%	0.0%	39.6%	4.9%	44.5%	96.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	46.8%	0.0%	48.7%	0.0%	0.0%	4.1%	0.0%	2.7%	6.8%	4.0%		
Cars Total	--	--	2171	261	**2432**	47	--	--	--	--	**0**	--	--	105	2557	--	**2662**	--	--	221	--	143	**364**	2	5458	49
Cars % of Movement	0.0%	0.0%	98.6%	96.3%	98.4%	95.9%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	98.1%	98.4%	0.0%	98.4%	0.0%	0.0%	97.4%	0.0%	96.6%	97.1%	4.1%	98.3%	
Trucks Total	--	--	30	10	**40**	1	--	--	--	--	**0**	--	--	2	41	--	**43**	--	--	6	--	5	**11**	--	94	1
Trucks % of Movement	0.0%	0.0%	1.4%	3.7%	1.6%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	1.9%	1.6%	0.0%	1.6%	0.0%	0.0%	2.6%	0.0%	3.4%	2.9%	0.0%	1.7%	

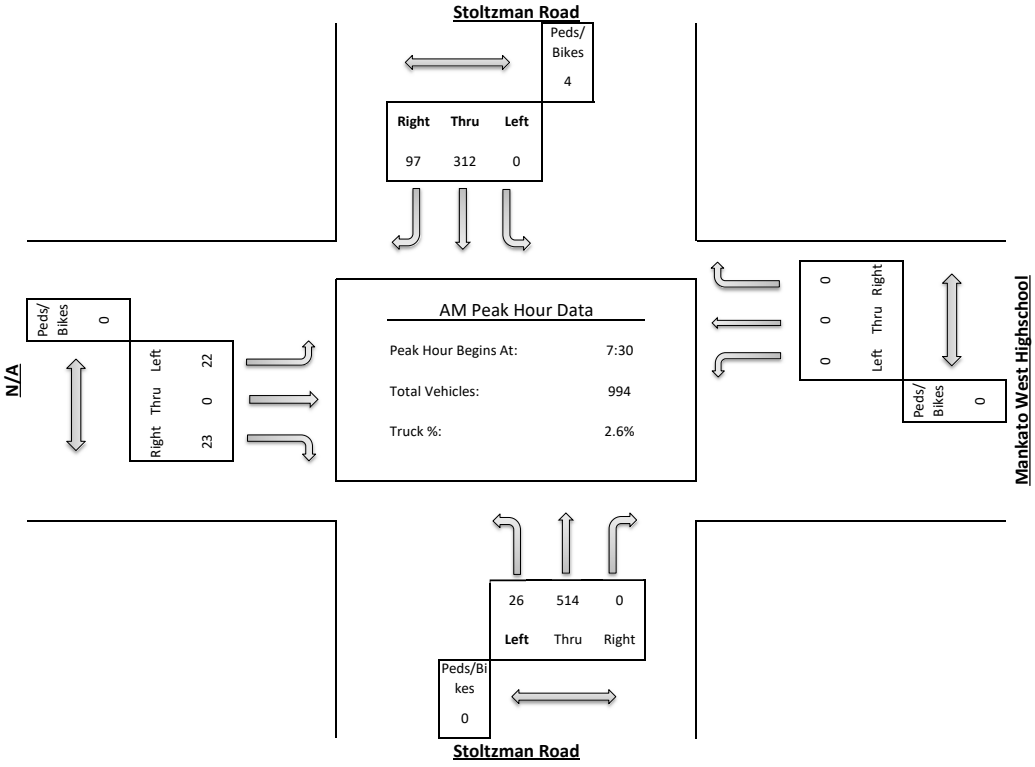
ALLIANT ENGINEERING, INC.
733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Stoltzman Road & Mankato West Highschool
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 200
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Stoltzman Road Southbound						Mankato West Highschool Westbound						Stoltzman Road Northbound						N/A Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
7:30	--	--	81	5	**86**	--	--	--	--	--	**0**	--	--	3	147	--	**150**	--	--	6	--	1	**7**	--	243	--
7:45	--	--	81	19	**100**	2	--	--	--	--	**0**	--	--	5	182	--	**187**	--	--	2	--	3	**5**	--	292	2
8:00	--	--	89	29	**118**	--	--	--	--	--	**0**	--	--	7	92	--	**99**	--	--	3	--	2	**5**	--	222	--
8:15	--	--	61	44	**105**	2	--	--	--	--	**0**	--	--	11	93	--	**104**	--	--	11	--	17	**28**	--	237	2
Hour Total	--	--	312	97	**409**	4	--	--	--	--	**--**	--	--	26	514	--	**540**	--	--	22	--	23	**45**	--	994	4
% of App.	0.0%	0.0%	76.3%	23.7%			0.0%	0.0%	0.0%	0.0%			0.0%	4.8%	95.2%	0.0%			0.0%	48.9%	0.0%	51.1%				
% of Total	0.0%	0.0%	31.4%	9.8%	41.1%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.6%	51.7%	0.0%	54.3%	0.0%	0.0%	2.2%	0.0%	2.3%	4.5%	0.0%		
Cars Total	--	--	305	95	**400**	4	--	--	--	--	**0**	--	--	25	501	--	**526**	--	--	19	--	23	**42**	--	968	4
Cars % of Movement	0.0%	0.0%	97.8%	97.9%	97.8%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	96.2%	97.5%	0.0%	97.4%	0.0%	0.0%	86.4%	0.0%	100%	93.3%	0.0%	97.4%	
Trucks Total	--	--	7	2	**9**	--	--	--	--	--	**0**	--	--	1	13	--	**14**	--	--	3	--	--	**3**	--	26	--
Trucks % of Movement	0.0%	0.0%	2.2%	2.1%	2.2%	--	0.0%	0.0%	0.0%	0.0%	0.0%	--	0.0%	3.8%	2.5%	0.0%	2.6%	--	0.0%	13.6%	0.0%	0.0%	6.7%	--	2.6%	



ALLIANT ENGINEERING, INC.

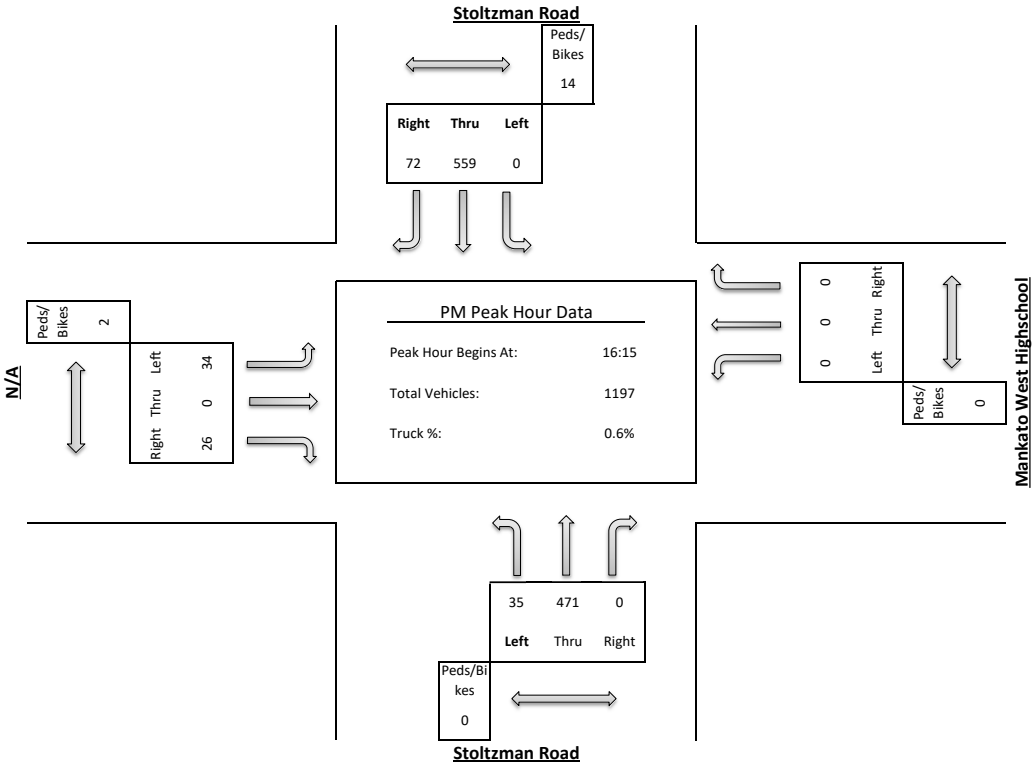
733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Stoltzman Road & Mankato West Highschool
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 200
Ref Pt: N/A
Page No: 3 of 3

All Vehicles (Cars & Trucks) Printed

	Stoltzman Road Southbound						Mankato West Highschool Westbound						Stoltzman Road Northbound						N/A Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
16:15	--	--	144	12	**156**	--	--	--	--	--	**0**	--	--	1	111	--	**112**	--	--	2	--	--	**2**	--	270	--
16:30	--	--	129	12	**141**	2	--	--	--	--	**0**	--	--	9	131	--	**140**	--	--	4	--	2	**6**	--	287	2
16:45	--	--	133	32	**165**	7	--	--	--	--	**0**	--	--	12	122	--	**134**	--	--	7	--	6	**13**	2	312	9
17:00	--	--	153	16	**169**	5	--	--	--	--	**0**	--	--	13	107	--	**120**	--	--	21	--	18	**39**	--	328	5
Hour Total	--	--	559	72	**631**	14	--	--	--	--	**--**	--	--	35	471	--	**506**	--	--	34	--	26	**60**	2	1197	16
% of App.	0.0%	0.0%	88.6%	11.4%			0.0%	0.0%	0.0%	0.0%			0.0%	6.9%	93.1%	0.0%			0.0%	56.7%	0.0%	43.3%				
% of Total	0.0%	0.0%	46.7%	6.0%	52.7%	87.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	2.9%	39.3%	0.0%	42.3%	0.0%	0.0%	2.8%	0.0%	2.2%	5.0%	12.5%		
Cars Total	--	--	554	72	**626**	14	--	--	--	--	**0**	--	--	35	469	--	**504**	--	--	34	--	26	**60**	2	1190	16
Cars % of Movement	0.0%	0.0%	99.1%	100%	99.2%	87.5%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	100%	99.6%	0.0%	99.6%	0.0%	0.0%	100%	0.0%	100%	100%	12.5%	99.4%	
Trucks Total	--	--	5	--	**5**	--	--	--	--	--	**0**	--	--	--	2	--	**2**	--	--	--	--	--	**0**	--	7	--
Trucks % of Movement	0.0%	0.0%	0.9%	0.0%	0.8%	--	0.0%	0.0%	0.0%	0.0%	0.0%	--	0.0%	0.0%	0.4%	0.0%	0.4%	--	0.0%	0.0%	0.0%	0.0%	0.0%	--	0.6%	



ALLIANT ENGINEERING, INC.

733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Stoltzman Road & Linder Avenue
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 300
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Stoltzman Road Southbound						Linder Avenue Westbound						Cub Foods Access Northbound						Linder Avenue Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
6:30	--	--	1	--	**1**	--	--	--	--	--	**0**	--	--	1	2	--	**3**	--	--	--	2	3	**5**	--	9	--
6:45	--	1	4	--	**5**	--	--	--	1	--	**1**	1	--	1	3	--	**4**	--	--	--	1	2	**3**	--	13	1
Hour Total	--	1	5	--	**6**	--	--	--	1	--	**1**	1	--	2	5	--	**7**	--	--	--	3	5	**8**	--	22	1
7:00	--	--	--	--	**0**	--	--	--	--	--	**0**	--	--	1	3	--	**4**	--	--	--	1	1	**2**	--	6	--
7:15	--	--	--	--	**0**	--	--	1	1	--	**2**	--	--	--	6	2	**8**	--	--	2	1	1	**4**	--	14	--
7:30	--	1	2	--	**3**	--	--	--	--	--	**0**	--	--	--	4	2	**6**	--	--	1	2	1	**4**	--	13	--
7:45	--	--	11	--	**11**	--	--	--	--	--	**0**	--	--	--	3	--	**3**	--	--	--	1	--	**1**	--	15	--
Hour Total	--	1	13	--	**14**	--	--	1	1	--	**2**	--	--	1	16	4	**21**	--	--	3	5	3	**11**	--	48	--
8:00	--	--	4	2	**6**	--	--	--	--	--	**0**	--	--	--	2	--	**2**	--	--	--	1	3	**4**	--	12	--
8:15	--	--	7	1	**8**	--	--	--	--	--	**0**	--	--	--	5	--	**5**	--	--	1	2	3	**6**	--	19	--
Hour Total	--	--	11	3	**14**	--	--	--	--	--	**--**	--	--	--	7	--	**7**	--	--	1	3	6	**10**	--	31	--
BREAK	--	--	--	--	**--**	--	--	--	--	--	**--**	--	--	--	--	--	**--**	--	--	--	--	--	**--**	--	--	--
14:00	--	--	8	--	**8**	--	--	2	--	--	**2**	--	--	6	5	2	**13**	--	--	--	2	5	**7**	--	30	--
14:15	--	--	4	1	**5**	--	--	2	1	--	**3**	--	--	2	6	--	**8**	--	--	--	3	5	**8**	--	24	--
14:30	--	--	13	--	**13**	--	--	1	2	--	**3**	--	--	2	8	3	**13**	--	--	2	1	7	**10**	--	39	--
14:45	--	1	6	3	**10**	1	--	--	4	1	**5**	--	--	5	8	--	**13**	--	--	1	1	7	**9**	2	37	3
Hour Total	--	1	31	4	**36**	1	--	5	7	1	**13**	--	--	15	27	5	**47**	--	--	3	7	24	**34**	2	130	3
15:00	--	--	6	--	**6**	--	--	--	1	--	**1**	--	--	3	7	--	**10**	--	--	1	1	5	**7**	--	24	--
15:15	--	--	5	--	**5**	1	--	2	1	--	**3**	--	--	3	2	1	**6**	--	--	1	--	2	**3**	1	17	2
15:30	--	--	5	1	**6**	--	--	--	--	--	**0**	--	--	2	7	2	**11**	--	--	1	--	10	**11**	--	28	--
15:45	--	--	19	--	**19**	--	--	4	--	1	**5**	--	--	3	7	5	**15**	--	--	1	1	7	**9**	--	48	--
Hour Total	--	--	35	1	**36**	1	--	6	2	1	**9**	--	--	11	23	8	**42**	--	--	4	2	24	**30**	1	117	2
16:00	--	2	12	3	**17**	--	--	6	--	--	**6**	--	--	8	7	3	**18**	--	--	1	1	10	**12**	--	53	--
16:15	--	--	9	1	**10**	1	--	3	--	1	**4**	--	--	9	4	1	**14**	--	--	3	--	11	**14**	1	42	2
16:30	--	1	9	--	**10**	--	--	1	1	--	**2**	--	--	4	10	1	**15**	--	--	2	--	11	**13**	--	40	--
16:45	--	--	9	--	**9**	--	--	2	--	--	**2**	--	--	5	6	--	**11**	--	--	1	--	5	**6**	--	28	--
Hour Total	--	3	39	4	**46**	1	--	12	1	1	**14**	--	--	26	27	5	**58**	--	--	7	1	37	**45**	1	163	2
17:00	--	1	5	1	**7**	--	--	--	1	--	**1**	2	--	4	7	1	**12**	--	--	1	1	3	**5**	--	25	2
17:15	--	--	4	--	**4**	--	--	--	--	1	**1**	2	--	2	7	1	**10**	--	--	--	--	2	**2**	2	17	4
17:30	--	--	8	--	**8**	--	--	--	--	--	**0**	--	--	3	6	--	**9**	--	--	--	--	5	**5**	--	22	--
17:45	--	1	4	2	**7**	--	--	--	--	--	**0**	2	--	5	5	--	**10**	--	--	--	--	5	**5**	--	22	2
Hour Total	--	2	21	3	**26**	--	--	--	1	1	**2**	6	--	14	25	2	**41**	--	--	1	1	15	**17**	2	86	8
Grand Total	--	8	155	15	**178**	3	--	24	13	4	**41**	7	--	69	130	24	**223**	--	--	19	22	114	**155**	6	597	16
% of App.	0.0%	4.5%	87.1%	8.4%			0.0%	58.5%	31.7%	9.8%			0.0%	30.9%	58.3%	10.8%			0.0%	12.3%	14.2%	73.5%				
% of Total	0.0%	1.3%	26.0%	2.5%	29.8%	18.8%	0.0%	4.0%	2.2%	0.7%	6.9%	43.8%	0.0%	11.6%	21.8%	4.0%	37.4%	0.0%	0.0%	3.2%	3.7%	19.1%	26.0%	37.5%		
Cars Total	--	7	153	13	**173**	3	--	23	10	4	**37**	7	--	69	118	24	**211**	--	--	17	20	111	**148**	6	569	16
Cars % of Movement	0.0%	87.5%	98.7%	86.7%	97.2%	18.8%	0.0%	95.8%	76.9%	100%	90.2%	43.8%	0.0%	100%	90.8%	100%	94.6%	0.0%	0.0%	89.5%	90.9%	97.4%	95.5%	37.5%	95.3%	
Trucks Total	--	1	2	2	**5**	--	--	1	3	--	**4**	--	--	--	12	--	**12**	--	--	2	2	3	**7**	--	28	--
Trucks % of Movement	0.0%	12.5%	1.3%	13.3%	2.8%	--	0.0%	4.2%	23.1%	0.0%	9.8%	--	0.0%	0.0%	9.2%	0.0%	5.4%	--	0.0%	10.5%	9.1%	2.6%	4.5%	--	4.7%	

ALLIANT ENGINEERING, INC.

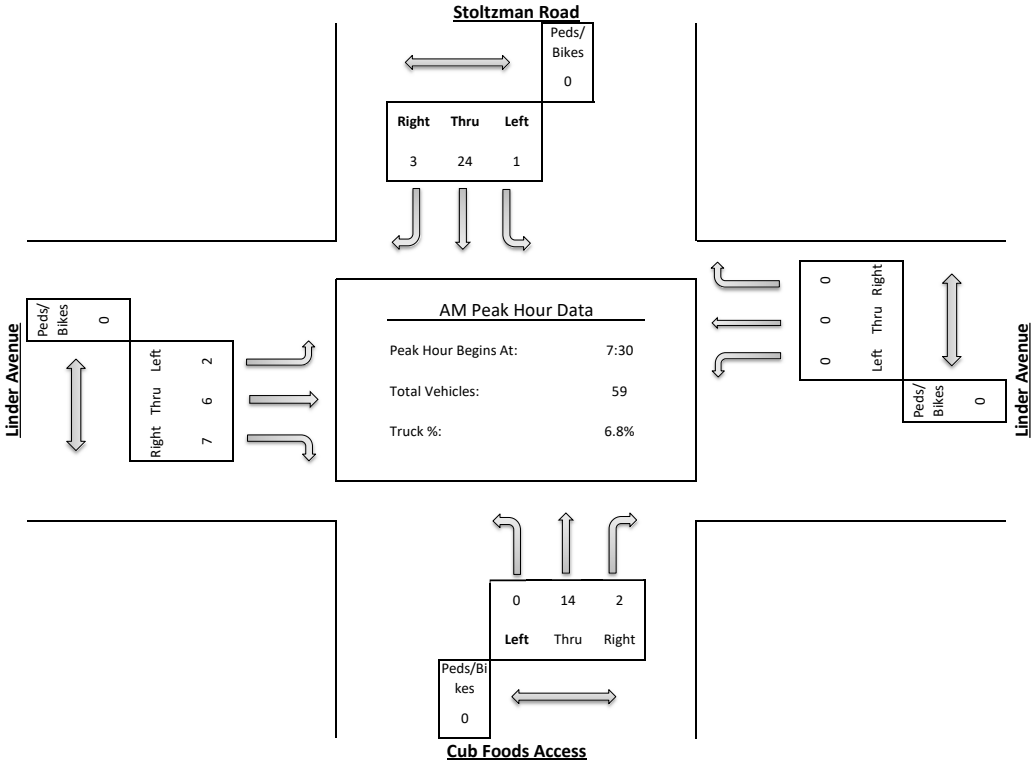
733 S Marquette Ave #700, Minneapolis, MN 55402

Intersection: Stoltzman Road & Linder Avenue
Date: 4/23/2024
Duration: 6:30-8:30, 14:00-18:00

Site Code 300
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Stoltzman Road Southbound						Linder Avenue Westbound						Cub Foods Access Northbound						Linder Avenue Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
7:30	--	1	2	--	**3**	--	--	--	--	--	**0**	--	--	--	4	2	**6**	--	--	1	2	1	**4**	--	13	--
7:45	--	--	11	--	**11**	--	--	--	--	--	**0**	--	--	--	3	--	**3**	--	--	--	1	--	**1**	--	15	--
8:00	--	--	4	2	**6**	--	--	--	--	--	**0**	--	--	--	2	--	**2**	--	--	--	1	3	**4**	--	12	--
8:15	--	--	7	1	**8**	--	--	--	--	--	**0**	--	--	--	5	--	**5**	--	--	1	2	3	**6**	--	19	--
Hour Total	--	1	24	3	**28**	--	--	--	--	--	**--**	--	--	--	14	2	**16**	--	--	2	6	7	**15**	--	59	--
% of App.	0.0%	3.6%	85.7%	10.7%			0.0%	0.0%	0.0%	0.0%			0.0%	0.0%	87.5%	12.5%			0.0%	13.3%	40.0%	46.7%				
% of Total	0.0%	1.7%	40.7%	5.1%	47.5%	--	0.0%	0.0%	0.0%	0.0%	0.0%	--	0.0%	0.0%	23.7%	3.4%	27.1%	--	0.0%	3.4%	10.2%	11.9%	25.4%	--		
Cars Total	--	1	24	2	**27**	--	--	--	--	--	**0**	--	--	--	12	2	**14**	--	--	2	6	6	**14**	--	55	--
Cars % of Movement	0.0%	100%	100%	66.7%	96.4%	--	0.0%	0.0%	0.0%	0.0%	0.0%	--	0.0%	0.0%	85.7%	100%	87.5%	--	0.0%	100%	100%	85.7%	93.3%	--	93.2%	
Trucks Total	--	--	--	1	**1**	--	--	--	--	--	**0**	--	--	--	2	--	**2**	--	--	--	--	1	**1**	--	4	--
Trucks % of Movement	0.0%	0.0%	0.0%	33.3%	3.6%	--	0.0%	0.0%	0.0%	0.0%	0.0%	--	0.0%	0.0%	14.3%	0.0%	12.5%	--	0.0%	0.0%	0.0%	14.3%	6.7%	--	6.8%	



ALLIANT ENGINEERING, INC.
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Intersection: Stoltzman Road & Linder Avenue
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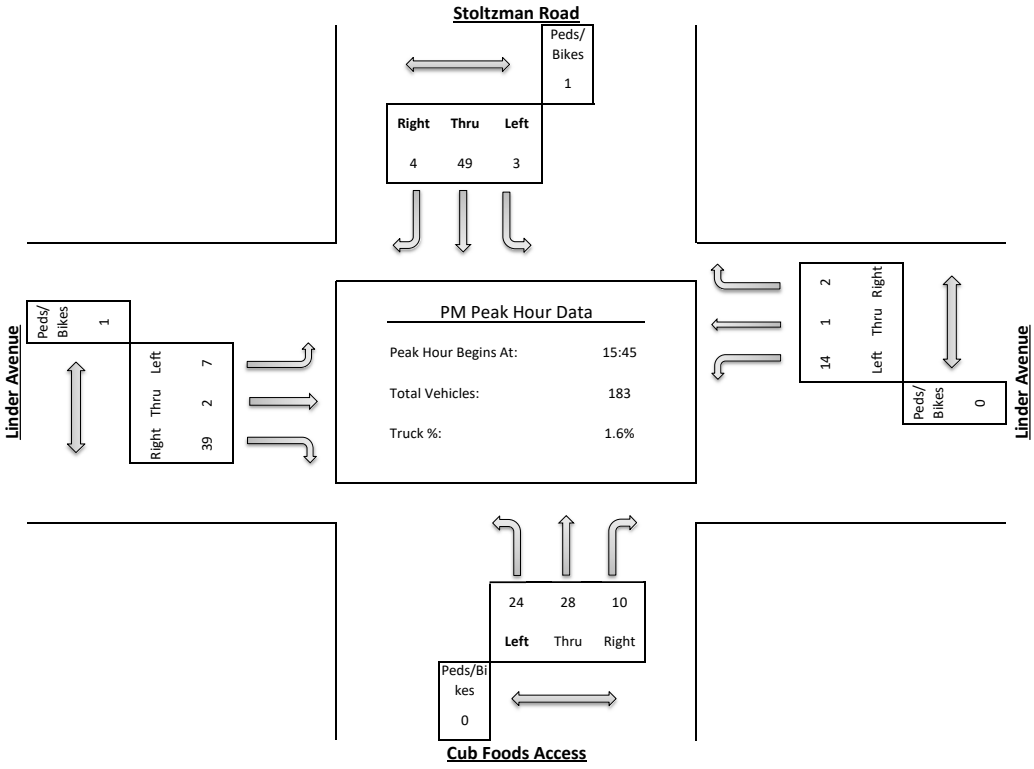
Site Code 300
Ref Pt: N/A

All Vehicles (Cars & Trucks) Printed

	Stoltzman Road Southbound						Linder Avenue Westbound						Cub Foods Access Northbound						Linder Avenue Eastbound						Int. Veh. Total	Int. Ped/ Bike Total
Start Time	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes	U-Turn	Left	Thru	Right	App. Total	Peds/ Bikes		
15:45	--	--	19	--	**19**	--	--	4	--	1	**5**	--	--	3	7	5	**15**	--	--	1	1	7	**9**	--	48	--
16:00	--	2	12	3	**17**	--	--	6	--	--	**6**	--	--	8	7	3	**18**	--	--	1	1	10	**12**	--	53	--
16:15	--	--	9	1	**10**	1	--	3	--	1	**4**	--	--	9	4	1	**14**	--	--	3	--	11	**14**	1	42	2
16:30	--	1	9	--	**10**	--	--	1	1	--	**2**	--	--	4	10	1	**15**	--	--	2	--	11	**13**	--	40	--
Hour Total	--	3	49	4	**56**	1	--	14	1	2	**17**	--	--	24	28	10	**62**	--	--	7	2	39	**48**	1	183	2
% of App.	0.0%	5.4%	87.5%	7.1%			0.0%	82.4%	5.9%	11.8%			0.0%	38.7%	45.2%	16.1%			0.0%	14.6%	4.2%	81.3%				
% of Total	0.0%	1.6%	26.8%	2.2%	30.6%	50.0%	0.0%	7.7%	0.5%	1.1%	9.3%	0.0%	0.0%	13.1%	15.3%	5.5%	33.9%	0.0%	0.0%	3.8%	1.1%	21.3%	26.2%	50.0%		
Cars Total	--	3	49	4	**56**	1	--	14	1	2	**17**	--	--	24	26	10	**60**	--	--	7	2	38	**47**	1	180	2
Cars % of Movement	0.0%	100%	100%	100%	100%	50.0%	0.0%	100%	100%	100%	100%	0.0%	0.0%	100%	92.9%	100%	96.8%	0.0%	0.0%	100%	100%	97.4%	97.9%	50.0%	98.4%	
Trucks Total	--	--	--	--	**0**	--	--	--	--	--	**0**	--	--	--	2	--	**2**	--	--	--	--	1	**1**	--	3	--
Trucks % of Movement	0.0%	0.0%	0.0%	0.0%	0.0%	--	0.0%	0.0%	0.0%	0.0%	0.0%	--	0.0%	0.0%	7.1%	0.0%	3.2%	--	0.0%	0.0%	0.0%	2.6%	2.1%	--	1.6%	



Appendix C: Signal Warrant Analyses

TRAFFIC CONTROL WARRANTS ANALYSIS

MAPO ICE, Riverfront Drive & Stoltzman Road

ALLIANT

Background

Project Data			Analysis	Volumes	Direction	Analysis Approach	Roadway	Speed	Lanes	RT %
Project: MAPO ICE			***Date:***	***Scenario:***	WB	Major Approach 1	Riverfront Drive	30	3	100%
Intersection: Riverfront Drive & Stoltzman Road			4/30/2024	2024 EXIST	EB	Major Approach 3	Riverfront Drive	30	3	100%
Population < 10,000?	NO	***Exist. Traffic Control:***	***Analyst:***	***Format:***	NB	Minor Approach 2	Stoltzman Road	30	2	0%
70% Factor Used:	NO	Signal	EHH	15 MIN	SB	Minor Approach 4	Stoltzman Road	30	2	0%

Analysis

Hour	Major Approaches					Minor Approaches					Traffic Signal Warrants					Existing Signal Justification						AWSC Warrants		
	Approach			Volumes Met		Approach			Volumes Met		8-Hour			4-Hr	Peak	60%			80%			C1	C2	80% of C1&C2
	WB	EB	Total	A	B	NB	SB	Max	A	B	1A	1B	1C (1A/1B)	2	3B	1A	1B	1C (1A/1B)	1A	1B	1C (1A/1B)			
	1	3		600	900	2	4		200	100												300	200	D
12 - 1 AM	0	0	0			0	0	0																
1 - 2 AM	0	0	0			0	0	0																
2 - 3 AM	0	0	0			0	0	0																
3 - 4 AM	0	0	0			0	0	0																
4 - 5 AM	0	0	0			0	0	0																
5 - 6 AM	0	0	0			0	0	0																
6 - 7 AM	125	232	357			196	27	196		X								X / -				X	X	X
7 - 8 AM	284	555	839	X		356	36	356	X	X	X		X / X	X		X	X	X / X	X	X	X / X	X	X	X
8 - 9 AM	308	678	986	X	X	278	37	278	X	X	X	X	X / X	X		X	X	X / X	X	X	X / X	X	X	X
9 - 10 AM	300	466	766	X		200	50	200	X	X	X		X / X			X	X	X / X	X	X	X / X	X	X	X
10 - 11 AM	365	485	850	X		164	87	164		X			X / X			X	X	X / X	X	X	X / X	X	X	X
11 - Noon	415	542	957	X	X	209	91	209	X	X	X	X	X / X			X	X	X / X	X	X	X / X	X	X	X
12 - 1 PM	486	503	989	X	X	258	68	258	X	X	X	X	X / X	X		X	X	X / X	X	X	X / X	X	X	X
1 - 2 PM	414	463	877	X		274	105	274	X	X	X		X / X	X		X	X	X / X	X	X	X / X	X	X	X
2 - 3 PM	463	469	932	X	X	329	101	329	X	X	X	X	X / X	X		X	X	X / X	X	X	X / X	X	X	X
3 - 4 PM	533	646	1179	X	X	388	122	388	X	X	X	X	X / X	X	X	X	X	X / X	X	X	X / X	X	X	X
4 - 5 PM	694	735	1429	X	X	355	160	355	X	X	X	X	X / X	X	X	X	X	X / X	X	X	X / X	X	X	X
5 - 6 PM	615	682	1297	X	X	348	155	348	X	X	X	X	X / X	X	X	X	X	X / X	X	X	X / X	X	X	X
6 - 7 PM	405	472	877	X		252	119	252	X	X	X		X / X	X		X	X	X / X	X	X	X / X	X	X	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																
11 - Midnight	0	0	0			0	0	0																

Summary

Signal Warrants[1]	Met	Req'd.	Warrant Met?	
Warrant 1				
1A: 8-Hour (Minimum Vehicular Volume)	11	8	MET	MET
1B: 8-Hour (Interruption of Continuous Traffic)	7	8	NO	
1C: 8-Hour (Combination of 1A & 1B at 80%)	12	8	MET	
Warrant 2: 4-Hour	9	4	MET	MET
Warrant 3B: Peak Hour	3	1	MET	MET
Warrant 7				
7B: Crash History	1	5	NO	NO
7C: Condition A or Condition B (80%)	12	8	MET	

Existing Signal Justification[2]	Met 60%	Met 80%	Req'd.	Justification Criteria Met?	
Existing Signal Justification: Reduced Warrant 1A	12	12	8	JUSTIFIED	MET
Existing Signal Justification: Reduced Warrant 1B	12	12	8	JUSTIFIED	
Existing Signal Justification: Reduced Warrant 1C	12	12	8	JUSTIFIED	

All-Way Stop Warrants[1]	Met	Req'd.	Warrant Met?	
All-Way Stop: Crit. A (Signal Justified)	3	1	MET	MET
All-Way Stop: Crit. B (Crash History)	2	5	NO	
All-Way Stop: Crit. C1 & C2 (Min Vols, Same Hrs)	13	8	MET	
All-Way Stop: Crit. C2 (Minor App. Delay)	360	30	MET	
All-Way Stop: Crit. D (80% of B, C1, & C2)	-	-	NO	

[1] ***Source:*** *U.S. Dept. of Transportation FHWA Manual on Uniform Traffic Control Devices (2009 Edition)*

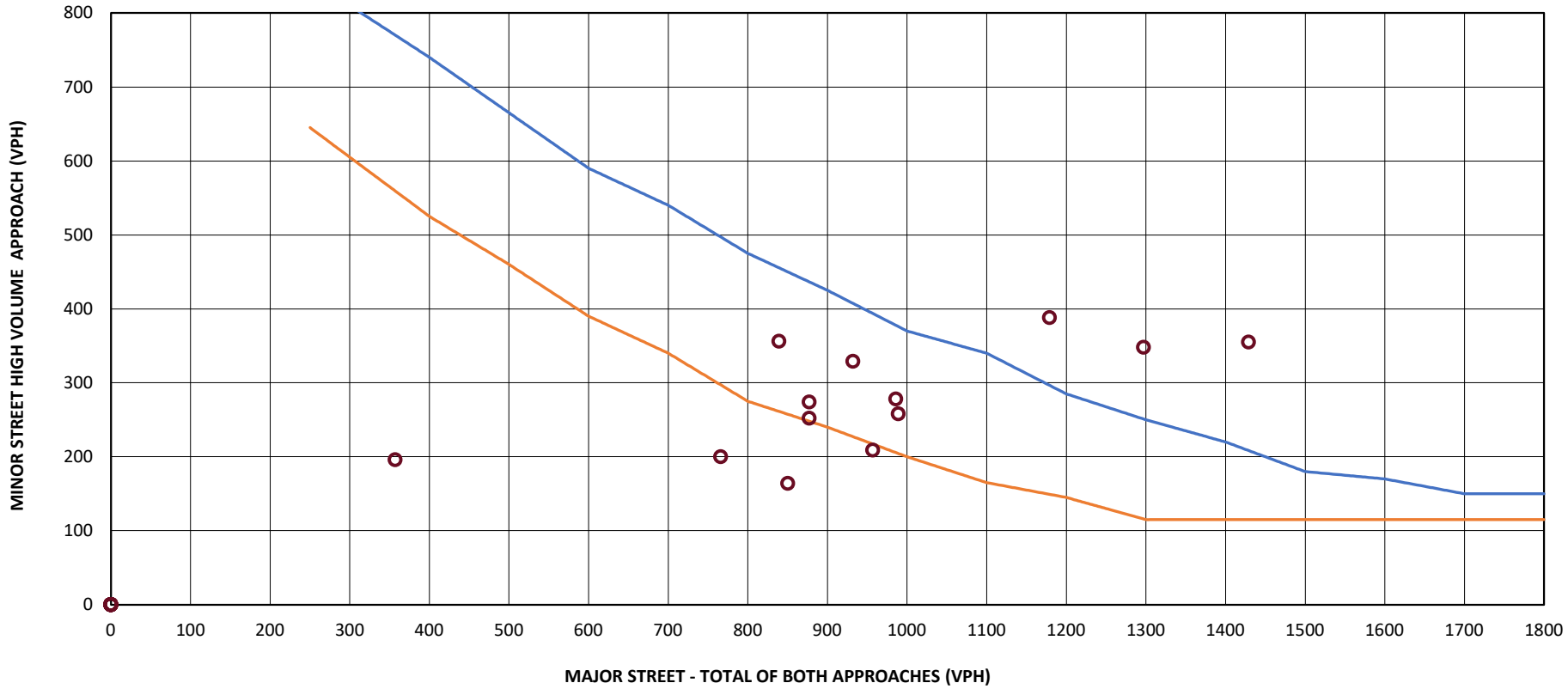
[2] ***Source:*** *MnDOT Traffic Engineering Manual, Chapter 9-5.02.05 "Traffic Control Signal Removal Justification Criteria"*

Prepared by Alliant Engineering, 10/30/2024

TRAFFIC CONTROL WARRANTS ANALYSIS

MAPO ICE, Riverfront Drive & Stoltzman Road

Warrant 2 & Warrant 3B



Scenario:	Major: 2	Minor: 2								
2024 EXIST	70% Factor:	**NO**	Warrant 2 (Four-Hour)	Lower Threshold:	115	Hours Met:	9	Hours Req'd:	4	Met? **MET**
			Warrant 3B (Peak Hour)		150		3		1	**MET**

Source: *U.S. Department of Transportation FHWA Manual on Uniform Traffic Control Devices (2009 Edition)*

Warrant 2 (Four-Hour) Notes:

100%: 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 approach with one lane.
70%: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Warrant 3B (Peak Hour) Notes:

100%: 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 approach with one lane.
70%: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

TRAFFIC CONTROL WARRANTS ANALYSIS

MAPO ICE, Riverfront Drive & Stoltzman Road

ALLIANT

Background

Project Data			Analysis	Volumes	Direction	Analysis Approach	Roadway	Speed	Lanes	RT %
Project: MAPO ICE			***Date:***	***Scenario:***	WB	Major Approach 1	Riverfront Drive	30	3	100%
Intersection: Riverfront Drive & Stoltzman Road			4/30/2024	2044 Forecast	EB	Major Approach 3	Riverfront Drive	30	3	100%
Population < 10,000?	NO	***Exist. Traffic Control:***	***Analyst:***	***Format:***	NB	Minor Approach 2	Stoltzman Road	30	2	0%
70% Factor Used:	NO	Signal	EHH	15 MIN	SB	Minor Approach 4	Stoltzman Road	30	2	0%

Analysis

Hour	Major Approaches					Minor Approaches					Traffic Signal Warrants					Existing Signal Justification						AWSC Warrants		
	Approach			Volumes Met		Approach			Volumes Met		8-Hour			4-Hr	Peak	60%			80%			C1	C2	80% of C1&C2
	WB	EB	Total	A	B	NB	SB	Max	A	B	1A	1B	1C (1A/1B)	2	3B	1A	1B	1C (1A/1B)	1A	1B	1C (1A/1B)			
	1	3		600	900	2	4		200	100												300	200	D
12 - 1 AM	0	0	0			0	0	0																
1 - 2 AM	0	0	0			0	0	0																
2 - 3 AM	0	0	0			0	0	0																
3 - 4 AM	0	0	0			0	0	0																
4 - 5 AM	0	0	0			0	0	0																
5 - 6 AM	0	0	0			0	0	0																
6 - 7 AM	141	261	402			219	32	219	X	X						X		X / -			X / -	X	X	X
7 - 8 AM	316	618	934	X	X	396	43	396	X	X	X	X	X / X	X		X	X	X / X	X	X	X / X	X	X	X
8 - 9 AM	343	754	1097	X	X	310	43	310	X	X	X	X	X / X	X		X	X	X / X	X	X	X / X	X	X	X
9 - 10 AM	335	519	854	X		223	57	223	X	X	X		X / X			X	X	X / X	X	X	X / X	X	X	X
10 - 11 AM	405	539	944	X	X	184	99	184		X		X	X / X			X	X	X / X	X	X	X / X	X	X	X
11 - Noon	462	602	1064	X	X	233	103	233	X	X	X	X	X / X	X		X	X	X / X	X	X	X / X	X	X	X
12 - 1 PM	538	558	1096	X	X	287	77	287	X	X	X	X	X / X	X		X	X	X / X	X	X	X / X	X	X	X
1 - 2 PM	460	514	974	X	X	305	117	305	X	X	X	X	X / X	X		X	X	X / X	X	X	X / X	X	X	X
2 - 3 PM	516	521	1037	X	X	364	113	364	X	X	X	X	X / X	X	X	X	X	X / X	X	X	X / X	X	X	X
3 - 4 PM	592	716	1308	X	X	430	139	430	X	X	X	X	X / X	X	X	X	X	X / X	X	X	X / X	X	X	X
4 - 5 PM	771	814	1585	X	X	394	179	394	X	X	X	X	X / X	X	X	X	X	X / X	X	X	X / X	X	X	X
5 - 6 PM	684	757	1441	X	X	387	173	387	X	X	X	X	X / X	X	X	X	X	X / X	X	X	X / X	X	X	X
6 - 7 PM	451	526	977	X	X	280	134	280	X	X	X	X	X / X	X		X	X	X / X	X	X	X / X	X	X	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																
11 - Midnight	0	0	0			0	0	0																

Summary

Signal Warrants[1]	Met	Req'd.	Warrant Met?	
Warrant 1				
1A: 8-Hour (Minimum Vehicular Volume)	11	8	MET	MET
1B: 8-Hour (Interruption of Continuous Traffic)	11	8	MET	
1C: 8-Hour (Combination of 1A & 1B at 80%)	12	8	MET	
Warrant 2: 4-Hour	10	4	MET	MET
Warrant 3B: Peak Hour	4	1	MET	MET
Warrant 7				
7B: Crash History	1	5	NO	NO
7C: Condition A or Condition B (80%)	12	8	MET	

Existing Signal Justification[2]	Met 60%	Met 80%	Req'd.	Justification Criteria Met?	
Existing Signal Justification: Reduced Warrant 1A	13	12	8	JUSTIFIED	MET
Existing Signal Justification: Reduced Warrant 1B	12	12	8	JUSTIFIED	
Existing Signal Justification: Reduced Warrant 1C	12	12	8	JUSTIFIED	

All-Way Stop Warrants[1]	Met	Req'd.	Warrant Met?	
All-Way Stop: Crit. A (Signal Justified)	3	1	MET	MET
All-Way Stop: Crit. B (Crash History)	2	5	NO	
All-Way Stop: Crit. C1 & C2 (Min Vols, Same Hrs)	13	8	MET	
All-Way Stop: Crit. C2 (Minor App. Delay)	360	30	MET	
All-Way Stop: Crit. D (80% of B, C1, & C2)	-	-	NO	

[1] ***Source:*** *U.S. Dept. of Transportation FHWA Manual on Uniform Traffic Control Devices (2009 Edition)*

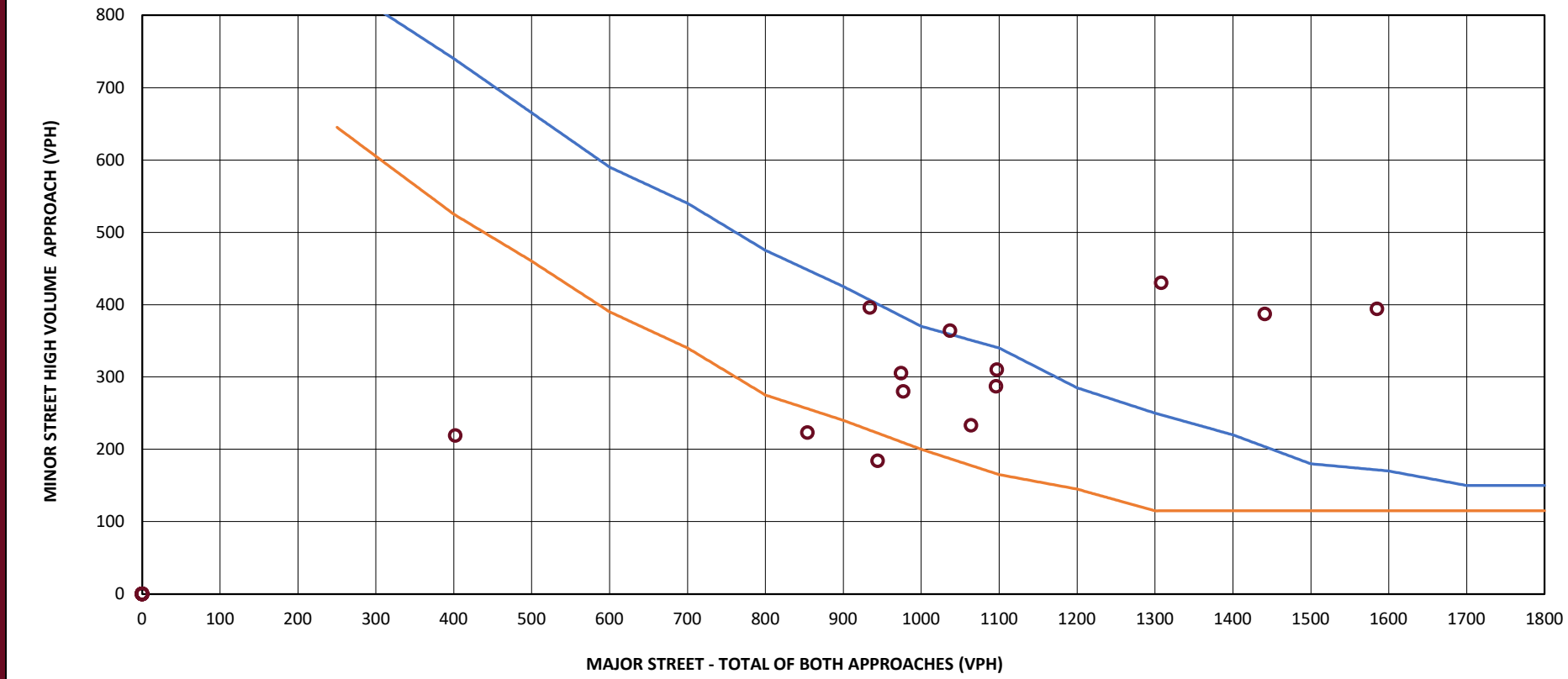
[2] ***Source:*** *MnDOT Traffic Engineering Manual, Chapter 9-5.02.05 "Traffic Control Signal Removal Justification Criteria"*

Prepared by Alliant Engineering, 10/30/2024

TRAFFIC CONTROL WARRANTS ANALYSIS

MAPO ICE, Riverfront Drive & Stoltzman Road

Warrant 2 & Warrant 3B



Scenario:	Major: 2	Minor: 2								
2044 Forecast	70% Factor:	**NO**	Warrant 2 (Four-Hour)	Lower Threshold:	115	Hours Met:	10	Hours Req'd:	4	Met? **MET**
			Warrant 3B (Peak Hour)		150		4		1	Met? **MET**

Source: *U.S. Department of Transportation FHWA Manual on Uniform Traffic Control Devices (2009 Edition)*

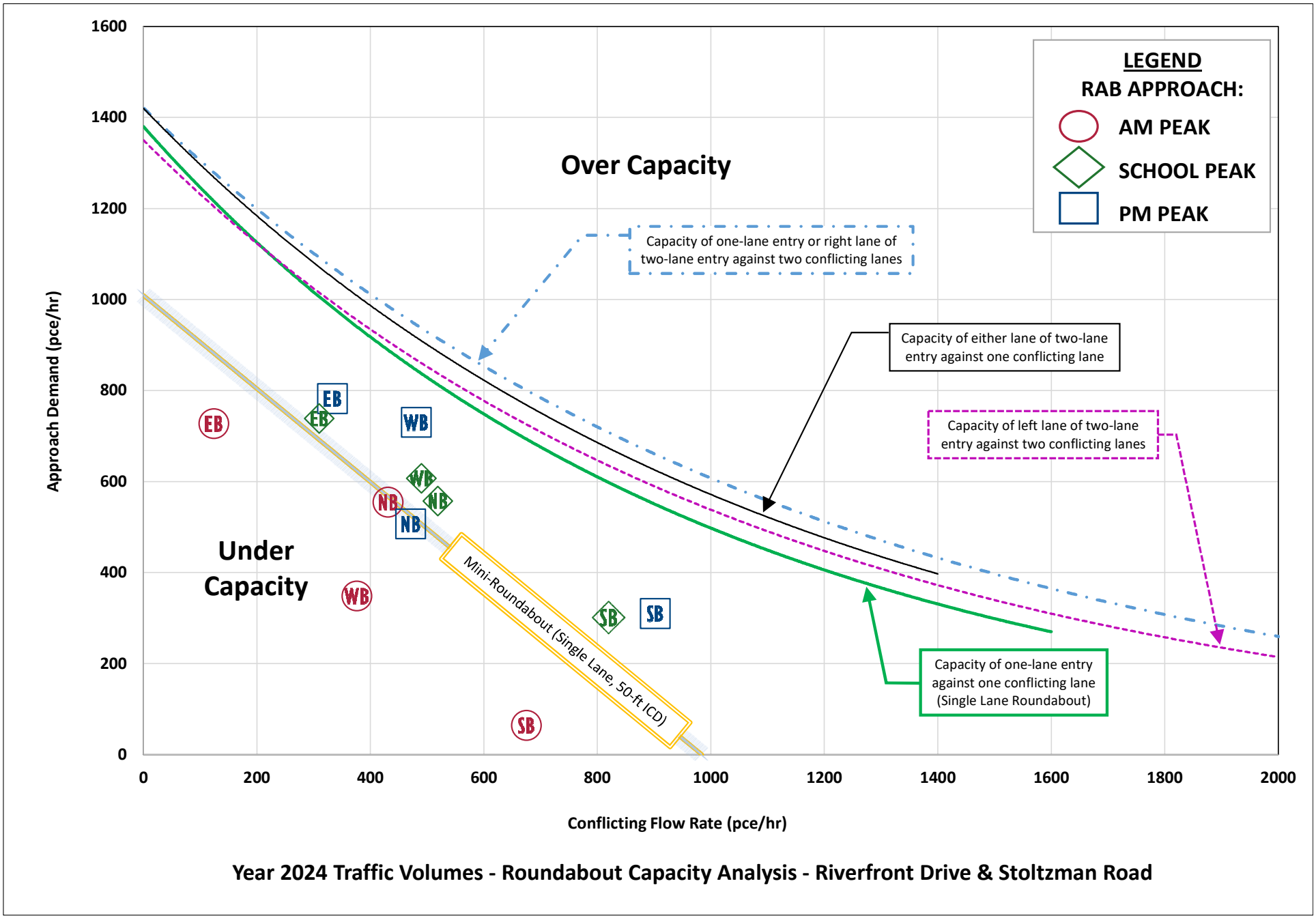
Warrant 2 (Four-Hour) Notes:

100%: 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 approach with one lane.
70%: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

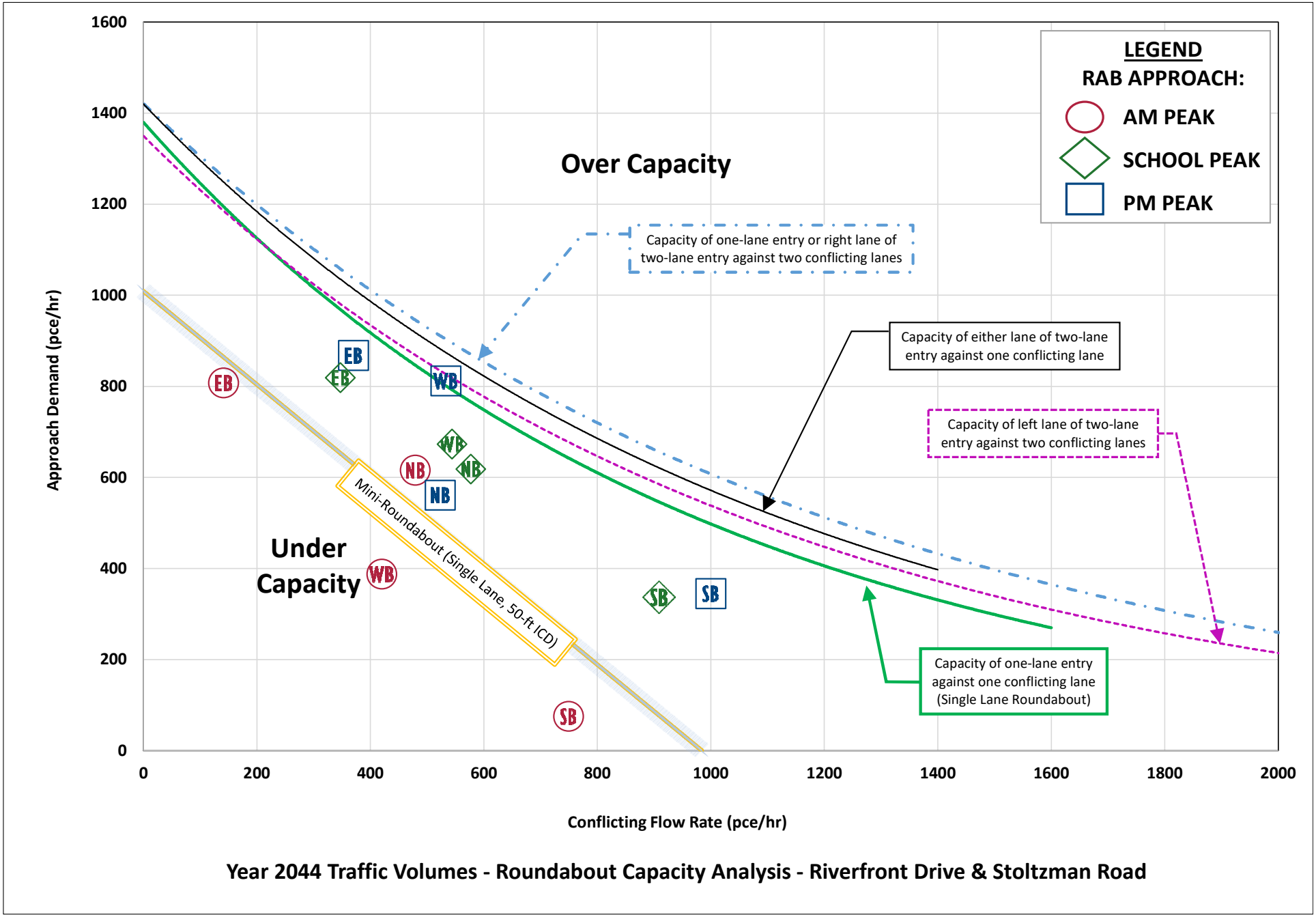
Warrant 3B (Peak Hour) Notes:

100%: 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 approach with one lane.
70%: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Appendix D: Planning-Level Roundabout Capacity Analysis



Year 2024 Traffic Volumes - Roundabout Capacity Analysis - Riverfront Drive & Stoltzman Road



Year 2044 Traffic Volumes - Roundabout Capacity Analysis - Riverfront Drive & Stoltzman Road

Appendix E: Excerpt from MnDOT's *A Study of the Traffic Safety at Roundabouts in Minnesota* (2021)

Unbalanced (2x1 Lane) Roundabouts

Unbalanced roundabouts, or those that have a different number of circulating lanes on different approaches, are typically used in locations where there is a significant traffic volume on the main road and a much smaller volume on the minor road. Typically with the traffic patterns at these locations, certain legs will only need one lane within the circulatory roadway, while other will need additional (typically two) lanes in the circulatory roadway.

Based on the before-after analysis, unbalanced roundabouts are not having the same success as the single lane roundabouts. Many of the sites have seen an *increase* in the frequency of crashes, and the overall total crash rates. However, unbalanced roundabouts are achieving a noticeable reduction in fatal, serious injury, and other injury crashes.

Table 15: Crash data from Unbalanced Roundabouts with before construction and after construction crash data based on Severity

Description	Vehicles Entering	Total Crashes	K	A	B	C	PDO
Before Crashes	998,943,195	524	0	7	42	124	351
Before Crash Rate	NA	0.525	0.000	0.007	0.042	0.124	0.351
After Crashes	664,905,712	502	0	1	18	74	409
After Crash Rate	NA	0.755	0.000	0.002	0.027	0.111	0.615
Percent Increase/ Decrease (By Rate)	**-33.4%**	**+43.9%**	**0.0%**	**-78.5%**	**-35.6%**	**-10.3%**	**+75.1%**

Table 16: Crash data from Unbalanced Roundabouts with before construction and after construction crash data based on the crash diagram

Description	Rear End	Sideswipe Same Dir	Left Turn	Ran-off-Road Left	Right Angle	Ran-off-Road Rt.	Head On	Sideswipe Opp
Before Crashes	221	28	43	5	158	10	19	6
Before Rate	0.221	0.028	0.043	0.005	0.158	0.010	0.019	0.006
After Crashes	112	163	5	20	79	40	13	6
After Rate	0.168	0.245	0.008	0.030	0.119	0.060	0.020	0.009
Percent Increase/Decr	**-23.9%**	**+774.6%**	**-82.5%**	**+501.0%**	**-24.9%**	**+501.0%**	**+2.8%**	**+50.2%**

Table 17: Crash data from Unbalanced Roundabouts with before construction and after construction crash data based on the crash diagram/type

Description	Other	Not Applicable	Unknown	Blank/Right-Turn	Multi-Vehicle
Before Crashes	20	6	1	7	491
Before Crash Rate	0.020	0.006	0.001	0.007	0.492
After Crashes	33	15	1	15	399
After Crash Rate	0.050	0.023	0.002	0.023	0.600
Percent Increase/ Decrease	**+147.9%**	**+275.6%**	**0.0%**	**+221.9%**	**+22.1%**

Some of the highlights from the unbalanced roundabout analysis include:

- No reported fatal crashes at any of the sites.
- A 78% reduction in Serious Injury Crashes
- The Fatal and Serious Injury Crash Rate, one of the Minnesota Department of Transportation's Statewide Performance Measures, decreased from 0.007 Severe Crashes per 1,000,000 Vehicles Entering to 0.002 Severe Crashes per 1,000,000 Vehicles Entering. This marks a 78% reduction in severe crashes.
- Fatal and Injury Crashes (K, A, B, and C injury) decreased from 0.17 injury crashes per 1,000,000 Vehicles Entering to 0.14 injury crashes per 1,000,000 Vehicles Entering. This marks an18% reduction in injury crashes.
- Right Angle crashes, typically the most deadly type of crash in Minnesota, had a total reduction of 25% of all crash severities.
- Left Turn into Traffic crashes had an 83% reduction.

Some of the results to notice for future considerations of unbalanced roundabouts include:

- The total crashes rate is up about 44%
- Sideswipe Same Direction crash rate is up 774%
- Multi-vehicle crashes had a 22% increase.

Appendix F: CMF ID 7696

CRASH MODIFICATION FACTORS CLEARINGHOUSE

CMF / CRF Details

CMF ID: 7696

CMF Name: Change from 5-section

Description: Change from 5-section

Prior Condition: 5 section doghouse signal

Category: Intersection traffic control

Study ID: *Safety Effectiveness of Flashing Yellow Arrow: Evaluation of 222 Signalized Intersections in North Carolina*, Simpson and Troy 2015

Star Quality Rating	
Star Quality Rating:	4 Stars

Crash Modification Factor (CMF)	
Value:	0.838
Adjusted Standard Error:	
Unadjusted Standard Error:	0.053

Crash Reduction Factor	
Value:	16.2
Adjusted Standard Error:	
Unadjusted Standard Error:	5.3

Applicability	
Crash Type:	Left turn
Crash Severity:	All
Roadway Types:	Not specified
Minimum Number of Lanes:	
Maximum Number of Lanes:	
Number of Lanes Direction:	
Number of Lanes Comment:	
Road Division Type:	
Minimum Speed Limit:	20
Maximum Speed Limit:	55
Speed Unit:	mph
Speed Limit Comment:	
Area Type:	Not specified
Traffic Volume:	
Average Traffic Volume:	
Time of Day:	Not specified
If countermeasure is intersection-based.	
Intersection Type:	Roadway/roadway (not interchange related)
Intersection Geometry:	3-leg,4-leg
Traffic Control:	Signalized
Major Road Traffic Volume:	Minimum of 3500 to Maximum of 52000 Annual Average Daily Traffic (AADT)
Minor Road Traffic Volume:	Minimum of 300 to Maximum of 26500 Annual Average Daily Traffic (AADT)

Average Major Road Volume:	
Average Minor Road Volume:	

Development Details

Date Range of Data Used:	2003 to 2013
Municipality:	
State:	NC
Country:	
Type of Methodology Used:	Simple before/after
Sample Size (crashes):	441 crashes before, 325 crashes after
Sample Size (sites):	156 sites before, 156 sites after

Other Details

Included in HSM:	No
Date Added to Clearinghouse:	Nov 01, 2015
Comments:	Target crashes are defined as

This site is funded by the U.S. Department of Transportation Federal Highway Administration and maintained by the University of North Carolina Highway Safety Research Center

Appendix G: Excerpt from MnDOT's *Pedestrian User Experience at Roundabouts* (2023)

3.2 Comparative urban traffic signal Analysis

One of the typical alternatives to installation of a roundabout at urban locations is installation of a traffic signal. This analysis compares the crash data at signalized intersections with volumes and characteristics similar to what would be found at the roundabouts selected for this evaluation.

3.2.1 Question Addressed

How do crash rates and densities at roundabouts in urbanized areas compare with traffic signal control at similar locations?

3.2.2 Locations

For this comparison, all 95 roundabout treatment sites were included that had an existing roundabout during the 2019 through 2021 period allowing for at least three years of analysis data at each roundabout.

When determining control sites to be used in a comparison group against treatment sites, locations are typically chosen that have similar characteristics to the treatment sites. Signalized intersections were selected for this comparison group using the same criteria that were used to select roundabout locations for this evaluation, which can be found in section 2.1 of this report.

Efforts were made to find an appropriate "match" for each of the 95 roundabout sites but because traffic signals are usually installed at higher-volume intersections, appropriate comparisons were difficult to find for some of the lower volume roundabouts in the treatment group. The affected treatment sites are:

50. W 70th St / Galleria Central Entrance;

51. W 70th St / Galleria East Entrance;

52. W 70th St / Galleria West Entrance in Hennepin County

The lower traffic volumes and nearby land use made identification of suitable control sites difficult for this set of roundabout sites. Using Google Maps to browse for other retail-heavy corridors in the Twin Cities and other large cities across the state, two control sites were identified in southern Ramsey County: CSAH 42 / Finn Ave and CSAH 42 / Kenneth St in the Highland Park neighborhood of Saint Paul. Traffic volume on CSAH 42 (Ford Pkwy) at Finn Ave was higher than any of the individual treatment sites, but when the major road volumes were added together for treatment sites 50 and 51, the number was like the volume for the Finn Ave control site. Traffic volume for treatment site 52 and the CSAH 42 (Ford Pkwy) / Kenneth St control site more closely matched, so they were considered an appropriate pair for comparison. The treatment sites on W 70th St are in the Galleria retail area of Edina and the control sites were located on a retail-heavy corridor in Saint Paul. Considering the total traffic volume and similar adjacent land uses, the selection of two control sites for comparison with three treatment sites is considered appropriate.

81. Hadley Ave S / 95th St S in Washington County

This roundabout intersection was included as a treatment site due to its location in a multi-use trail network connecting local parks, housing, and an elementary school. Pedestrians were also viewed traveling through the roundabout in Google Streetview. This site currently has low traffic volumes, with about 5,300 entering vehicles per day. No matching control site was selected for this treatment site.

Using the criteria described above for selection of control sites and considering the affected sites, 93 signalized intersections were selected as control sites and crash data from 2017 through 2021 was used. Figure 3.2 shows the locations of the included sites.

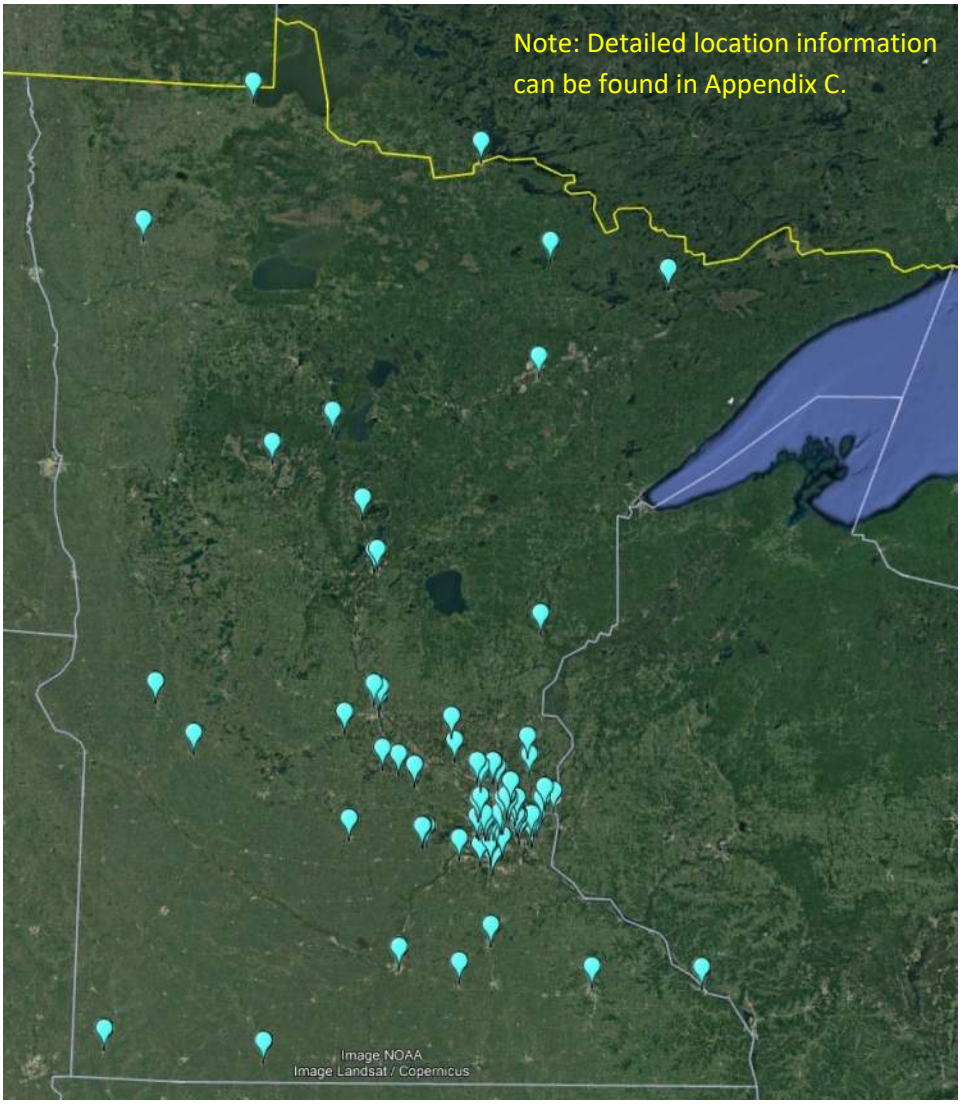


Figure 3.2 – Locations for Comparative Urban Traffic Signal Analysis

3.2.3 Crash Data

The area included when gathering crash data at roundabouts was previously discussed in Section 2.2. For urban signalized intersections, all crashes within 500 feet of the intersection on all approaches were included.

Crash data from 2017 through 2021 was used for the roundabout treatment sites and the traffic signal control sites. The following tables show the total entering volumes, the number of crashes, crash densities, and crash rates (crashes per MEV) for the After period at the roundabout treatment locations and from 2017 through 2021 at the traffic signal control sites.

Table 3.8 - Comparative Analysis Site-Years and Entering Volumes

	Roundabout (95 sites)	Urban Signals (93 sites)
Total Site-Years	447	465
Total Crashes	34	55
Total Entering Volume	1.75 billion	2.40 billion

Table 3.9 – Comparative Analysis Crash Densities – Roundabouts by Type with Urban Signal Comparison

Location	*Metric*	*K*	*A*	*KA*	*B*	*C*	*PDO*	*Total*	*Site Years*
Single Lane	# of Crashes	0	1	1	3	6	2	12	*256*
(53 sites)	**Crashes/Site-Year**	**0.000**	**0.004**	**0.004**	**0.012**	**0.023**	**0.008**	**0.047**	
Multi-Lane	# of Crashes	1	0	1	12	5	4	22	*191*
(41 sites)	**Crashes/Site-Year**	**0.005**	**0.000**	**0.005**	**0.063**	**0.026**	**0.021**	**0.115**	
Roundabout	# of Crashes	1	1	2	15	11	6	34	*447*
Total (94 sites)	**Crashes/Site-Year**	**0.002**	**0.002**	**0.004**	**0.034**	**0.025**	**0.013**	**0.076**	
Urban Signals	# of Crashes	2	8	10	25	13	7	55	*465*
(93 sites)	**Crashes/Site-Year**	**0.004**	**0.017**	**0.022**	**0.054**	**0.028**	**0.015**	**0.118**	

Table 3.10 – Comparative Analysis Crash Rates – Roundabouts by Type with Urban Signal Comparison

Location	*Metric*	*K*	*A*	*KA*	*B*	*C*	*PDO*	*Total*	Entering Volume
Single Lane	# of Crashes	0	1	1	3	6	2	12	633 million
(53 sites)	**Crashes / MEV**	**0.0000**	**0.0016**	**0.0016**	**0.0047**	**0.0095**	**0.0032**	**0.0189**	
Multi-Lane	# of Crashes	1	0	1	12	5	4	22	505 million
(41 sites)	**Crashes / MEV**	**0.0020**	**0.0000**	**0.0020**	**0.0237**	**0.0099**	**0.0079**	**0.0435**	
Roundabout	# of Crashes	1	1	2	15	11	6	34	1.14 billion
Total (94 sites)	**Crashes / MEV**	**0.0009**	**0.0009**	**0.0018**	**0.0132**	**0.0097**	**0.0053**	**0.0299**	
Urban Signals	# of Crashes	2	8	10	25	13	7	55	2.40 billion
(93 sites)	**Crashes / MEV**	**0.0008**	**0.0033**	**0.0042**	**0.0104**	**0.0054**	**0.0029**	**0.0229**	

Figures 3.3 through 3.6 illustrate the crash densities and rates from Tables 3.9 and 3.10.

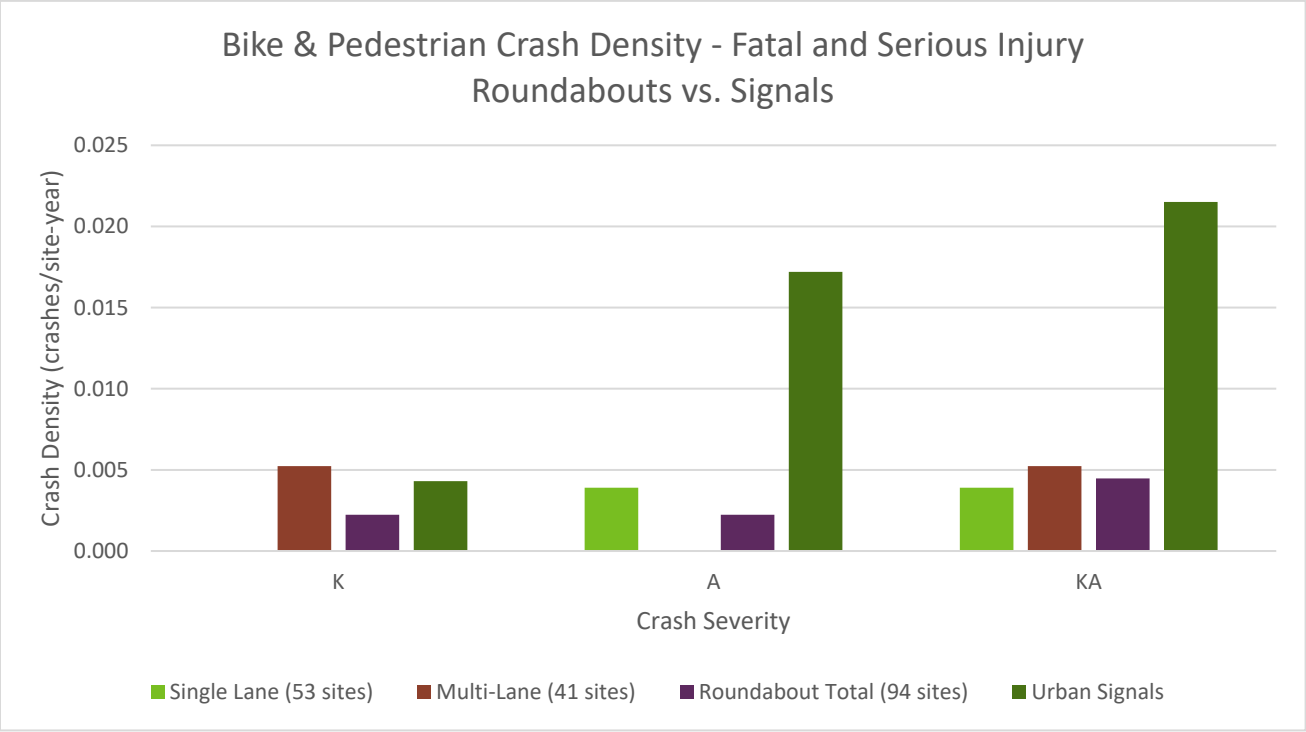


Figure 3.3 – Comparative Analysis K+A Crash Density – Roundabouts by Type with Urban Signal Comparison

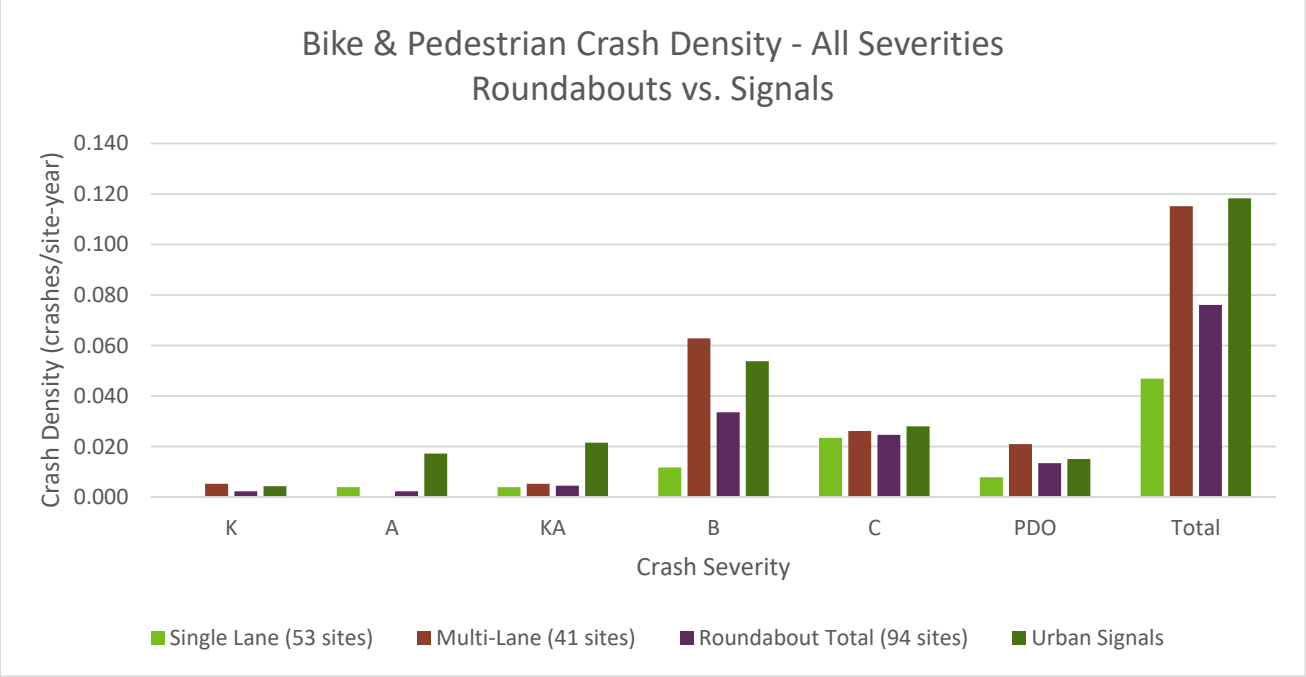


Figure 3.4 – Comparative Analysis All Crash Density – Roundabouts by Type with Urban Signal Comparison

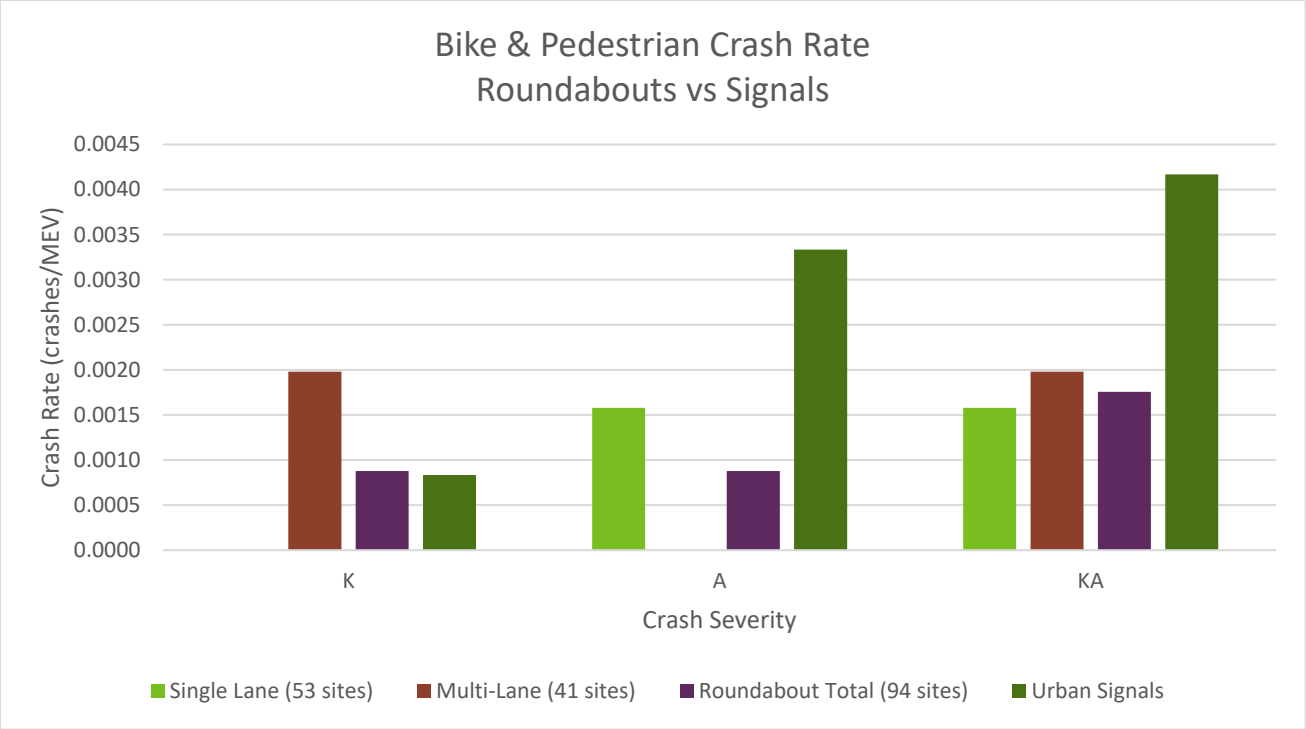


Figure 3.5 – Comparative Analysis K+A Crash Rates – Roundabouts by Type with Urban Signal Comparison

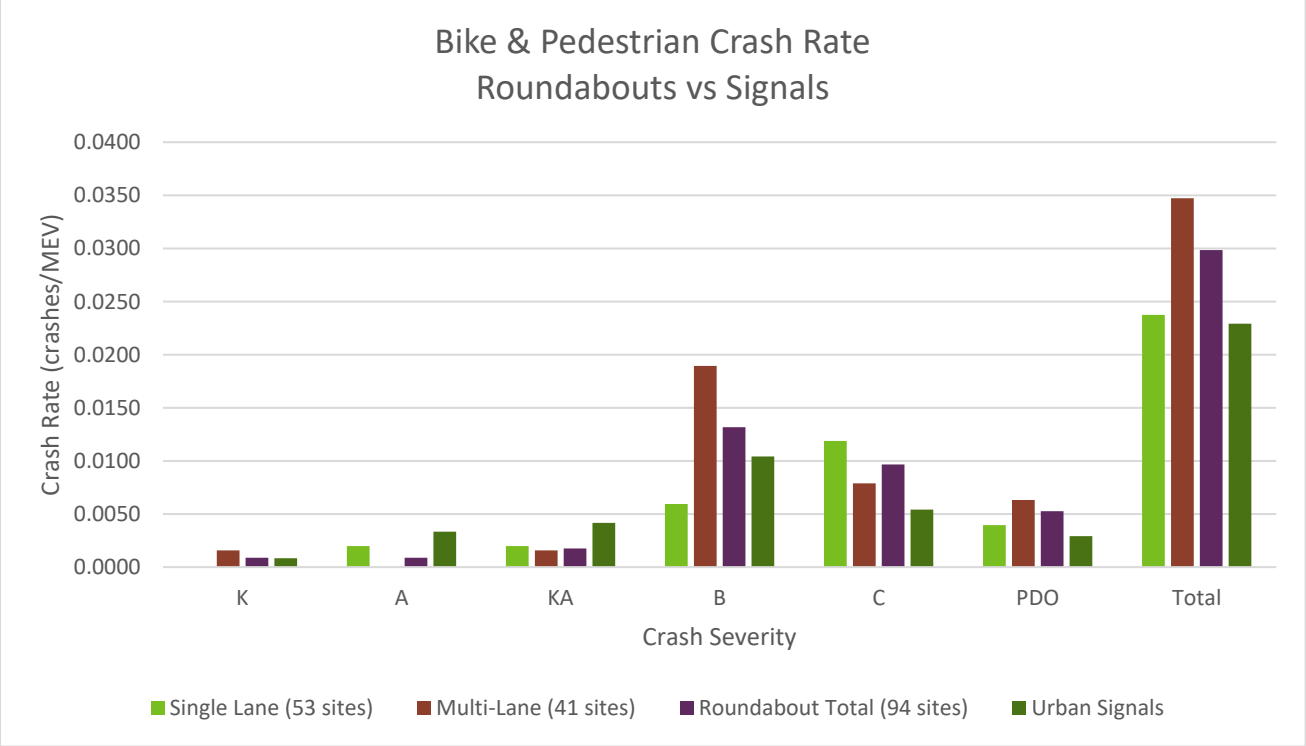


Figure 3.6 – Comparative Analysis All Crash Rates – Roundabouts by Type with Urban Signal Comparison

3.2.4 Crash Analysis

This analysis looked at the safety performance of single-lane and multi-lane roundabouts compared to urban traffic signals in the context of intersection crash density and crash rate. Crash density is a useful metric for looking at the number of crashes over a certain span of time while crash rate is a way to provide an equal comparison among sites with different traffic characteristics. For example, the figures above show multi-lane roundabouts have a higher crash rate than urban traffic signals, but it's possible this is a function of vehicle volumes/conflict potential as the two comparison groups have similar crash densities, or crashes per year at a site.

Previous studies and crash records have indicated roundabouts tend to have higher crash rates compared to signalized intersection when it comes to overall crashes and considerably lower crash rates compared to signalized intersections when it comes to fatal (K) and suspected serious injury (A) crashes. These findings are consistent with the results from this study.

Table 3.9 and 3.10 and associated Figures 3.3 through 3.6 show that roundabouts have a lower density of fatal and serious injury as well as total crashes when compared signalized intersections in urban areas. The results are similar for crash rates, where roundabouts have lower fatal and serious injury rates, but a higher rate of total crashes compared to urban traffic signals.

Appendix H: Detailed Measures of Effectiveness

Existing Conditions - AM Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	8.9	12.3	10.8	19.5	16.8	7.0	34.0	48.8	7.5	29.2	29.2	9.4	14.6
	Total Delay (hr)	0.1	2.1	0.5	0.6	2.3	0.0	0.6	0.1	0.1	0.1	0.1	0.2	6.8
	Movement LOS	A	B	B	B	B	A	C	D	A	C	C	A	B
	Movement Volume	46	625	172	105	489	5	59	5	70	12	10	66	1664
	Movement 95th Queue (ft)	56	226	279	123	201	217	117	117	67	77	77	77	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		11.8			17.2			20.7			14.4		
	Approach LOS		B			B			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	8.4	12.9	6.0	11.6	7.9	1.4	45.7	22.6	8.5	61.7	54.7	6.7	17.8
	Total Delay (hr)	0.0	1.4	0.5	0.3	0.5	0.0	4.3	0.2	0.5	0.3	0.3	0.1	8.4
	Movement LOS	A	B	A	B	A	A	D	C	A	E	D	A	B
	Movement Volume	13	385	307	84	241	14	332	35	202	20	17	27	1677
	Movement 95th Queue (ft)	25	133	119	65	69	12	196	201	126	64	51	33	
	Storage Bay Distance (ft)	130	0	140	150	0	120	0	0	180	0	80	80	
	Approach Delay (sec/veh)		9.8			8.5			31.1			36.6		
	Approach LOS		A			A			C			D		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	2.3	2.5	5.6	1.4	0.0	58.6	0.0	1.5	0.0	0.0	0.0	3.9
	Total Delay (hr)	0.0	0.3	0.1	0.1	0.1	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.1
	Movement LOS	A	A	A	A	A	A	E	A	A	A	A	A	A
	Movement Volume	0	510	96	36	306	0	32	0	26	0	0	0	1006
	Movement 95th Queue (ft)	0	63	0	46	42	0	79	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	0	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		2.3			1.8			33.0			0.0		
	Approach LOS		A			A			C			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	2.0	0.1	0.1	0.0	0.0	0.0	0.0	2.9	4.3	4.3	5.8	2.5	3.5
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	1	6	6	0	0	0	0	43	2	1	28	3	90
	Movement 95th Queue (ft)	0	0	0	0	0	0	40	40	40	42	42	42	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.2			0.0			3.0			5.4		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	11.5	0.0	3.8	0.0	0.0	0.0	5.5	1.0	0.0	0.0	1.0	1.1	1.4
	Total Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.4
	Movement LOS	B	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	19	0	23	0	0	0	23	523	0	0	309	102	999
	Movement 95th Queue (ft)	42	0	43	0	0	0	33	21	0	0	7	7	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	0	
	Approach Delay (sec/veh)		7.3			0.0			1.2			1.0		
	Approach LOS		A			A			A			A		

Existing Conditions - Afternoon School Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	10.7	10.1	8.8	15.4	18.8	15.3	33.2	40.9	6.4	40.4	38.7	11.7	14.8
	Total Delay (hr)	0.2	1.7	0.2	0.3	3.7	0.0	0.8	0.1	0.2	0.1	0.1	0.5	7.9
	Movement LOS	B	B	A	B	B	B	C	D	A	D	D	B	B
	Movement Volume	74	615	83	71	712	9	88	5	106	9	6	146	1924
	Movement 95th Queue (ft)	65	176	201	116	226	234	123	123	73	124	124	124	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		10.0			18.5			19.1			14.3		
	Approach LOS		B			B			B			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	17.8	20.5	6.7	18.2	18.2	3.3	32.4	26.7	6.5	34.8	36.8	7.7	18.6
	Total Delay (hr)	0.5	2.0	0.5	0.7	1.8	0.1	2.9	0.6	0.3	0.7	0.9	0.3	11.3
	Movement LOS	B	C	A	B	B	A	C	C	A	C	D	A	B
	Movement Volume	93	358	280	140	347	107	319	83	158	69	88	125	2167
	Movement 95th Queue (ft)	78	135	101	114	117	43	169	177	75	109	118	90	
	Storage Bay Distance (ft)	130	0	140	150	0	120	0	0	180	0	80	80	
	Approach Delay (sec/veh)		14.9			15.5			24.2			23.4		
	Approach LOS		B			B			C			C		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	6.7	3.4	5.7	2.0	0.0	38.7	0.0	1.7	0.0	0.0	0.0	6.1
	Total Delay (hr)	0.0	0.9	0.1	0.1	0.3	0.0	0.8	0.0	0.0	0.0	0.0	0.0	2.2
	Movement LOS	A	A	A	A	A	A	D	A	A	A	A	A	A
	Movement Volume	0	462	119	68	522	0	72	0	41	0	0	0	1284
	Movement 95th Queue (ft)	0	135	71	57	68	0	101	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	100	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		6.0			2.4			25.3			0.0		
	Approach LOS		A			A			C			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	2.0	0.9	0.2	2.2	0.0	0.2	5.3	1.5	3.8	3.7	6.0	2.5	2.2
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	4	1	38	13	0	3	22	236	11	2	46	4	380
	Movement 95th Queue (ft)	0	0	0	9	9	9	51	51	51	48	48	48	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.4			1.8			1.9			5.6		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	15.1	0.0	4.8	0.0	0.0	0.0	4.9	0.8	0.0	0.0	1.1	1.1	1.9
	Total Delay (hr)	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.5
	Movement LOS	C	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	55	0	49	0	0	0	20	470	0	0	468	48	1110
	Movement 95th Queue (ft)	62	0	53	0	0	0	29	0	0	0	3	3	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	0	
	Approach Delay (sec/veh)		10.2			0.0			1.0			1.1		
	Approach LOS		B			A			A			A		

Existing Conditions - PM Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	13.0	12.9	11.8	17.7	13.0	10.0	35.6	38.2	7.9	34.3	43.4	13.0	14.2
	Total Delay (hr)	0.2	2.2	0.4	0.6	2.4	0.0	0.8	0.1	0.2	0.1	0.0	0.5	7.5
	Movement LOS	B	B	B	B	B	A	D	D	A	C	D	B	B
	Movement Volume	60	597	109	119	658	10	84	7	102	11	4	133	1894
	Movement 95th Queue (ft)	62	225	285	99	143	153	138	138	74	125	125	125	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)	12.8			13.7			21.1			15.4			
	Approach LOS	B			B			C			B			

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	16.9	13.2	6.5	16.7	14.8	3.1	41.6	36.8	6.2	41.4	43.9	8.0	18.1
	Total Delay (hr)	0.5	1.0	0.6	0.8	1.5	0.1	3.3	0.7	0.2	0.5	1.2	0.3	10.7
	Movement LOS	B	B	A	B	B	A	D	D	A	D	D	A	B
	Movement Volume	100	280	328	169	360	122	282	63	111	47	93	144	2099
	Movement 95th Queue (ft)	84	99	116	125	119	44	187	194	88	114	127	108	
	Storage Bay Distance (ft)	130	0	140	150	0	120	0	0	180	0	80	80	
	Approach Delay (sec/veh)	10.6			13.1			32.3			25.3			
	Approach LOS	B			B			C			C			

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	6.0	3.0	5.3	2.5	0.0	48.5	0.0	1.4	0.0	0.0	0.0	6.1
	Total Delay (hr)	0.0	0.6	0.1	0.1	0.4	0.0	0.8	0.0	0.0	0.0	0.0	0.0	2.0
	Movement LOS	A	A	A	A	A	A	D	A	A	A	A	A	A
	Movement Volume	0	351	86	50	589	0	63	0	35	0	0	0	1174
	Movement 95th Queue (ft)	0	116	31	47	88	0	105	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	100	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)	5.4			2.7			31.7			0.0			
	Approach LOS	A			A			C			A			

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	1.7	0.0	0.1	1.7	0.0	0.0	5.2	1.5	3.1	5.5	5.7	2.2	1.9
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	2	1	23	3	3	1	17	260	4	2	24	1	341
	Movement 95th Queue (ft)	0	0	0	0	0	0	48	48	48	46	46	46	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)	0.2			0.7			1.7			5.6			
	Approach LOS	A			A			A			A			

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	24.0	0.0	6.5	0.0	0.0	0.0	7.4	0.8	0.0	0.0	1.3	1.2	2.3
	Total Delay (hr)	0.3	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0	0.8
	Movement LOS	C	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	41	0	30	0	0	0	43	410	0	0	528	68	1120
	Movement 95th Queue (ft)	71	0	50	0	0	0	51	0	0	0	8	11	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	0	
	Approach Delay (sec/veh)	16.6			0.0			1.4			1.3			
	Approach LOS	C			A			A			A			

No Build - Forecast Year 2044 - AM Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	8.9	14.3	15.4	23.7	17.6	17.1	38.0	36.8	7.7	30.9	23.0	10.5	16.6
	Total Delay (hr)	0.1	2.8	0.9	0.8	2.7	0.0	0.7	0.1	0.2	0.2	0.1	0.2	8.8
	Movement LOS	A	B	B	C	B	B	D	D	A	C	C	B	B
	Movement Volume	53	704	200	127	554	7	67	7	74	18	10	72	1893
	Movement 95th Queue (ft)	66	281	346	138	242	252	132	132	62	99	99	99	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		14.2			18.7			22.8			15.4		
	Approach LOS		B			B			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	13.8	15.8	6.2	15.1	9.5	1.4	43.2	28.0	9.7	54.7	54.4	7.2	18.9
	Total Delay (hr)	0.1	2.0	0.6	0.4	0.8	0.0	4.6	0.3	0.6	0.3	0.3	0.0	10.0
	Movement LOS	B	B	A	B	A	A	D	C	A	D	D	A	B
	Movement Volume	17	442	335	90	282	14	380	40	217	22	23	25	1887
	Movement 95th Queue (ft)	33	158	127	81	91	12	222	222	147	50	45	32	
	Storage Bay Distance (ft)	130	0	140	150	0	120	0	0	180	0	80	80	
	Approach Delay (sec/veh)		11.7			10.5			30.8			37.6		
	Approach LOS		B			B			C			D		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	2.9	2.7	5.0	1.5	0.0	57.9	0.0	1.4	0.0	0.0	0.0	4.6
	Total Delay (hr)	0.0	0.5	0.1	0.1	0.1	0.0	0.7	0.0	0.0	0.0	0.0	0.0	1.5
	Movement LOS	A	A	A	A	A	A	E	A	A	A	A	A	A
	Movement Volume	0	586	95	46	343	0	43	0	29	0	0	0	1142
	Movement 95th Queue (ft)	0	86	21	45	43	0	92	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	100	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		2.9			1.9			35.1			0.0		
	Approach LOS		A			A			D			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	1.5	0.0	0.1	0.0	0.0	0.0	0.0	2.8	4.4	0.0	5.7	2.2	3.1
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	2	5	9	0	0	0	0	53	3	0	24	3	99
	Movement 95th Queue (ft)	0	0	0	0	0	0	43	43	43	43	43	43	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.2			0.0			2.9			5.3		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	12.2	0.0	3.7	0.0	0.0	0.0	6.1	1.2	0.0	0.0	1.0	1.0	1.6
	Total Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.5
	Movement LOS	B	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	26	0	25	0	0	0	30	583	0	0	350	100	1114
	Movement 95th Queue (ft)	49	0	44	0	0	0	43	0	0	0	7	7	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	0	
	Approach Delay (sec/veh)		8.0			0.0			1.4			1.0		
	Approach LOS		A			A			A			A		

No Build - Forecast Year 2044 - Afternoon School Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	12.8	11.1	10.2	15.9	18.2	16.5	37.5	34.2	6.8	30.2	32.4	12.8	15.5
	Total Delay (hr)	0.3	2.1	0.3	0.4	4.1	0.0	1.1	0.1	0.2	0.1	0.1	0.6	9.4
	Movement LOS	B	B	B	B	B	B	D	C	A	C	C	B	B
	Movement Volume	86	680	99	78	810	10	109	7	108	11	7	167	2172
	Movement 95th Queue (ft)	74	195	223	101	236	245	155	155	72	121	121	121	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		11.2			18.0			22.6			14.6		
	Approach LOS		B			B			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	18.2	21.7	7.4	19.9	21.5	4.0	31.0	28.1	8.3	33.3	36.4	8.2	19.6
	Total Delay (hr)	0.5	2.5	0.6	0.8	2.2	0.1	3.2	0.7	0.4	0.7	1.0	0.3	13.0
	Movement LOS	B	C	A	B	C	A	C	C	A	C	D	A	B
	Movement Volume	95	409	302	152	375	114	373	94	185	77	95	152	2423
	Movement 95th Queue (ft)	89	147	102	117	136	49	192	201	107	108	123	100	
	Storage Bay Distance (ft)	130	0	140	150	0	120	0	0	180	0	80	80	
	Approach Delay (sec/veh)		15.9			18.0			24.1			22.4		
	Approach LOS		B			B			C			C		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	7.3	3.6	6.1	2.9	0.0	38.3	0.0	1.8	0.0	0.0	0.0	6.9
	Total Delay (hr)	0.0	1.1	0.1	0.1	0.5	0.0	0.9	0.0	0.0	0.0	0.0	0.0	2.7
	Movement LOS	A	A	A	A	A	A	D	A	A	A	A	A	A
	Movement Volume	0	534	134	78	554	0	89	0	47	0	0	0	1436
	Movement 95th Queue (ft)	0	156	85	65	89	0	116	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	100	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		6.6			3.3			25.7			0.0		
	Approach LOS		A			A			C			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	1.9	0.2	0.2	2.0	0.0	0.0	5.6	1.7	3.7	4.4	6.4	3.1	2.4
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	6	3	41	12	0	3	25	248	13	1	48	5	405
	Movement 95th Queue (ft)	0	0	0	6	6	6	48	48	48	55	55	55	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.4			1.6			2.1			6.1		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	21.9	0.0	5.3	0.0	0.0	0.0	6.0	0.9	0.0	0.0	1.2	1.0	2.4
	Total Delay (hr)	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.8
	Movement LOS	C	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	63	0	63	0	0	0	17	544	0	0	505	51	1243
	Movement 95th Queue (ft)	88	0	70	0	0	0	29	13	0	0	3	3	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	0	
	Approach Delay (sec/veh)		13.6			0.0			1.1			1.2		
	Approach LOS		B			A			A			A		

No Build - Forecast Year 2044 - PM Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	12.4	14.3	12.0	22.3	15.2	8.3	35.7	37.1	10.8	38.4	33.1	16.3	16.2
	Total Delay (hr)	0.3	2.8	0.4	0.9	3.4	0.0	1.1	0.1	0.4	0.2	0.0	0.7	10.3
	Movement LOS	B	B	B	C	B	A	D	D	B	D	C	B	B
	Movement Volume	73	702	119	144	804	12	112	8	123	15	4	150	2266
	Movement 95th Queue (ft)	68	248	309	127	189	199	160	160	99	137	137	137	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		13.8			16.2			23.1			18.7		
	Approach LOS		B			B			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	17.5	13.7	6.5	19.2	17.8	3.1	40.5	37.0	6.7	43.5	44.5	9.7	18.8
	Total Delay (hr)	0.6	1.3	0.7	1.0	2.2	0.1	3.8	0.7	0.3	0.8	1.3	0.5	13.3
	Movement LOS	B	B	A	B	B	A	D	D	A	D	D	A	B
	Movement Volume	116	333	391	191	440	155	336	68	145	65	104	187	2531
	Movement 95th Queue (ft)	87	107	114	148	159	50	187	193	78	126	134	115	
	Storage Bay Distance (ft)	130	0	140	150	0	120	0	0	180	0	80	80	
	Approach Delay (sec/veh)		10.9			15.2			31.1			26.0		
	Approach LOS		B			B			C			C		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	6.4	3.0	6.0	2.7	0.0	49.4	0.0	1.4	0.0	0.0	0.0	6.5
	Total Delay (hr)	0.0	0.8	0.1	0.1	0.5	0.0	1.1	0.0	0.0	0.0	0.0	0.0	2.6
	Movement LOS	A	A	A	A	A	A	D	A	A	A	A	A	A
	Movement Volume	0	430	108	62	705	0	79	0	37	0	0	0	1421
	Movement 95th Queue (ft)	0	126	64	50	97	0	126	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	100	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		5.7			3.0			34.1			0.0		
	Approach LOS		A			A			C			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	2.1	0.0	0.2	1.6	0.1	0.0	4.9	1.5	3.5	5.2	5.8	2.3	1.9
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	3	1	24	4	2	1	18	312	3	2	29	1	400
	Movement 95th Queue (ft)	0	0	0	0	0	0	48	48	48	49	49	49	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.4			0.9			1.7			5.7		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	28.5	0.0	6.8	0.0	0.0	0.0	8.7	0.9	0.0	0.0	1.3	1.3	2.7
	Total Delay (hr)	0.5	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0	1.0
	Movement LOS	D	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	57	0	38	0	0	0	40	489	0	0	611	80	1315
	Movement 95th Queue (ft)	99	0	70	0	0	0	49	0	0	0	7	10	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	0	
	Approach Delay (sec/veh)		19.8			0.0			1.5			1.3		
	Approach LOS		C			A			A			A		

Alternative 2 - Forecast Year 2044 - AM Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	9.3	16.4	17.0	23.3	16.6	13.1	38.0	28.8	9.5	31.6	33.8	10.4	17.1
	Total Delay (hr)	0.1	3.0	0.8	0.8	2.4	0.0	0.6	0.0	0.2	0.1	0.1	0.2	8.3
	Movement LOS	A	B	B	C	B	B	D	C	A	C	C	B	B
	Movement Volume	46	650	172	116	508	7	53	3	68	14	7	70	1714
	Movement 95th Queue (ft)	54	300	397	132	197	201	117	117	68	84	84	84	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		16.1			17.8			22.1			15.5		
	Approach LOS		B			B			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	14.2	17.0	7.2	16.0	11.2	1.6	51.5	14.2	8.7	52.1	58.9	6.1	20.8
	Total Delay (hr)	0.1	1.9	0.6	0.4	0.8	0.0	5.0	0.2	0.5	0.3	0.3	0.0	10.1
	Movement LOS	B	B	A	B	B	A	D	B	A	D	E	A	C
	Movement Volume	13	401	315	85	258	16	349	44	192	20	19	24	1736
	Movement 95th Queue (ft)	31	163	121	83	101	16	462	134	128	53	47	37	
	Storage Bay Distance (ft)	130	0	140	150	0	120	0	0	180	0	80	80	
	Approach Delay (sec/veh)		12.7			11.9			34.6			36.6		
	Approach LOS		B			B			C			D		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	3.5	2.9	5.0	1.6	0.0	54.0	0.0	1.5	0.0	0.0	0.0	4.7
	Total Delay (hr)	0.0	0.5	0.1	0.1	0.1	0.0	0.6	0.0	0.0	0.0	0.0	0.0	1.4
	Movement LOS	A	A	A	A	A	A	D	A	A	A	A	A	A
	Movement Volume	0	528	86	46	320	0	38	0	29	0	0	0	1047
	Movement 95th Queue (ft)	0	99	32	45	46	0	93	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	100	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		3.4			2.0			31.3			0.0		
	Approach LOS		A			A			C			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	1.6	0.1	0.2	0.0	0.0	0.0	0.0	2.7	2.9	2.5	5.8	2.4	3.0
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	2	6	8	0	0	0	0	50	2	1	21	3	93
	Movement 95th Queue (ft)	0	0	0	0	0	0	42	42	42	44	44	44	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.3			0.0			2.7			5.3		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	12.6	0.0	3.9	0.0	0.0	0.0	6.4	1.4	0.0	0.0	1.1	1.1	1.7
	Total Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.0	0.0	0.1	0.0	0.4
	Movement LOS	B	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	23	0	23	0	0	0	21	532	0	0	333	89	1021
	Movement 95th Queue (ft)	45	0	46	0	0	0	33	15	0	0	8	8	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	0	
	Approach Delay (sec/veh)		8.3			0.0			1.6			1.1		
	Approach LOS		A			A			A			A		

Alternative 2 - Forecast Year 2044 - Afternoon School Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	11.6	10.8	8.9	14.9	17.8	17.2	34.1	34.6	7.9	36.0	34.6	12.9	14.9
	Total Delay (hr)	0.3	2.1	0.2	0.3	3.8	0.1	1.0	0.1	0.3	0.1	0.1	0.6	9.0
	Movement LOS	B	B	A	B	B	B	C	C	A	D	C	B	B
	Movement Volume	82	686	89	67	769	11	105	9	116	10	7	175	2126
	Movement 95th Queue (ft)	78	192	222	76	204	212	127	127	76	128	128	128	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		10.7			17.6			20.9			14.9		
	Approach LOS		B			B			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	19.0	22.8	7.7	19.7	20.3	3.8	27.6	25.6	6.4	22.7	36.9	7.2	18.2
	Total Delay (hr)	0.5	2.5	0.7	0.8	2.1	0.1	2.6	0.6	0.3	0.5	1.0	0.3	12.0
	Movement LOS	B	C	A	B	C	A	C	C	A	C	D	A	B
	Movement Volume	104	392	318	152	371	115	330	81	178	78	98	146	2363
	Movement 95th Queue (ft)	95	148	114	108	129	51	246	93	87	107	122	106	
	Storage Bay Distance (ft)	130	0	140	150	0	120	0	0	180	0	80	80	
	Approach Delay (sec/veh)		16.4			17.2			20.9			20.0		
	Approach LOS		B			B			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	7.0	3.4	6.0	2.4	0.0	36.0	0.0	1.7	0.0	0.0	0.0	6.3
	Total Delay (hr)	0.0	1.0	0.1	0.1	0.4	0.0	0.8	0.0	0.0	0.0	0.0	0.0	2.4
	Movement LOS	A	A	A	A	A	A	D	A	A	A	A	A	A
	Movement Volume	0	507	138	87	555	0	85	0	54	0	0	0	1426
	Movement 95th Queue (ft)	0	145	64	59	78	0	107	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	100	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		6.2			2.9			22.7			0.0		
	Approach LOS		A			A			C			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	2.0	0.4	0.2	2.1	0.0	0.0	5.5	1.6	3.6	6.1	6.3	2.6	2.3
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	5	3	41	16	0	1	22	262	16	2	49	6	423
	Movement 95th Queue (ft)	7	7	7	9	9	9	51	51	51	53	53	53	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.4			2.0			2.0			5.9		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	17.0	0.0	4.8	0.0	0.0	0.0	6.6	0.9	0.0	0.0	1.2	1.1	2.1
	Total Delay (hr)	0.3	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.7
	Movement LOS	C	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	59	0	57	0	0	0	20	499	0	0	513	53	1201
	Movement 95th Queue (ft)	66	0	60	0	0	0	36	0	0	0	5	5	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	0	
	Approach Delay (sec/veh)		11.0			0.0			1.1			1.2		
	Approach LOS		B			A			A			A		

Alternative 2 - Forecast Year 2044 - PM Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	11.9	15.1	14.1	20.2	20.2	14.9	33.2	43.4	9.8	36.8	39.4	15.0	18.0
	Total Delay (hr)	0.2	3.0	0.5	0.8	4.5	0.0	1.0	0.1	0.3	0.2	0.0	0.7	11.3
	Movement LOS	B	B	B	C	C	B	C	D	A	D	D	B	B
	Movement Volume	70	700	127	137	794	12	107	9	112	19	4	155	2246
	Movement 95th Queue (ft)	63	261	327	132	229	237	151	151	92	139	139	139	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		14.7			20.1			22.1			17.9		
	Approach LOS		B			C			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	15.3	20.6	9.4	18.4	18.1	3.7	32.0	28.0	6.0	28.2	46.1	9.1	18.3
	Total Delay (hr)	0.5	2.0	1.0	1.0	2.2	0.2	3.0	0.6	0.3	0.5	1.3	0.5	13.1
	Movement LOS	B	C	A	B	B	A	C	C	A	C	D	A	B
	Movement Volume	114	340	374	198	426	150	330	82	152	58	100	183	2507
	Movement 95th Queue (ft)	98	148	152	129	136	51	290	88	77	131	135	115	
	Storage Bay Distance (ft)	130	0	140	150	0	120	0	0	180	0	80	80	
	Approach Delay (sec/veh)		14.8			15.4			24.4			23.2		
	Approach LOS		B			B			C			C		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	3.3	3.1	5.8	2.8	0.0	50.9	0.0	1.4	0.0	0.0	0.0	5.8
	Total Delay (hr)	0.0	0.4	0.1	0.1	0.5	0.0	1.2	0.0	0.0	0.0	0.0	0.0	2.3
	Movement LOS	A	A	A	A	A	A	D	A	A	A	A	A	A
	Movement Volume	0	444	109	55	687	0	81	0	43	0	0	0	1419
	Movement 95th Queue (ft)	0	68	25	47	94	0	126	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	100	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		3.3			3.0			33.7			0.0		
	Approach LOS		A			A			C			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	1.9	0.2	0.2	2.0	0.0	0.0	5.4	1.5	3.6	3.6	6.1	2.3	2.0
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	3	2	24	4	2	0	15	318	4	3	32	1	408
	Movement 95th Queue (ft)	0	0	0	0	0	0	47	47	47	51	51	51	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.4			1.3			1.7			5.8		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	25.2	0.0	6.2	0.0	0.0	0.0	9.2	1.0	0.0	0.0	1.4	1.3	2.8
	Total Delay (hr)	0.4	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0	0.9
	Movement LOS	D	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	63	0	38	0	0	0	46	496	0	0	589	82	1314
	Movement 95th Queue (ft)	80	0	54	0	0	0	50	9	0	0	9	11	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	0	
	Approach Delay (sec/veh)		18.1			0.0			1.7			1.4		
	Approach LOS		C			A			A			A		

Alternative 3 - Forecast Year 2044 - AM Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	11.6	14.2	13.7	20.3	17.3	15.9	35.6	39.1	8.1	32.9	31.5	10.7	16.2
	Total Delay (hr)	0.2	2.8	0.7	0.7	2.6	0.0	0.8	0.1	0.2	0.1	0.1	0.2	8.5
	Movement LOS	B	B	B	C	B	B	D	D	A	C	C	B	B
	Movement Volume	53	697	192	115	530	8	77	6	75	15	8	76	1852
	Movement 95th Queue (ft)	63	260	321	110	213	227	136	136	66	93	93	93	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		14.0			17.8			22.7			15.7		
	Approach LOS		B			B			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	10.3	14.6	7.0	16.0	8.3	1.3	45.8	20.0	8.7	56.5	54.9	7.3	18.6
	Total Delay (hr)	0.0	1.8	0.7	0.5	0.6	0.0	4.6	0.2	0.5	0.4	0.3	0.1	9.7
	Movement LOS	B	B	A	B	A	A	D	B	A	E	D	A	B
	Movement Volume	17	436	333	102	270	17	357	42	220	26	20	25	1865
	Movement 95th Queue (ft)	25	147	113	89	77	12	197	59	116	62	47	0	
	Storage Bay Distance (ft)	130	0	140	150	0	120	125	0	180	0	80	0	
	Approach Delay (sec/veh)		11.3			10.0			30.9			38.7		
	Approach LOS		B			B			C			D		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	3.1	2.7	5.2	1.5	0.0	51.6	0.0	1.4	0.0	0.0	0.0	4.1
	Total Delay (hr)	0.0	0.5	0.1	0.1	0.1	0.0	0.5	0.0	0.0	0.0	0.0	0.0	1.3
	Movement LOS	A	A	A	A	A	A	D	A	A	A	A	A	A
	Movement Volume	0	568	109	46	351	0	36	0	32	0	0	0	1142
	Movement 95th Queue (ft)	0	91	31	44	43	0	86	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	100	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		3.0			1.9			28.0			0.0		
	Approach LOS		A			A			C			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	1.6	0.0	0.0	0.0	0.0	0.0	0.0	2.6	5.6	4.1	5.6	2.4	3.1
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	2	6	7	0	0	0	0	56	2	1	28	3	105
	Movement 95th Queue (ft)	0	0	0	0	0	0	41	41	41	47	47	47	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.2			0.0			2.7			5.3		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	15.3	0.0	3.0	0.0	0.0	0.0	6.6	1.1	0.0	0.0	0.8	1.0	1.5
	Total Delay (hr)	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.2	0.0	0.0	0.1	0.0	0.5
	Movement LOS	C	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	24	0	25	0	0	0	31	557	0	0	347	111	1095
	Movement 95th Queue (ft)	49	0	42	0	0	0	41	5	0	0	0	10	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	200	
	Approach Delay (sec/veh)		9.0			0.0			1.4			0.8		
	Approach LOS		A			A			A			A		

Alternative 3 - Forecast Year 2044 - Afternoon School Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	12.0	10.8	9.2	15.4	20.0	14.8	37.0	37.2	7.1	34.3	28.6	13.1	15.9
	Total Delay (hr)	0.3	2.0	0.2	0.3	4.5	0.0	1.1	0.0	0.2	0.1	0.0	0.6	9.3
	Movement LOS	B	B	A	B	B	B	D	D	A	C	C	B	B
	Movement Volume	83	679	96	68	804	11	108	4	122	10	6	163	2154
	Movement 95th Queue (ft)	69	197	239	95	255	259	158	158	75	120	120	120	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		10.7			19.6			21.4			14.8		
	Approach LOS		B			B			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	17.8	21.8	10.4	22.0	19.1	3.7	33.0	24.1	6.9	23.4	38.6	9.2	19.4
	Total Delay (hr)	0.5	2.4	0.9	1.0	2.0	0.1	3.3	0.7	0.4	0.5	1.1	0.4	13.3
	Movement LOS	B	C	B	C	B	A	C	C	A	C	D	A	B
	Movement Volume	100	398	318	163	370	125	355	97	182	79	102	158	2447
	Movement 95th Queue (ft)	90	152	161	133	128	50	170	110	89	121	126	0	
	Storage Bay Distance (ft)	130	0	140	150	0	120	125	0	180	0	80	0	
	Approach Delay (sec/veh)		16.9			16.9			24.1			21.4		
	Approach LOS		B			B			C			C		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	6.6	3.5	5.8	2.5	0.0	38.3	0.0	1.8	0.0	0.0	0.0	6.3
	Total Delay (hr)	0.0	1.0	0.1	0.1	0.4	0.0	0.9	0.0	0.0	0.0	0.0	0.0	2.5
	Movement LOS	A	A	A	A	A	A	D	A	A	A	A	A	A
	Movement Volume	0	523	132	75	575	0	82	0	47	0	0	0	1434
	Movement 95th Queue (ft)	0	138	74	58	86	0	105	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	100	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		6.0			2.9			25.0			0.0		
	Approach LOS		A			A			C			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	2.3	1.2	0.2	1.8	0.0	0.0	5.3	1.7	3.7	4.2	6.3	2.7	2.3
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.1	0.0	0.2
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	5	2	44	13	0	2	20	271	14	1	49	7	428
	Movement 95th Queue (ft)	0	0	0	6	6	6	50	50	50	51	51	51	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.4			1.6			2.0			5.8		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	24.0	0.0	4.3	0.0	0.0	0.0	6.7	0.9	0.0	0.0	1.2	1.1	2.4
	Total Delay (hr)	0.4	0.0	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.2	0.0	0.8
	Movement LOS	C	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	63	0	55	0	0	0	21	524	0	0	532	57	1252
	Movement 95th Queue (ft)	91	0	75	0	0	0	36	9	0	0	7	3	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	200	
	Approach Delay (sec/veh)		14.8			0.0			1.1			1.2		
	Approach LOS		B			A			A			A		

Alternative 3 - Forecast Year 2044 - PM Peak Hour

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Poplar Street	Movement Delay (sec/veh)	13.3	14.9	10.9	18.1	20.9	17.6	36.6	28.1	9.6	29.9	33.3	16.6	18.0
	Total Delay (hr)	0.2	2.7	0.3	0.7	4.4	0.1	1.0	0.1	0.3	0.1	0.0	0.7	10.6
	Movement LOS	B	B	B	B	C	B	D	C	A	C	C	B	B
	Movement Volume	59	641	108	133	750	14	94	8	114	15	2	146	2084
	Movement 95th Queue (ft)	76	229	267	136	243	251	132	132	84	137	137	137	
	Storage Bay Distance (ft)	150	0	0	150	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		14.2			20.4			22.0			18.0		
	Approach LOS		B			C			C			B		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & CSAH 16 (Stoltzman Road)	Movement Delay (sec/veh)	17.1	20.3	10.0	18.0	18.9	3.5	33.8	29.8	5.6	24.9	46.1	9.2	18.8
	Total Delay (hr)	0.5	1.8	1.0	0.9	2.2	0.1	3.0	0.5	0.2	0.4	1.2	0.4	12.2
	Movement LOS	B	C	A	B	B	A	C	C	A	C	D	A	B
	Movement Volume	110	312	351	188	421	136	315	60	137	59	93	163	2345
	Movement 95th Queue (ft)	112	134	173	133	136	47	308	90	75	131	134	111	
	Storage Bay Distance (ft)	130	0	140	150	0	120	0	0	180	0	80	80	
	Approach Delay (sec/veh)		15.2			15.9			25.8			23.0		
	Approach LOS		B			B			C			C		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Riverfront Drive & Marshall Street	Movement Delay (sec/veh)	0.0	3.1	3.0	5.2	2.9	0.0	44.6	0.0	1.4	0.0	0.0	0.0	5.4
	Total Delay (hr)	0.0	0.4	0.1	0.1	0.5	0.0	1.0	0.0	0.0	0.0	0.0	0.0	2.1
	Movement LOS	A	A	A	A	A	A	D	A	A	A	A	A	A
	Movement Volume	0	403	105	52	663	0	78	0	39	0	0	0	1340
	Movement 95th Queue (ft)	0	64	0	53	100	0	120	0	0	0	0	0	
	Storage Bay Distance (ft)	0	0	0	100	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		3.1			3.1			30.2			0.0		
	Approach LOS		A			A			C			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
Linder Street & Parking Lot	Movement Delay (sec/veh)	1.5	0.0	0.2	2.3	0.1	0.1	4.7	1.4	3.5	4.1	6.0	2.2	1.8
	Total Delay (hr)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.1
	Movement LOS	A	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	3	1	23	3	2	2	17	284	4	2	25	2	368
	Movement 95th Queue (ft)	0	0	0	5	5	5	47	47	47	50	50	50	
	Storage Bay Distance (ft)	0	0	0	0	0	0	0	0	0	0	0	0	
	Approach Delay (sec/veh)		0.3			1.0			1.6			5.6		
	Approach LOS		A			A			A			A		

Intersection	MOE	Eastbound Approach			Westbound Approach			Northbound Approach			Southbound Approach			Intersection Total
		EBL	EBT	EBR	WBL	WBT	WBR	NBL	NBT	NBR	SBL	SBT	SBR	
CSAH 16 (Stoltzman Road) & Mankato West High School	Movement Delay (sec/veh)	24.4	0.0	6.4	0.0	0.0	0.0	8.8	1.0	0.0	0.0	1.3	1.3	2.7
	Total Delay (hr)	0.4	0.0	0.1	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.2	0.0	0.9
	Movement LOS	C	A	A	A	A	A	A	A	A	A	A	A	A
	Movement Volume	57	0	34	0	0	0	42	455	0	0	557	72	1217
	Movement 95th Queue (ft)	75	0	55	0	0	0	51	0	0	0	5	5	
	Storage Bay Distance (ft)	100	0	0	0	0	0	50	0	0	0	0	0	
	Approach Delay (sec/veh)		17.7			0.0			1.7			1.3		
	Approach LOS		C			A			A			A		

Appendix I: Detailed Benefit/Cost Analysis

Riverfront Drive & CSAH 16 (Stoltzman Road)

Crash Cost Analysis

	Right Angle	Left Turn	Rear End	Sideswipe	Run Off Road	Head On	Right Turn	Other	Total
All Crashes	1	2	7	1	3	0	1	2	15
Fatal	0	0	0	0	0	0	0	0	
A Injury	0	0	0	0	0	0	0	0	
B Injury	0	1	0	0	1	0	1	1	17
C Injury	0	1	1	0	0	0	0	1	
PDO	1	0	6	1	2	0	0	0	
Cross-Street Crashes	0	0	0	0	0	0	0	0	0
Fatal									
A Injury									
B Injury									0
C Injury									
PDO									
Alternative 0 (No Build)									
Total Crashes	1.0	2.0	7.0	1.0	3.0	0.0	1.0	2.0	17.0
Fatal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A Injury	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B Injury	0.0	1.0	0.0	0.0	1.0	0.0	1.0	1.0	4.0
C Injury	0.0	1.0	1.0	0.0	0.0	0.0	0.0	1.0	3.0
PDO	1.0	0.0	6.0	1.0	2.0	0.0	0.0	0.0	10.0
								Crash Rate =	**0.39**
Alternative 1 Multi-Lane Roundabout									
	MnDOT Roundabout Study for Hybrid 2x1 RABs (1)								
Total Crashes									17.0
Fatal									0.0
A Injury									0.0
B Injury									0.6
C Injury									2.5
PDO									13.9
								Crash Rate =	**0.76**
Alternative 2 Traffic Signal, Standard Phasing									
CMF = 0.838	CMF ID 7696 (2)								
Total Crashes	1.0	1.7	7.0	1.0	3.0	0.0	1.0	2.0	16.7
Fatal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A Injury	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B Injury	0.0	0.8	0.0	0.0	1.0	0.0	1.0	1.0	3.8
C Injury	0.0	0.8	1.0	0.0	0.0	0.0	0.0	1.0	2.8
PDO	1.0	0.0	6.0	1.0	2.0	0.0	0.0	0.0	10.0
								Crash Rate =	**0.38**
Alternative 3 Traffic Signal, Standard Phasing									
CMF = 0.838	CMF ID 7696 (2)								
Total Crashes	1.0	1.7	7.0	1.0	3.0	0.0	1.0	2.0	16.7
Fatal	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
A Injury	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
B Injury	0.0	0.8	0.0	0.0	1.0	0.0	1.0	1.0	3.8
C Injury	0.0	0.8	1.0	0.0	0.0	0.0	0.0	1.0	2.8
PDO	1.0	0.0	6.0	1.0	2.0	0.0	0.0	0.0	10.0
								Crash Rate =	**0.38**

(1) Source: A Study of the Traffic Safety at Roundabouts in Minnesota Revised 2021
(2) Source: CMF ID 7696 for *Change 5-section "doghouse" P/P left-turn to falshing yellow arrow P/P left turn*

2024 Annual Crash Costs

Scenario	Traffic Control	Severity	Severity Proportion	Crash Rate	Total Entering Volume	Average Crashes / Year (No.)	Cost / Crash ($)	Cost / Year ($)
Alternative 0 (No Build)	All-Way Stop	K	0.0%	0.39	8,687,000	0.000	$ 14,600,000	$ -
		A	0.0%			0.000	$ 800,000	$ -
		B	23.5%			0.800	$ 250,000	$ 200,000.00
		C	17.6%			0.600	$ 130,000	$ 78,000.00
		PDO	58.8%			2.000	$ 15,000	$ 30,000.00
		Total	**100%**			**3.400**		**$ 308,000.00**
Scenario	**Traffic Control**	**Severity**	**Severity Proportion**	**Crash Rate**	**Total Entering Volume**	**Average Crashes / Year (No.)**	**Cost / Crash ($)**	**Cost / Year ($)**
Alternative 1 Multi-Lane Roundabout	Roundabout	K	0.0%	0.76	8,687,000	0.000	$ 14,600,000	$ -
		A	0.0%			0.000	$ 800,000	$ -
		B	3.8%			0.251	$ 250,000	$ 62,720.14
		C	14.7%			0.971	$ 130,000	$ 126,166.51
		PDO	81.5%			5.381	$ 15,000	$ 80,710.92
		Total	**100%**			**6.602**		**$ 269,597.57**
Scenario	**Traffic Control**	**Severity**	**Severity Proportion**	**Crash Rate**	**Total Entering Volume**	**Average Crashes / Year (No.)**	**Cost / Crash ($)**	**Cost / Year ($)**
Alternative 2 Traffic Signal, Standard Phasing	Traffic Signal	K	0.0%	0.38	8,687,000	0.000	$ 14,600,000	$ -
		A	0.0%			0.000	$ 800,000	$ -
		B	23.0%			0.768	$ 250,000	$ 191,900.00
		C	17.0%			0.568	$ 130,000	$ 73,788.00
		PDO	60.0%			2.000	$ 15,000	$ 30,000.00
		Total	**100%**			**3.335**		**$ 295,688.00**
Scenario	**Traffic Control**	**Severity**	**Severity Proportion**	**Crash Rate**	**Total Entering Volume**	**Average Crashes / Year (No.)**	**Cost / Crash ($)**	**Cost / Year ($)**
Alternative 3 Traffic Signal, Standard Phasing	Traffic Signal	K	0.0%	0.38	8,687,000	0.000	$ 14,600,000	$ -
		A	0.0%			0.000	$ 800,000	$ -
		B	23.0%			0.768	$ 250,000	$ 191,900.00
		C	17.0%			0.568	$ 130,000	$ 73,788.00
		PDO	60.0%			2.000	$ 15,000	$ 30,000.00
		Total	**100%**			**3.335**		**$ 295,688.00**

Cost/Crash reflects MnDOT's Cost-Effectiveness & Benefit-Cost Analysis for Transportation Projects Appendix A, published July 2021. (http://www.dot.state.mn.us/planning/program/appendix_a.html)

2044 Annual Crash Costs

Scenario	Traffic Control	Severity	Severity Proportion	Crash Rate	Total Entering Volume	Average Crashes / Year (No.)	Cost / Crash ($)	Cost / Year ($)
Alternative 0 (No Build)	All-Way Stop	K	0.0%	0.39	9,598,266	0.000	$ 14,600,000	N/A
		A	0.0%			0.000	$ 800,000	$ -
		B	23.5%			0.884	$ 250,000	$ 220,980.00
		C	17.6%			0.663	$ 130,000	$ 86,182.20
		PDO	58.8%			2.210	$ 15,000	$ 33,147.00
		Total	**100%**			**3.757**		**$ 340,309.20**
Scenario	**Traffic Control**	**Severity**	**Severity Proportion**	**Crash Rate**	**Total Entering Volume**	**Average Crashes / Year (No.)**	**Cost / Crash ($)**	**Cost / Year ($)**
Alternative 1 Multi-Lane Roundabout	Roundabout	K	0.0%	0.76	9,598,266	0.000	$ 14,600,000	N/A
		A	0.0%			0.000	$ 800,000	$ -
		B	3.8%			0.277	$ 250,000	$ 69,299.48
		C	14.7%			1.072	$ 130,000	$ 139,401.38
		PDO	81.5%			5.945	$ 15,000	$ 89,177.49
		Total	**100%**			**7.295**		**$ 297,878.36**
Scenario	**Traffic Control**	**Severity**	**Severity Proportion**	**Crash Rate**	**Total Entering Volume**	**Average Crashes / Year (No.)**	**Cost / Crash ($)**	**Cost / Year ($)**
Alternative 2 Traffic Signal, Standard Phasing	Traffic Signal	K	0.0%	0.38	9,598,266	0.000	$ 14,600,000	N/A
		A	0.0%			0.000	$ 800,000	$ -
		B	23.0%			0.848	$ 250,000	$ 212,030.31
		C	17.0%			0.627	$ 130,000	$ 81,528.36
		PDO	60.0%			2.210	$ 15,000	$ 33,147.00
		Total	**100%**			**3.685**		**$ 326,705.67**
Scenario	**Traffic Control**	**Severity**	**Severity Proportion**	**Crash Rate**	**Total Entering Volume**	**Average Crashes / Year (No.)**	**Cost / Crash ($)**	**Cost / Year ($)**
Alternative 3 Traffic Signal, Standard Phasing	Traffic Signal	K	0.0%	0.38	9,598,266	0.000	$ 14,600,000	N/A
		A	0.0%			0.000	$ 800,000	$ -
		B	23.0%			0.848	$ 250,000	$ 212,030.31
		C	17.0%			0.627	$ 130,000	$ 81,528.36
		PDO	60.0%			2.210	$ 15,000	$ 33,147.00
		Total	**100%**			**3.685**		**$ 326,705.67**

Cost/Crash reflects MnDOT's Cost-Effectiveness & Benefit-Cost Analysis for Transportation Projects Appendix A, published July 2021. (http://www.dot.state.mn.us/planning/program/appendix_a.html)

Riverfront Drive & CSAH 16 (Stoltzman Road) - Present Value Crash Benefit - 2044 Forecast

Year	Annual Crash Cost				Crash Benefit				Present Value Crash Benefit			
	Alternative 0 (No Build)	Alternative 1 Multi-Lane Roundabout	Alternative 2 Traffic Signal, Standard Phasing	Alternative 3 Traffic Signal, Standard Phasing	Alternative 0 (No Build)	Alternative 1 Multi-Lane Roundabout	Alternative 2 Traffic Signal, Standard Phasing	Alternative 3 Traffic Signal, Standard Phasing	Alternative 0 (No Build)	Alternative 1 Multi-Lane Roundabout	Alternative 2 Traffic Signal, Standard Phasing	Alternative 3 Traffic Signal, Standard Phasing
2024	$ 308,000	$ 269,598	$ 295,688	$ 295,688	$ -	$ 38,402	$ 12,312	$ 12,312	$ -	$ 38,402	$ 12,312	$ 12,312
2025	$ 309,615	$ 271,012	$ 297,239	$ 297,239	$ -	$ 38,604	$ 12,377	$ 12,377	$ -	$ 38,297	$ 12,278	$ 12,278
2026	$ 311,231	$ 272,426	$ 298,790	$ 298,790	$ -	$ 38,805	$ 12,441	$ 12,441	$ -	$ 38,192	$ 12,244	$ 12,244
2027	$ 312,846	$ 273,840	$ 300,341	$ 300,341	$ -	$ 39,007	$ 12,506	$ 12,506	$ -	$ 38,085	$ 12,210	$ 12,210
2028	$ 314,462	$ 275,254	$ 301,892	$ 301,892	$ -	$ 39,208	$ 12,570	$ 12,570	$ -	$ 37,978	$ 12,176	$ 12,176
2029	$ 316,077	$ 276,668	$ 303,442	$ 303,442	$ -	$ 39,410	$ 12,635	$ 12,635	$ -	$ 37,870	$ 12,141	$ 12,141
2030	$ 317,693	$ 278,082	$ 304,993	$ 304,993	$ -	$ 39,611	$ 12,699	$ 12,699	$ -	$ 37,762	$ 12,107	$ 12,107
2031	$ 319,308	$ 279,496	$ 306,544	$ 306,544	$ -	$ 39,812	$ 12,764	$ 12,764	$ -	$ 37,653	$ 12,072	$ 12,072
2032	$ 320,924	$ 280,910	$ 308,095	$ 308,095	$ -	$ 40,014	$ 12,829	$ 12,829	$ -	$ 37,543	$ 12,036	$ 12,036
2033	$ 322,539	$ 282,324	$ 309,646	$ 309,646	$ -	$ 40,215	$ 12,893	$ 12,893	$ -	$ 37,432	$ 12,001	$ 12,001
2034	$ 324,155	$ 283,738	$ 311,197	$ 311,197	$ -	$ 40,417	$ 12,958	$ 12,958	$ -	$ 37,321	$ 11,965	$ 11,965
2035	$ 325,770	$ 285,152	$ 312,748	$ 312,748	$ -	$ 40,618	$ 13,022	$ 13,022	$ -	$ 37,209	$ 11,930	$ 11,930
2036	$ 327,386	$ 286,566	$ 314,299	$ 314,299	$ -	$ 40,819	$ 13,087	$ 13,087	$ -	$ 37,097	$ 11,894	$ 11,894
2037	$ 329,001	$ 287,980	$ 315,849	$ 315,849	$ -	$ 41,021	$ 13,151	$ 13,151	$ -	$ 36,984	$ 11,857	$ 11,857
2038	$ 330,616	$ 289,394	$ 317,400	$ 317,400	$ -	$ 41,222	$ 13,216	$ 13,216	$ -	$ 36,871	$ 11,821	$ 11,821
2039	$ 332,232	$ 290,808	$ 318,951	$ 318,951	$ -	$ 41,424	$ 13,281	$ 13,281	$ -	$ 36,757	$ 11,785	$ 11,785
2040	$ 333,847	$ 292,222	$ 320,502	$ 320,502	$ -	$ 41,625	$ 13,345	$ 13,345	$ -	$ 36,643	$ 11,748	$ 11,748
2041	$ 335,463	$ 293,636	$ 322,053	$ 322,053	$ -	$ 41,827	$ 13,410	$ 13,410	$ -	$ 36,528	$ 11,711	$ 11,711
2042	$ 337,078	$ 295,050	$ 323,604	$ 323,604	$ -	$ 42,028	$ 13,474	$ 13,474	$ -	$ 36,412	$ 11,674	$ 11,674
2043	$ 338,694	$ 296,464	$ 325,155	$ 325,155	$ -	$ 42,229	$ 13,539	$ 13,539	$ -	$ 36,297	$ 11,637	$ 11,637
2044	$ 340,309	$ 297,878	$ 326,706	$ 326,706	$ -	$ 42,431	$ 13,604	$ 13,604	$ -	$ 36,180	$ 11,600	$ 11,600
	$ 6,807,247	**$ 5,958,497**	**$ 6,535,134**	**$ 6,535,134**	**$ -**	**$ 848,749**	**$ 272,113**	**$ 272,113**	**$ -**	**$ 783,515**	**$ 251,198**	**$ 251,198**

Discount Rate	0.8%
Current Year	2024
Construction Year	2024
Design Year	2044

Daily and Annual Vehicle Hours Traveled

2024 Vehicle Hours Traveled (VHT)

Time Period	Grouping	Percent of Grouping by Volume	2024 ALT 0 Total Delay (Veh-Hr)	2024 ALT 1 Total Delay (Veh-Hr)	2024 ALT 2 Total Delay (Veh-Hr)	2024 ALT 3 Total Delay (Veh-Hr)
12:00 AM	AM OFF	5.8%	0.49	0.18	0.52	0.49
1:00 AM	AM OFF	1.7%	0.14	0.05	0.15	0.14
2:00 AM	AM OFF	4.7%	0.39	0.15	0.42	0.40
3:00 AM	AM OFF	3.8%	0.32	0.12	0.34	0.33
4:00 AM	AM OFF	5.1%	0.43	0.16	0.46	0.43
5:00 AM	AM OFF	14.3%	1.20	0.46	1.29	1.22
6:00 AM	AM	39.4%	3.31	1.25	3.55	3.35
7:00 AM	AM	85.3%	7.17	2.71	7.68	7.25
8:00 AM	**AM**	**100.0%**	**8.40**	**3.18**	**9.00**	**8.50**
9:00 AM	OFF	69.2%	5.82	2.20	6.23	5.89
10:00 AM	OFF	74.2%	6.23	2.36	6.68	6.30
11:00 AM	OFF	62.7%	4.50	1.70	4.82	4.55
12:00 PM	OFF	67.5%	7.22	4.28	7.49	7.83
1:00 PM	OFF	63.9%	6.84	4.06	7.10	7.42
2:00 PM	OFF	71.1%	7.60	4.51	7.89	8.24
3:00 PM	PM	84.7%	9.06	5.37	9.40	9.82
4:00 PM	**PM**	**100.0%**	**10.70**	**6.34**	**11.10**	**11.60**
5:00 PM	PM	89.7%	10.70	6.34	11.10	11.60
6:00 PM	PM	63.3%	6.77	4.01	7.02	7.34
7:00 PM	PM OFF	56.0%	5.99	3.55	6.21	6.49
8:00 PM	PM OFF	38.8%	4.15	2.46	4.30	4.50
9:00 PM	PM OFF	34.6%	3.71	2.20	3.84	4.02
10:00 PM	PM OFF	22.6%	2.41	1.43	2.51	2.62
11:00 PM	PM OFF	15.3%	1.64	0.97	1.70	1.78
2024 Daily Vehicle Hours Traveled (VHT)			**115.2**	**60.1**	**120.8**	**122.1**
2024 Annual Vehicle Hours Traveled (VHT)			**42043.4**	**21926.2**	**44092.3**	**44567.7**

2044 Vehicle Hours Traveled (VHT)

Time Period	Grouping	Percent of Grouping by Volume	2044 ALT 0 Total Delay (Veh-Hr)	2044 ALT 1 Total Delay (Veh-Hr)	2044 ALT 2 Total Delay (Veh-Hr)	2044 ALT 3 Total Delay (Veh-Hr)
12:00 AM	AM OFF	5.8%	0.51	0.23	0.59	0.56
1:00 AM	AM OFF	1.7%	0.15	0.07	0.17	0.16
2:00 AM	AM OFF	4.7%	0.41	0.19	0.47	0.45
3:00 AM	AM OFF	3.8%	0.34	0.15	0.39	0.37
4:00 AM	AM OFF	5.1%	0.45	0.20	0.52	0.49
5:00 AM	AM OFF	14.3%	1.26	0.57	1.44	1.39
6:00 AM	AM	39.4%	3.47	1.58	3.98	3.82
7:00 AM	AM	85.3%	7.51	3.42	8.62	8.28
8:00 AM	**AM**	**100.0%**	**8.80**	**4.01**	**10.10**	**9.70**
9:00 AM	OFF	69.2%	6.09	2.78	6.99	6.72
10:00 AM	OFF	74.2%	6.53	2.97	7.49	7.19
11:00 AM	OFF	62.7%	4.71	2.15	5.41	5.19
12:00 PM	OFF	67.5%	8.97	5.85	8.70	7.08
1:00 PM	OFF	63.9%	8.50	5.54	8.25	6.71
2:00 PM	OFF	71.1%	9.45	6.16	9.17	7.46
3:00 PM	PM	84.7%	11.26	7.34	10.92	8.89
4:00 PM	**PM**	**100.0%**	**13.30**	**8.66**	**12.90**	**10.50**
5:00 PM	PM	89.7%	13.30	8.66	12.90	10.50
6:00 PM	PM	63.3%	8.41	5.48	8.16	6.64
7:00 PM	PM OFF	56.0%	7.45	4.85	7.22	5.88
8:00 PM	PM OFF	38.8%	5.16	3.36	5.00	4.07
9:00 PM	PM OFF	34.6%	4.61	3.00	4.47	3.64
10:00 PM	PM OFF	22.6%	3.00	1.96	2.91	2.37
11:00 PM	PM OFF	15.3%	2.04	1.33	1.97	1.61
2044 Daily Vehicle Hours Traveled (VHT)			**135.7**	**80.5**	**138.7**	**119.7**
2044 Annual Vehicle Hours Traveled (VHT)			**49521.3**	**29384.4**	**50642.6**	**43688.5**

Riverfront Drive & CSAH 16 (Stoltzman Road) --- Benefit / Cost Analysis for Alternative 1 Multi-Lane Roundabout 2044 Forecast

BASE 2024	Total
DELAY (Stop)	42,043

2044 No Improvement	Total	2024 No Improvement	Total
DELAY (Stop)	49,521	DELAY (Stop)	42,043

2044 Improvement	Total	2024 Improvement	Total
DELAY (Alt)	29,384	DELAY (Alt)	21,926

2044 Changes:	Total	
DELAY	(20,137)	-40.7%

	COST ITEM				
	1	2	3	4	5
Category	Roadway	Bridge	Traffic Signal/ Lighting	Contingency Construction Costs	ROW
Capital Value ($)	1,906,448	$0	$124,721	$ 609,351	$0
Remaining Life (%)-20yr	36%	72%	22%	36%	86%
Remaining Cap. Value	$ 686,321	$ -	$ 27,439	$ 219,366	$ -

Note: Assume Expected Life of 30 Years. Analysis Period is 20 years.

B/C Analysis Summary

BENEFITS	*Value(Discounted)*	
1. Travel Time Savings:	$	15,669,249
TOTAL	$	15,669,249

COSTS	*Value(Discounted)*	
1. Roadway/Interchange	$	(1,906,448)
2. Bridges	$	-
3. Maintenance	$	(191,012)
4. Contingency Costs	$	(609,351)
5. Right-of-way (ROW)	$	-
Remaining Capital	$	795,664
TOTAL	$	(1,911,147)

Benefit/Cost Analysis Results		
20-Yr Operation Benefit	$	15,669,249
20-Yr Safety Benefit	$	783,515
COSTS	$	1,911,147
B/C Ratio:		**8.609**

Cost		Estimated	Estimated	Estimated
Category	Improvement Description	NA	NA	NA
1	Roadway Paving	$1,187,817	$0	$0
1	Drainage and Erosion	$296,955	$0	$0
1	Misc	$421,676	$0	$0
2	Bridge	$0	$0	$0
2				
3	Traffic Signal/Lighting	$124,721	$0	$0
3				
3				
	Total Estimated Construction Costs	$2,031,169	$0	$0
4	Indirect Costs & Contingency	$406,234	$0	$0
5	Right-of-Way/Easement Costs	$0	$0	$0
4	Professional Services	$203,117	$0	$0
	Total Project Costs	$2,640,520	$0	$0

BENEFIT 1: Travel Time Savings (VHT)

	Annual VHT		Annualized Savings		Discounted
YEAR	2044 No Improvement	2044 Improvement	Improvement w/ VHT Savings	'00 cost per hour $ 23.90	Value (0.8%)
2024	42,043	21,926	20117	$ 806,717.90	$ 806,717.90
2025	42,417	22,299	20118	$ 806,757.54	$ 800,354.70
2026	42,791	22,672	20119	$ 806,797.18	$ 794,041.69
2027	43,165	23,045	20120	$ 806,836.82	$ 787,778.48
2028	43,539	23,418	20121	$ 806,876.46	$ 781,564.66
2029	43,913	23,791	20122	$ 806,916.09	$ 775,399.86
2030	44,287	24,164	20123	$ 806,955.73	$ 769,283.68
2031	44,661	24,537	20124	$ 806,995.37	$ 763,215.74
2032	45,035	24,909	20125	$ 807,035.01	$ 757,195.67
2033	45,408	25,282	20126	$ 807,074.65	$ 751,223.07
2034	45,782	25,655	20127	$ 807,114.29	$ 745,297.59
2035	46,156	26,028	20128	$ 807,153.93	$ 739,418.84
2036	46,530	26,401	20129	$ 807,193.57	$ 733,586.46
2037	46,904	26,774	20130	$ 807,233.21	$ 727,800.08
2038	47,278	27,147	20131	$ 807,272.84	$ 722,059.35
2039	47,652	27,520	20132	$ 807,312.48	$ 716,363.89
2040	48,026	27,893	20133	$ 807,352.12	$ 710,713.36
2041	48,400	28,266	20134	$ 807,391.76	$ 705,107.39
2042	48,774	28,639	20135	$ 807,431.40	$ 699,545.64
2043	49,147	29,011	20136	$ 807,471.04	$ 694,027.76
2044	49,521	29,384	20137	$ 807,510.68	$ 688,553.41
TOTAL				$ 16,949,400	$ 15,669,249

Note: Trucks on average account for approximately 2% of network traffic. Passenger vehicle occupancy assumed to be 1.68.

MnDOT Office of Investment Management, Benefit Cost Analysis

Standard Values, Appendix A, Fiscal Year 2022

Trucks (Value of Time) **$ 37.60**

COST 1: Roadways/Interchange Construction

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ (1,906,448)	(1,906,448)
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ (1,906,448)	$ (1,906,448)

COST 2: Bridge

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ -	-
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ -	$ -

COST 3: Maintenance & Operation

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ (124,721)	(124,721)
2025	$ (3,600)	(3,571)
2026	$ (3,600)	(3,543)
2027	$ (3,600)	(3,515)
2028	$ (3,600)	(3,487)
2029	$ (3,600)	(3,459)
2030	$ (3,600)	(3,432)
2031	$ (3,600)	(3,405)
2032	$ (3,600)	(3,378)
2033	$ (3,600)	(3,351)
2034	$ (3,600)	(3,324)
2035	$ (3,600)	(3,298)
2036	$ (3,600)	(3,272)
2037	$ (3,600)	(3,246)
2038	$ (3,600)	(3,220)
2039	$ (3,600)	(3,194)
2040	$ (3,600)	(3,169)
2041	$ (3,600)	(3,144)
2042	$ (3,600)	(3,119)
2043	$ (3,600)	(3,094)
2044	$ (3,600)	(3,070)
TOTAL	$ (196,721)	$ (191,012)

Note: Assume maintenance and operation costs of the Roundabout to be -3600 per year.

COST 4: Contingency Construction Costs

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ (609,351)	(609,351)
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ (609,351)	$ (609,351)

COST 5: Right of Way (ROW)

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ -	-
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ -	$ -

Remaining Capital Value

YEAR	Remaining Capital Value	Discounted Value (0.8%)
2024	$ -	-
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ 933,126	795,664
TOTAL	$ 933,126	$ 795,664

Riverfront Drive & CSAH 16 (Stoltzman Road) --- Benefit / Cost Analysis for Alternative 2 Traffic Signal, Standard Phasing 2044 Forecast

BASE 2024	Total
DELAY (Stop)	42,043

2044 No Improvement	Total	2024 No Improvement	Total
DELAY (Stop)	49,521	DELAY (Stop)	42,043

2044 Improvement	Total	2024 Improvement	Total
DELAY (Alt)	50,643	DELAY (Alt)	44,092

2044 Changes:	Total	
DELAY	1,121	2.3%

	COST ITEM				
	1	2	3	4	5
Category	Roadway	Bridge	Traffic Signal/ Lighting	Contingency Construction Costs	ROW
Capital Value ($)	10,000	$0	$45,000	$ 22,000	$0
Remaining Life (%)-20yr	36%	72%	22%	36%	86%
Remaining Cap. Value	$ 3,600	$ -	$ 9,900	$ 7,920	$ -

Note: Assume Expected Life of 30 Years. Analysis Period is 20 years.

B/C Analysis Summary

BENEFITS	*Value(Discounted)*	
1. Travel Time Savings:	$	(1,244,561)
TOTAL	$	(1,244,561)

COSTS	*Value(Discounted)*	
1. Roadway/Interchange	$	(10,000)
2. Bridges	$	-
3. Maintenance	$	(91,035)
4. Contingency Costs	$	(22,000)
5. Right-of-way (ROW)	$	-
Remaining Capital	$	18,265
TOTAL	$	(104,771)

Benefit/Cost Analysis Results		
20-Yr Operation Benefit	$	(1,244,561)
20-Yr Safety Benefit	$	251,198
COSTS	$	104,771
B/C Ratio:		**-9.481**

Cost		Estimated	Estimated	Estimated
Category	Improvement Description	NA	NA	NA
1	Roadway Paving	$0	$0	$0
1	Drainage and Erosion	$0	$0	$0
1	Misc	$10,000	$0	$0
2	Bridge	$0	$0	$0
2				
3	Traffic Signal/Lighting	$45,000	$0	$0
3				
3				
	Total Estimated Construction Costs	$55,000	$0	$0
4	Indirect Costs & Contingency	$16,500	$0	$0
5	Right-of-Way/Easement Costs	$0	$0	$0
4	Professional Services	$5,500	$0	$0
	Total Project Costs	$77,000	$0	$0

BENEFIT 1: Travel Time Savings (VHT)

	Annual VHT		Annualized Savings		Discounted
YEAR	2044 No Improvement	2044 Improvement	Improvement w/ VHT Savings	'00 cost per hour $ 23.90	Value (0.8%)
2024	42,043	44,092	-2049	$ (82,161.72)	$ (82,161.72)
2025	42,417	44,420	-2002	$ (80,301.81)	$ (79,664.49)
2026	42,791	44,747	-1956	$ (78,441.90)	$ (77,201.73)
2027	43,165	45,075	-1910	$ (76,581.98)	$ (74,773.03)
2028	43,539	45,402	-1863	$ (74,722.07)	$ (72,378.03)
2029	43,913	45,730	-1817	$ (72,862.15)	$ (70,016.33)
2030	44,287	46,057	-1771	$ (71,002.24)	$ (67,687.56)
2031	44,661	46,385	-1724	$ (69,142.33)	$ (65,391.35)
2032	45,035	46,712	-1678	$ (67,282.41)	$ (63,127.31)
2033	45,408	47,040	-1631	$ (65,422.50)	$ (60,895.10)
2034	45,782	47,367	-1585	$ (63,562.59)	$ (58,694.34)
2035	46,156	47,695	-1539	$ (61,702.67)	$ (56,524.68)
2036	46,530	48,022	-1492	$ (59,842.76)	$ (54,385.76)
2037	46,904	48,350	-1446	$ (57,982.85)	$ (52,277.24)
2038	47,278	48,677	-1400	$ (56,122.93)	$ (50,198.75)
2039	47,652	49,005	-1353	$ (54,263.02)	$ (48,149.97)
2040	48,026	49,333	-1307	$ (52,403.11)	$ (46,130.54)
2041	48,400	49,660	-1260	$ (50,543.19)	$ (44,140.13)
2042	48,774	49,988	-1214	$ (48,683.28)	$ (42,178.41)
2043	49,147	50,315	-1168	$ (46,823.37)	$ (40,245.05)
2044	49,521	50,643	-1121	$ (44,963.45)	$ (38,339.73)
TOTAL				$ (1,334,814)	$ (1,244,561)

Note: Trucks on average account for approximately 2% of network traffic. Passenger vehicle occupancy assumed to be 1.68.

MnDOT Office of Investment Management, Benefit Cost Analysis — Trucks (Value of Time) $ 37.60

Standard Values, Appendix A, Fiscal Year 2022

COST 1: Roadways/Interchange Construction

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ (10,000)	(10,000)
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ (10,000)	$ (10,000)

COST 2: Bridge

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ -	-
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ -	$ -

COST 3: Maintenance & Operation

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ (45,000)	(45,000)
2025	$ (2,500)	(2,480)
2026	$ (2,500)	(2,460)
2027	$ (2,500)	(2,441)
2028	$ (2,500)	(2,422)
2029	$ (2,500)	(2,402)
2030	$ (2,500)	(2,383)
2031	$ (2,500)	(2,364)
2032	$ (2,500)	(2,346)
2033	$ (2,500)	(2,327)
2034	$ (2,500)	(2,309)
2035	$ (2,500)	(2,290)
2036	$ (2,500)	(2,272)
2037	$ (2,500)	(2,254)
2038	$ (2,500)	(2,236)
2039	$ (2,500)	(2,218)
2040	$ (2,500)	(2,201)
2041	$ (2,500)	(2,183)
2042	$ (2,500)	(2,166)
2043	$ (2,500)	(2,149)
2044	$ (2,500)	(2,132)
TOTAL	$ (95,000)	$ (91,035)

Note: Assume maintenance and operation costs of the Traffic Signal to be -2500 per year.

COST 4: Contingency Construction Costs

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ (22,000)	(22,000)
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ (22,000)	$ (22,000)

COST 5: Right of Way (ROW)

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ -	-
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ -	$ -

Remaining Capital Value

YEAR	Remaining Capital Value	Discounted Value (0.8%)
2024	$ -	-
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ 21,420	18,265
TOTAL	$ 21,420	$ 18,265

Riverfront Drive & CSAH 16 (Stoltzman Road) --- Benefit / Cost Analysis for Alternative 3 Traffic Signal, Standard Phasing 2044 Forecast

BASE 2024	Total
DELAY (Stop)	42,043

2044 No Improvement	Total	2024 No Improvement	Total
DELAY (Stop)	49,521	DELAY (Stop)	42,043

2044 Improvement	Total	2024 Improvement	Total
DELAY (Alt)	43,689	DELAY (Alt)	44,568

2044 Changes:	Total	
DELAY	(5,833)	-11.8%

	COST ITEM				
	1	2	3	4	5
Category	Roadway	Bridge	Traffic Signal/ Lighting	Contingency Construction Costs	ROW
Capital Value ($)	66,275	$0	$65,130	$ 52,562	$0
Remaining Life (%)-20yr	36%	72%	22%	36%	86%
Remaining Cap. Value	$ 23,859	$ -	$ 14,329	$ 18,922	$ -

Note: Assume Expected Life of 30 Years. Analysis Period is 20 years.

B/C Analysis Summary		
BENEFITS	*Value(Discounted)*	
1. Travel Time Savings:	$	1,192,863
TOTAL	$	1,192,863

COSTS	*Value(Discounted)*	
1. Roadway/Interchange	$	(66,275)
2. Bridges	$	-
3. Maintenance	$	(111,165)
4. Contingency Costs	$	(52,562)
5. Right-of-way (ROW)	$	-
Remaining Capital	$	48,697
TOTAL	$	(181,306)

Benefit/Cost Analysis Results		
20-Yr Operation Benefit	$	1,192,863
20-Yr Safety Benefit	$	251,198
COSTS	$	181,306
B/C Ratio:		**7.965**

Cost Category	Improvement Description	Estimated NA	Estimated NA	Estimated NA
1	Roadway Paving	$41,036	$0	$0
1	Drainage and Erosion	$5,130	$0	$0
1	Misc	$20,109	$0	$0
2	Bridge	$0	$0	$0
2				
3	Traffic Signal/Lighting	$65,130	$0	$0
3				
3				
	Total Estimated Construction Costs	$131,405	$0	$0
4	Indirect Costs & Contingency	$39,422	$0	$0
5	Right-of-Way/Easement Costs	$0	$0	$0
4	Professional Services	$13,141	$0	$0
	Total Project Costs	$183,967	$0	$0

BENEFIT 1: Travel Time Savings (VHT)

	Annual VHT		Annualized Savings		Discounted
YEAR	2044 No Improvement	2044 Improvement	Improvement w/ VHT Savings	'00 cost per hour $ 23.90	Value (0.8%)
2024	42,043	44,568	-2524	$ (101,228.89)	$ (101,228.89)
2025	42,417	44,524	-2106	$ (84,472.38)	$ (83,801.96)
2026	42,791	44,480	-1689	$ (67,715.87)	$ (66,645.28)
2027	43,165	44,436	-1271	$ (50,959.36)	$ (49,755.65)
2028	43,539	44,392	-853	$ (34,202.85)	$ (33,129.90)
2029	43,913	44,348	-435	$ (17,446.34)	$ (16,764.93)
2030	44,287	44,304	-17	$ (689.83)	$ (657.62)
2031	44,661	44,260	401	$ 16,066.68	$ 15,195.06
2032	45,035	44,216	819	$ 32,823.19	$ 30,796.16
2033	45,408	44,172	1236	$ 49,579.70	$ 46,148.67
2034	45,782	44,128	1654	$ 66,336.22	$ 61,255.54
2035	46,156	44,084	2072	$ 83,092.73	$ 76,119.72
2036	46,530	44,040	2490	$ 99,849.24	$ 90,744.09
2037	46,904	43,996	2908	$ 116,605.75	$ 105,131.54
2038	47,278	43,952	3326	$ 133,362.26	$ 119,284.91
2039	47,652	43,908	3744	$ 150,118.77	$ 133,206.99
2040	48,026	43,864	4161	$ 166,875.28	$ 146,900.57
2041	48,400	43,820	4579	$ 183,631.79	$ 160,368.41
2042	48,774	43,776	4997	$ 200,388.30	$ 173,613.22
2043	49,147	43,732	5415	$ 217,144.81	$ 186,637.69
2044	49,521	43,689	5833	$ 233,901.32	$ 199,444.49
TOTAL				$ 1,393,061	$ 1,192,863

Note: Trucks on average account for approximately 2% of network traffic. Passenger vehicle occupancy assumed to be 1.68.

MnDOT Office of Investment Management, Benefit Cost Analysis — Trucks (Value of Time) $ 37.60

Standard Values, Appendix A, Fiscal Year 2022

COST 1: Roadways/Interchange Construction

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ (66,275)	(66,275)
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ (66,275)	$ (66,275)

COST 2: Bridge

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ -	-
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ -	$ -

COST 3: Maintenance & Operation

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ (65,130)	(65,130)
2025	$ (2,500)	(2,480)
2026	$ (2,500)	(2,460)
2027	$ (2,500)	(2,441)
2028	$ (2,500)	(2,422)
2029	$ (2,500)	(2,402)
2030	$ (2,500)	(2,383)
2031	$ (2,500)	(2,364)
2032	$ (2,500)	(2,346)
2033	$ (2,500)	(2,327)
2034	$ (2,500)	(2,309)
2035	$ (2,500)	(2,290)
2036	$ (2,500)	(2,272)
2037	$ (2,500)	(2,254)
2038	$ (2,500)	(2,236)
2039	$ (2,500)	(2,218)
2040	$ (2,500)	(2,201)
2041	$ (2,500)	(2,183)
2042	$ (2,500)	(2,166)
2043	$ (2,500)	(2,149)
2044	$ (2,500)	(2,132)
TOTAL	$ (115,130)	$ (111,165)

Note: Assume maintenance and operation costs of the Traffic Signal to be -2500 per year.

COST 4: Contingency Construction Costs

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ (52,562)	(52,562)
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ (52,562)	$ (52,562)

COST 5: Right of Way (ROW)

YEAR	CHANGE with Improvement	Discounted Value (0.8%)
2024	$ -	-
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ -	-
TOTAL	$ -	$ -

Remaining Capital Value

YEAR	Remaining Capital Value	Discounted Value (0.8%)
2024	$ -	-
2025	$ -	-
2026	$ -	-
2027	$ -	-
2028	$ -	-
2029	$ -	-
2030	$ -	-
2031	$ -	-
2032	$ -	-
2033	$ -	-
2034	$ -	-
2035	$ -	-
2036	$ -	-
2037	$ -	-
2038	$ -	-
2039	$ -	-
2040	$ -	-
2041	$ -	-
2042	$ -	-
2043	$ -	-
2044	$ 57,110	48,697
TOTAL	$ 57,110	$ 48,697

Appendix J: Stakeholder Engagement Materials

Riverfront/Stoltzman ICE Study

7/22 Open House notes

- Need freight access – specifically to Echo food shelf
- Improve pedestrian crossings
- No side walk on west side of Stoltzman
- Marshall is close proximity and will be effected by Stoltzman/Riverfront improvements. Any considerations for Marshall?
- Cars back up and block north bound right turn lane
- Problems at pleasant. Kids crossing to get to the park and cars don't stop
- Lewis Lofts and Sinclair flats will cause more demand
- With development there will be more people walking to the Echo food shelf area.
- Consider grade separation
- HS drivers in area so need to account for new drivers in intersection design
- HS students cross mid block between Stoltzman and Poplar
- Roundabouts aren't safe
- What is timing of improvements at Riverfront/169?
- Pedestrian crossings should be enhanced with flashers/RRFB
- No buffer between sidewalk and travel lanes on Stoltzman

Project survey responses

Name :
Heather Otto

Message:
I use this intersection multiple times a day, every day. I am so happy this is being looked at. I strongly support making a roundabout at this intersection.

Name :
Brad A Friedrichs

Message:
Why don't you reduce it to 3 lanes like every other road in the city. Population is only growing and MSU Mankato wants student enrollment up to 30,000. You've ruined this city with stupidity and you might as well make it worse.

Name :
David Schmitt

Message:
As a biker and pedestrian who frequents this intersection often, I ask that biker and pedestrian accessibility for all directions of service be addressed with as much gravity as motor vehicle traffic. This means: designing the intersection to accommodate a future bike lane along Stoltzman Road that connects with an exists biking corridor, increasing and/or making 'Walk' indicator lights occur as a default rather than requiring a physical button be pushed, and also placing crosswalks as close the to actual corners of the intersection as possible so that motor vehicles do no occupy the crosswalk when waiting for a green light from their controlling semafore. Please make biking and walking at this intersection easier, not harder. Prioritizing pedestrian-and biker friendly transportation along this corridor is vital to enhancing our city's goal of being a Blue Zone city, public safety, increases roadbed lifespan through decreased motor traffic, and promotes residents' wellbeing.

Engaged the public on the range of alternatives at a gas station Popup Event.

Chris and Shawn
October 1, 2024
2:00 – 4:00 pm
Kwik Trip, 17 Stoltzman Road, Mankato

Alternative 0 = 4
Alternative 1 = 24
Alternative 2 = 4
Alternative 3 = 9

Kwik Trip Manager Comments = Planning to add 40’ to the Stoltzman side of the building and intend to close the entrance nearest Riverfront Drive. Delivery trucks enter the property from Stoltzman Road.

Public Comments
Alternative 1 uses less electricity and not susceptible to power outages
Alternative 2 the signal was previously not split phase and this caused issues
Alternative 3 would be bad for West High School
Alternative 3 Timing of the lights would be a big improvement
Alternative 3 No good

Welcome

Riverfront Drive & Stoltzman Road Intersection Control Evaluation

PROJECT OPEN HOUSE

Please sign in here.

BLUE EARTH COUNTY

City of MANKATO
Leading the way...

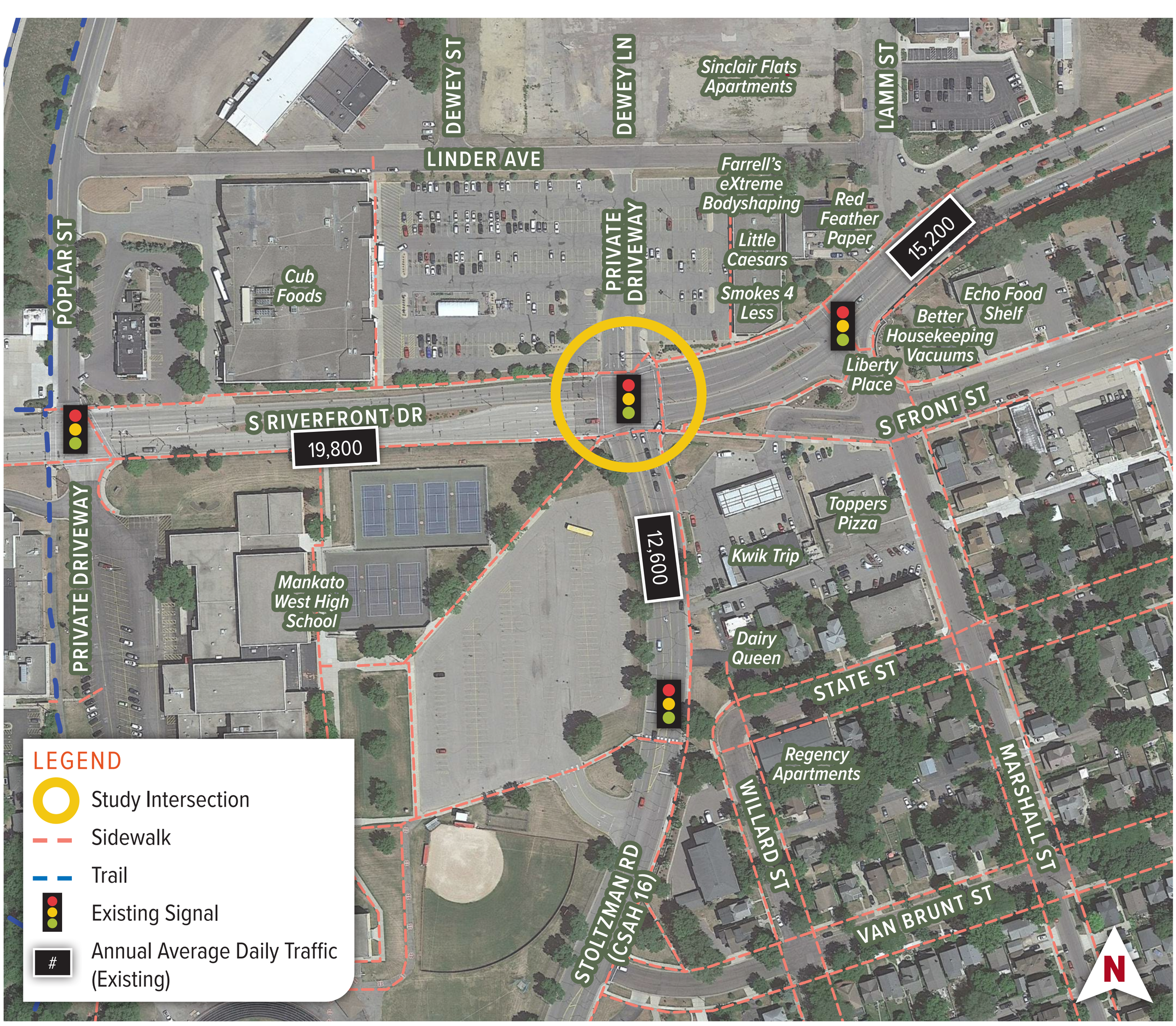
MAPO
MANKATO/NORTH MANKATO AREA PLANNING ORGANIZATION

ABOUT THE PROJECT

The Riverfront Drive and Stoltzman Road intersection is being studied to identify appropriate intersection traffic control and optimal intersection and roadway geometrics for existing and forecast conditions.

The preferred intersection traffic control alternative will:

- **Improve safety**
- **Relieve congestion and travel delays**
- **Accommodate all modes of travel**



ICE PROCESS & PROJECT SCHEDULE

Data Collection
April 2024

Existing Conditions
April-May 2024

Stakeholder Engagement
July 2024

WE ARE HERE

Alternatives Evaluation
August 2024

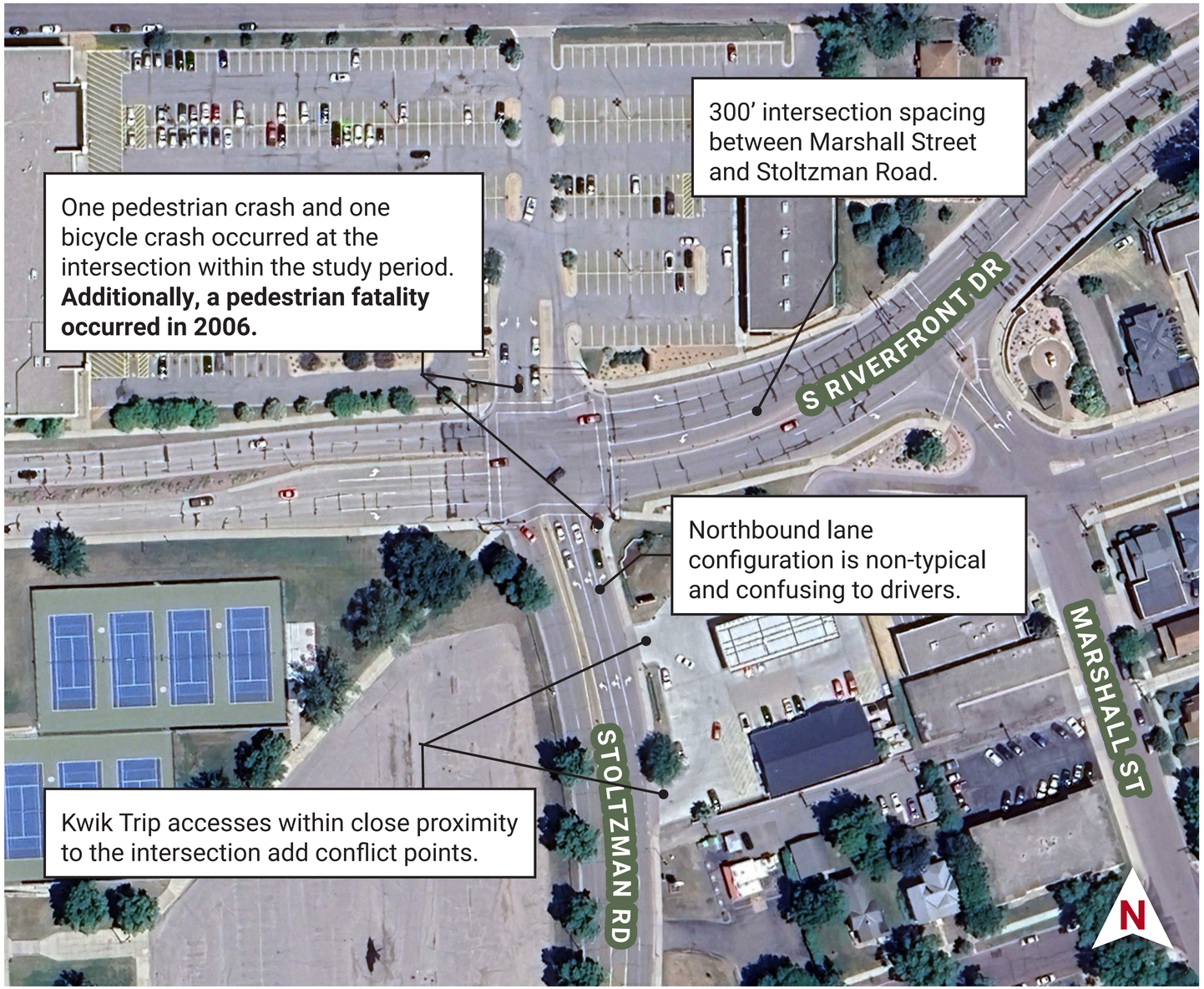
Recommended Alternative
September 2024

Final ICE Report
October 2024

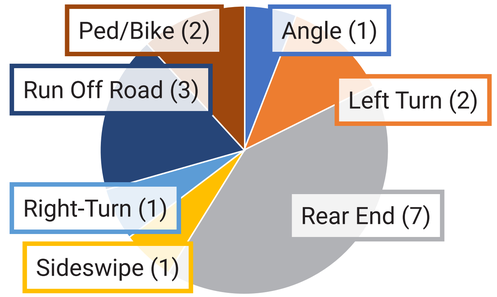
Next steps:

The project team seeks your feedback on intersection deficiencies and what improvements you would like to see. **Please visit the online survey using the QR code at right.**

EXISTING CONDITIONS: SAFETY

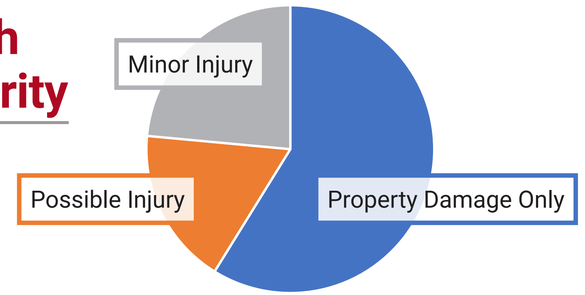


Crash Types



Primarily rear-end type crashes

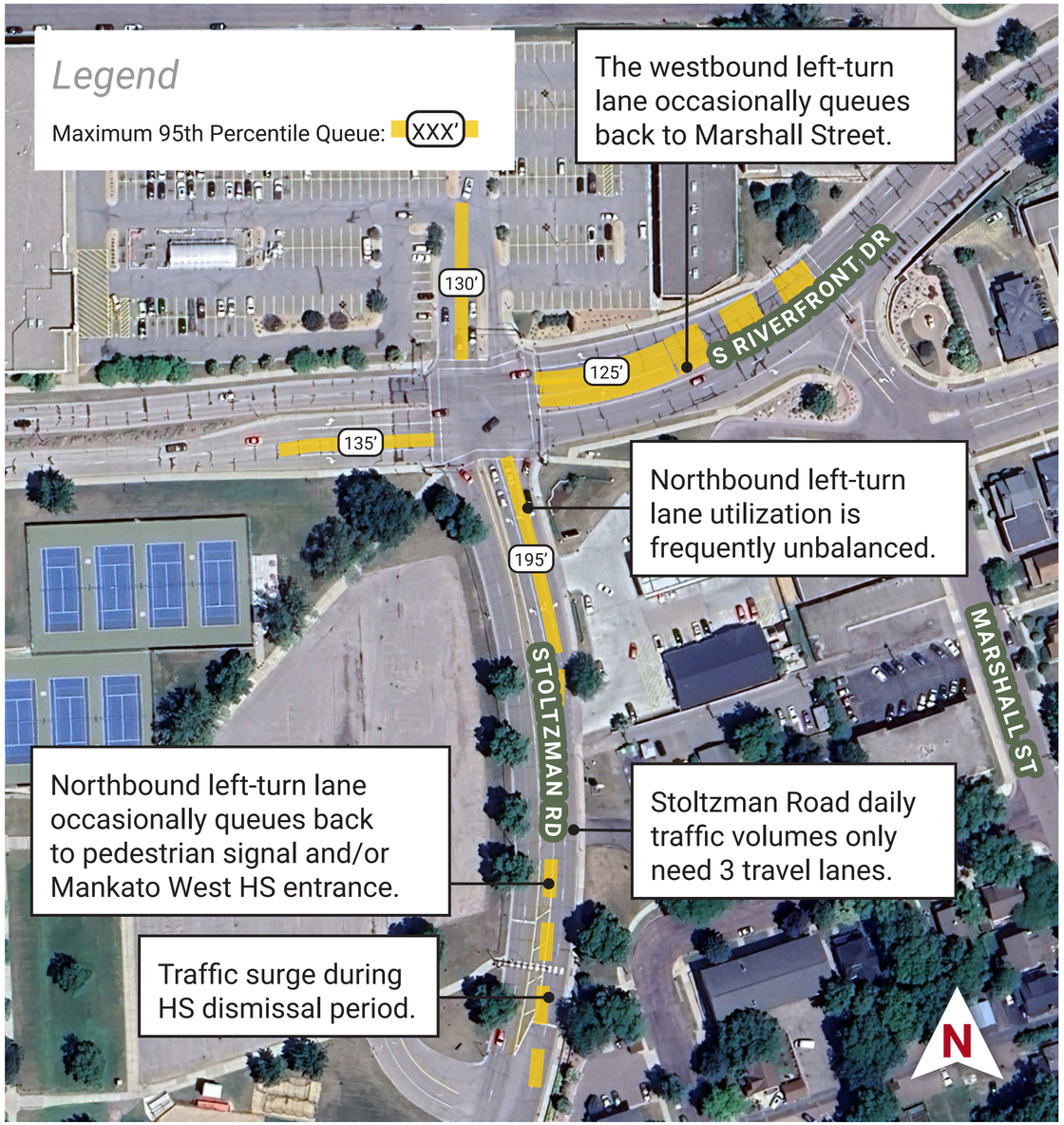
Crash Severity



Primarily property damage only crashes.

The intersection has an overall crash rate lower than the statewide average, therefore there is not a statistically significant safety issue.

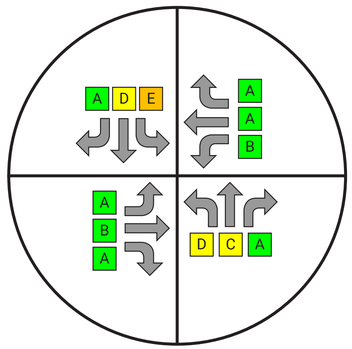
EXISTING CONDITIONS: OPERATIONS



Level of Service (LOS) by Movement

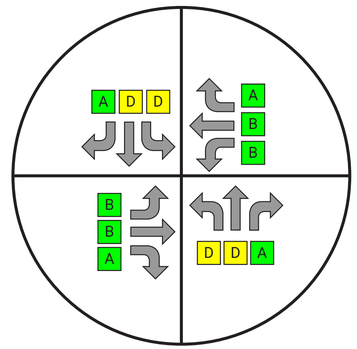
AM Peak LOS

Overall Intersection LOS: B



PM Peak LOS

Overall Intersection LOS: B



Level of Service: A | B | C | D | E | F

Traffic signal currently operates with north/south split phasing due to the northbound shared through/left-turn lane. **This type of signal phasing is inefficient from an operational perspective.**

POTENTIAL ALTERNATIVES

We want your feedback!

Alternative A: Revise Traffic Signal Split Phasing

Modifying the northbound lane configuration will allow the split phasing to be removed. Removing the split phasing may improve overall operations at the intersection.

Alternative B: Multi-Lane Roundabout

A multi-lane roundabout may improve operations at the intersection, and will be safer for pedestrians and bicyclists.