Rice Street Visioning Study
Traffic Analysis

Ramsey County
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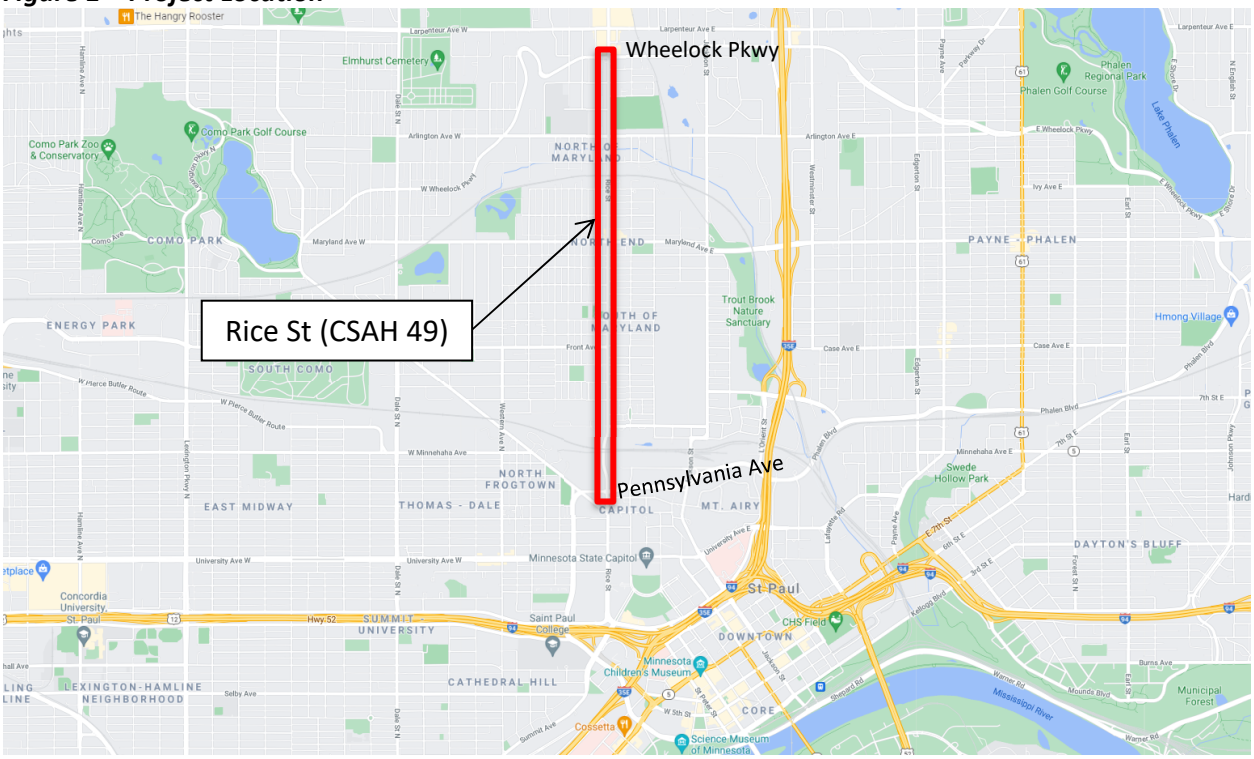
Executive Summary

This report summarizes the traffic analysis completed for the Rice Street Visioning Study. Rice St is being analyzed between Wheelock Parkway and Pennsylvania Avenue to create and advance a community supported vision for the Rice St corridor. Rice St serves a diverse mix of residents, users, businesses, and modes of travel. The aging roadway currently shows safety and traffic concerns. The project goals are to promote economic growth and community investment by providing business opportunities, creating an inviting environment, enhancing pedestrian safety, maintaining and augmenting transit service, and improving vehicle safety. Metro Transit has recommended the Metro G Line Bus Rapid Transit (BRT) along this corridor as a part of their Network Next 20-year planning. The corridor is located in the City of St Paul within Ramsey County. See **Figure 1** for the project location.

Figure 1 – Project Location



The recommended alternative for the corridor is a three-lane section. The recommendation includes a proposed trail on the west side of the corridor, sidewalk on the east side of the corridor, and boulevard space for signing, lighting, natural features, and snow storage throughout.

Crash Analysis

A crash review was completed analyzing five years of crash data (2014-2018) along Rice St throughout the project limits. In order to determine if there is a safety issue at an intersection or along the overall corridor MnDOT uses a comparison of the crash rate and the critical rate. The crash rate is the number of crashes per million entering vehicles (MEV) for intersections and crashes per million vehicle miles (MVM) for segments. The critical rate is a statistical comparison based on similar intersections or corridors statewide. An observed crash rate greater than the critical rate indicates that the intersection or corridor operates outside of the expected, normal range. The critical index reports the magnitude of this difference. A critical index of less than one indicates that the intersection or corridor is operating

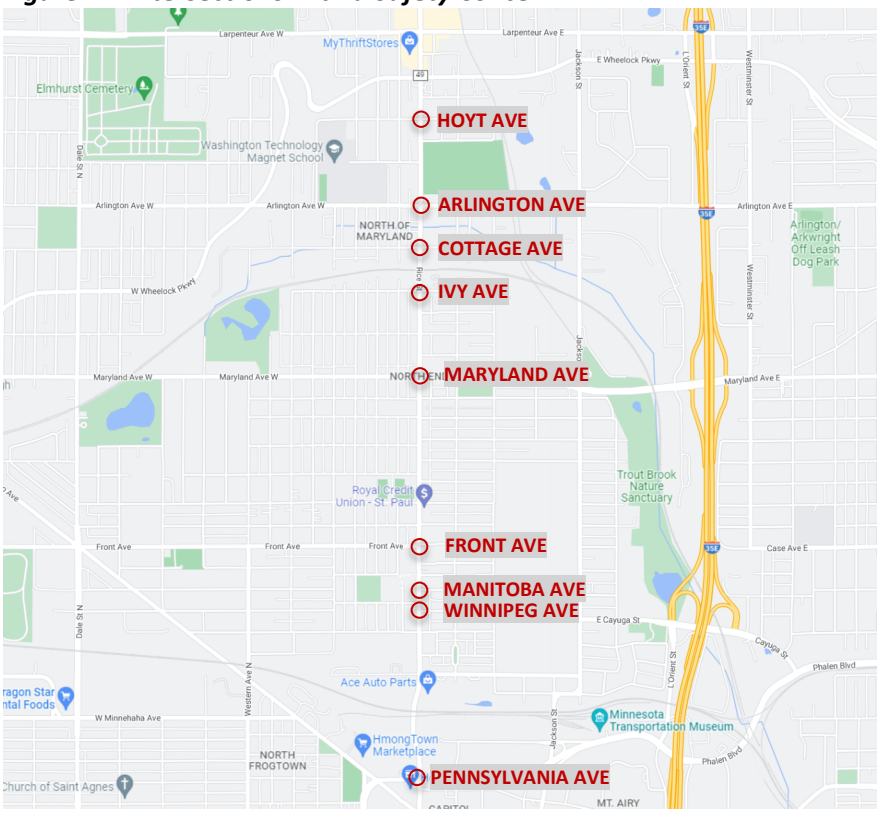
within the normal range and a critical index of greater than one indicates that the intersection or corridor is operating outside the normal range.

The crash analysis indicated that several intersections have a safety concern. All of the locations listed in **Table 1** and shown in **Figure 2** have a critical index greater than one indicating that the intersection is operating outside the normal range when compared to similar intersections statewide.

Table 1. Intersection Crash Summary (2014-2018)

Intersection along Rice St	Observed Crash Rate	Statewide Average Crash Rate	Critical Crash Rate	Critical Index
Hoyt Ave	0.65	0.18	0.41	1.59
Arlington Ave	1.18	0.7	1.06	1.71
Cottage Ave	0.64	0.18	0.41	1.56
Ivy Ave	0.78	0.18	0.41	1.90
Maryland Ave	2.06	0.7	1.01	2.04
Front Ave	1.3	0.52	0.88	1.48
Manitoba Ave	0.86	0.18	0.42	2.05
Winnipeg Ave	0.47	0.18	0.42	1.12
Pennsylvania Ave	1.24	0.7	1	1.24

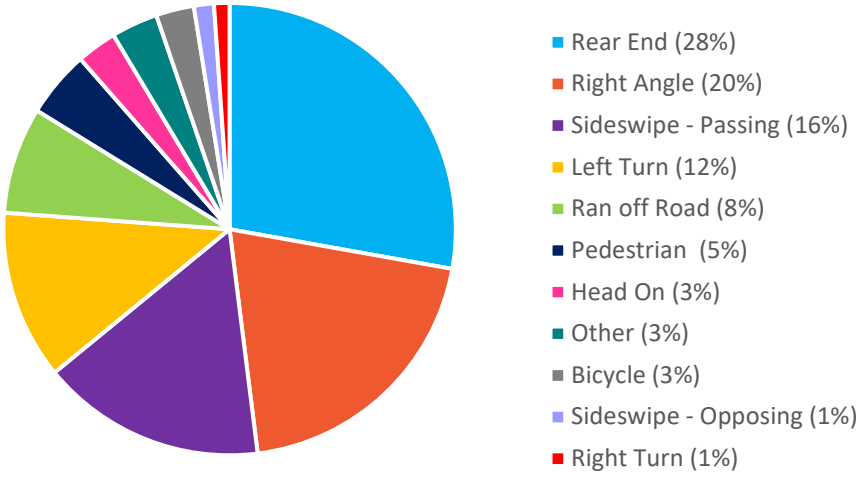
Figure 2 – Intersections with a Safety Concern



There were a total of 629 crashes along Rice St between Wheelock Pkwy and Pennsylvania Ave (including crashes at the intersection) in the five years of crash data reviewed (2014-2018). The observed total crash rate is 11.18 crashes per million vehicle miles. The statewide average is 3.8 crashes per million vehicle miles so the segment crash rate is nearly three times higher than the statewide average.

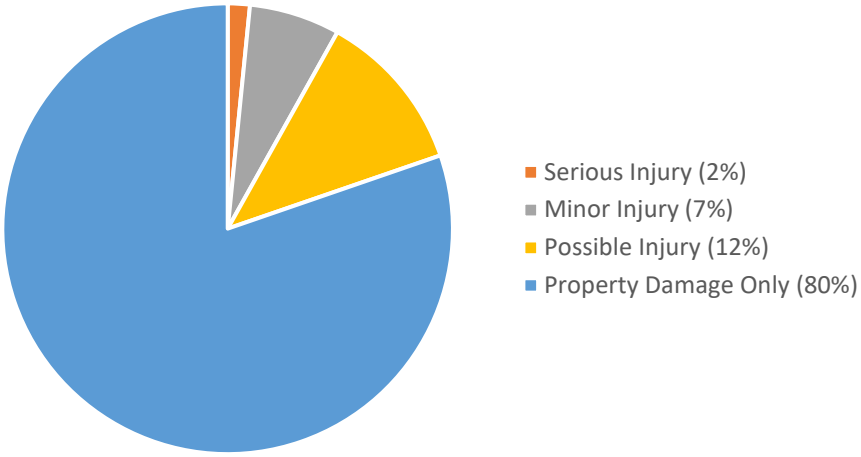
The most common crash types along the corridor were rear end, right able, sideswipe passing, and left turn crashes. These four crash types combined account for 76% of all crashes. The proposed 3-lane section is anticipated to reduce the number of crashes, especially the rear end, right-angle, sideswipe, left turn, and head-on crashes. **Figure 3** below shows the breakdown of crashes by type.

Figure 3 – Segment Crash Type (2014-2018)



Of the 629 crashes, none resulted in fatality, 10 resulted in serious injury, 41 were minor injury, 73 were possible injury crashes, and 505 resulted in property damage. This distribution is shown in **Figure 4** below.

Figure 4 – Segment Crash Severity (2014-2018)



A ten-year (2012-2021) crash analysis was completed in 2022 at the end of the study to review the location and frequency of fatal and serious injury crashes along the corridor. Over the last ten years there have been 22 crashes that resulted in serious injury and one crash that resulted in fatality. The fatal crash was a pedestrian crash at the intersection of Ivy Ave and Rice St. **Table 2** summarizes the crash type and location of the crashes.

Table 2. Fatal and Serious Injury Crashes (2012-2021)

Location	Number of Crashes	Crash Type
Hoyt Ave at Rice St	3	Pedestrian (2), Rear End
Arlington Ave at Rice St	2	Pedestrian, Left Turn
Ivy Ave at Rice St	2	Pedestrian (2)
Along Rice St South of Ivy Ave	1	Single Vehicle Run off Road
Maryland Ave at Rice St	4	Pedestrian (2), Left Turn, Single Vehicle Run off Road
Along Rice St South of Front Ave	1	Left Turn
Wayzata St at Rice St	1	Bicycle
Manitoba Ave at Rice St	1	Pedestrian
Milford St at Rice St	1	Pedestrian
Atwater St at Rice St	2	Right Angle, Right Turn
Sycamore St at Rice St	1	Sideswipe Passing
Along Rice St South of Sycamore St	1	Head On
Pennsylvania Ave at Rice St	3	Pedestrian, Right Angle (2)

Table 2 shows how 11 of the 23 serious and fatal injury crashes in the last ten years were pedestrian or bicycle crashes. This table also shows how serious injury crashes are not just occurring at a few intersections, rather they are occurring throughout the entire corridor.

Parking

On street parking is allowed between Hoyt Ave and Atwater Ave in the outside travel lane except along southbound Rice St from 7:00-8:00am and along northbound Rice St from 4:00-6:00pm. An existing parking inventory was completed along Rice St in November 2019. The inventory indicated that on street parking utilization is minimal. The only area where cars were noted to fully utilize Rice St and extend about half a block to one block along the side street is at Rice St and Manitoba Ave. With the reconstruction of Rice St, most on street parking would be removed, however, several potential areas for future on-street parking were identified.

Pedestrian Crossing Considerations

Pedestrian counts were analyzed to determine where marked crosswalks are recommended along the corridor in accordance with the Ramsey County Treatment Guide. Pedestrian crossings will be marked at all signalized intersections so only the unsignalized intersections were analyzed where count data was available. The pedestrian volume analysis indicates that only the crossing at Wayzata Ave and Rice St is recommended to be marked. All other unsignalized intersections were found to have less than 20 pedestrians (or less than 10 school aged children) crossing in one hour and therefore are not recommended to be marked. Updated pedestrian counts will be completed in the next phase of this project to reevaluate which crossings should be marked.

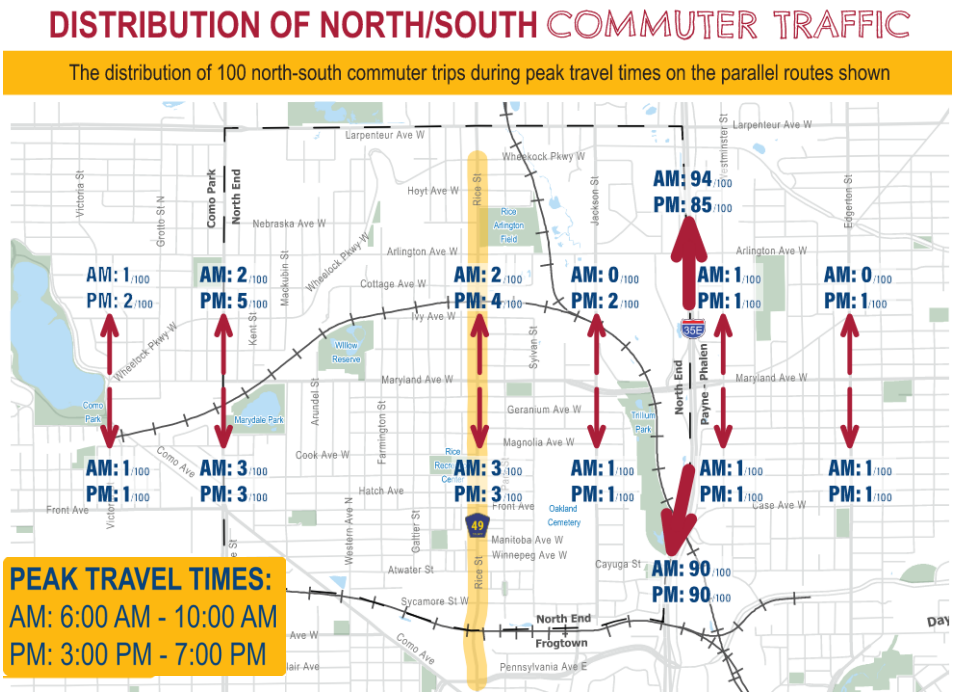
Origin-Destination Analysis

An origin-destination analysis was completed using StreetLight Insight. Streetlight Insight is a data aggregation tool which collects GPS and location information from cell phones and other GPS devices through an agreement with projected. The origin-destination analysis indicated that a portion of vehicles are likely avoiding I-35E during the peak hours by taking alternative north-south routes such as Rice St. The data indicates that the total number of vehicles traversing the entire length of the corridor in the peak hours is a larger proportion of the traffic that traverses the entire length of the corridor during the day overall. For example, during the AM rush 38% of the vehicles starting along Rice St north

of Wheelock Pkwy traverse the entire corridor to south of Pennsylvania Ave as compared to 23% of vehicles in the PM rush or 28% of vehicles overall during the day.

StreetLight Insight was also used to analyze how commuter trips along Rice St compares to other major parallel routes. As shown in **Figure 5** below, during the AM rush, of commuter traffic traveling northbound, 94% take I-35E, 2% take Rice St, and 4% take other north-south routes. However, during the PM rush only 85% of commuters going northbound take I-35E, 4% take Rice St and 11% take other nearby north-south routes. Southbound traffic was consistent with 90% of commuter traffic taking I-35E, 3% taking Rice St, and 7% taking other nearby north-south routes during both peaks.

Figure 5 – Distribution of North/South Commuter Traffic



Existing Traffic Operations

A level of service (LOS) analysis of the peak hours was completed using the previously collected 2016 turning movement counts in the traffic analysis and simulation software Synchro/SimTraffic. Traffic operations are measured in terms of LOS, with levels of A through D considered to be acceptable with minimal to no delay to vehicles, while E and F would be considered unacceptable for long periods of time. All intersections were found to operate with LOS C or better during both peak hours. All movements were found to operate with LOS E or better during both peak hours.

Warrant Analysis

A warrant analysis was completed based on the signal warrants as outlined in the Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD). Warrants are a primary factor to understand if a signal is justified at an intersection location. The analysis indicated that the existing signals at Wayzata Ave at Rice St and Geranium Ave at Rice St are not justified based on 2016 or 2021 traffic counts. The intersection of Rice St at Nebraska Ave meets warrant 1B (8-hour warrant) with 2016 counts, but only if the 60% volume threshold is applied for maintaining an existing inplace signal. Due to its location near a school and since the 2016 count was from July a new count of the intersection is recommended to be completed when school is in session and weather is warmer to account for school pedestrian traffic

when determining if the signal should remain. All other existing signals along the corridor were found to be justified.

Traffic Forecasting

Traffic forecasts were reevaluated with this study. Historic trends show volumes staying the same or decreasing over time and the projection factor in Ramsey County is 1 (which assumes flat or no growth). No growth was assumed between the 2016 volumes and a 20-year forecast so the traffic analysis was completed analyzing only the existing (2016) volumes.

Build Traffic Operations

A level of service analysis of the peak hours was completed using the 2016 turning movement counts in the traffic simulation software Vissim. Metro Transit ridership and bus stop dwell times were incorporated into the model to account for the buses and stops on the corridor. The proposed design converts Rice St from a four-lane undivided roadway to a three-lane roadway (two through lanes and a center left turn lane). The operational analysis indicates that operations will remain acceptable during the AM peak hour with the proposed three-lane section, however, increased delay and queuing is anticipated during the PM peak. A preliminary analysis of the build operations was completed in SimTraffic and showed that with 15% or ~125 of the northbound through vehicles diverting to other parallel north-south roadways traffic delay and queues would be reasonable. Although the PM peak shows some operational concerns, overall a three-lane roadway would be expected to have enough capacity to handle the anticipated traffic volumes on Rice St now and in the future, with capacity to handle traffic fluctuations during non-peak hours. The detailed analysis indicated there is a tradeoff between side street delay and queue lengths along Rice St. With a longer cycle length mainline queues are shorter, however side street delay is increased and vice versa.

Average travel speed of vehicles along Rice St was also compared with each build scenario to the existing condition. The travel times were calculated based on travel time measurements from the Vissim model for both the existing and build scenarios. The existing condition model assumed vehicles could not use the outside travel lane along northbound Rice St during the AM peak and southbound Rice St during the PM peak as parking is allowed at those times. During the AM peak hour, the existing condition model shows the average speed of cars and trucks at 24 MPH along southbound Rice St and 25 MPH along northbound Rice St. The build model shows an average speed of 16 MPH along southbound Rice St and 20 MPH along northbound Rice St. Therefore, vehicle speed is 5-8 MPH lower in the build scenario than the existing condition. During the PM peak hour, the existing condition model shows the average speed of cars and trucks at 11 MPH along southbound Rice St and 17 MPH along northbound Rice St. The build models show an average speed of 18-19 MPH along southbound Rice St and 10-14 MPH along northbound Rice St. This shows an operational benefit for southbound vehicles with the three-lane section as a vehicle in the through lane no longer gets stuck behind left turning traffic. Northbound average speeds during the PM peak hour are 3-7 MPH lower than the existing condition for cars and trucks.

Build Safety Improvements

The four-lane undivided roadway often results in increased crashes as all turning traffic must turn from the through lanes, entering traffic must navigate onto or across multiple lanes of traffic at once, and the current configuration does not allow for adequate pedestrian and bicycle facilities within the current right-of-way. Implementing a four to three lane conversion on Rice St would be anticipated to increase the safety of the corridor by providing a dedicated left turn lane, reducing the number of through lanes, decreasing crossing distances, simplifying left turns from the side streets, smoothing traffic flow, and

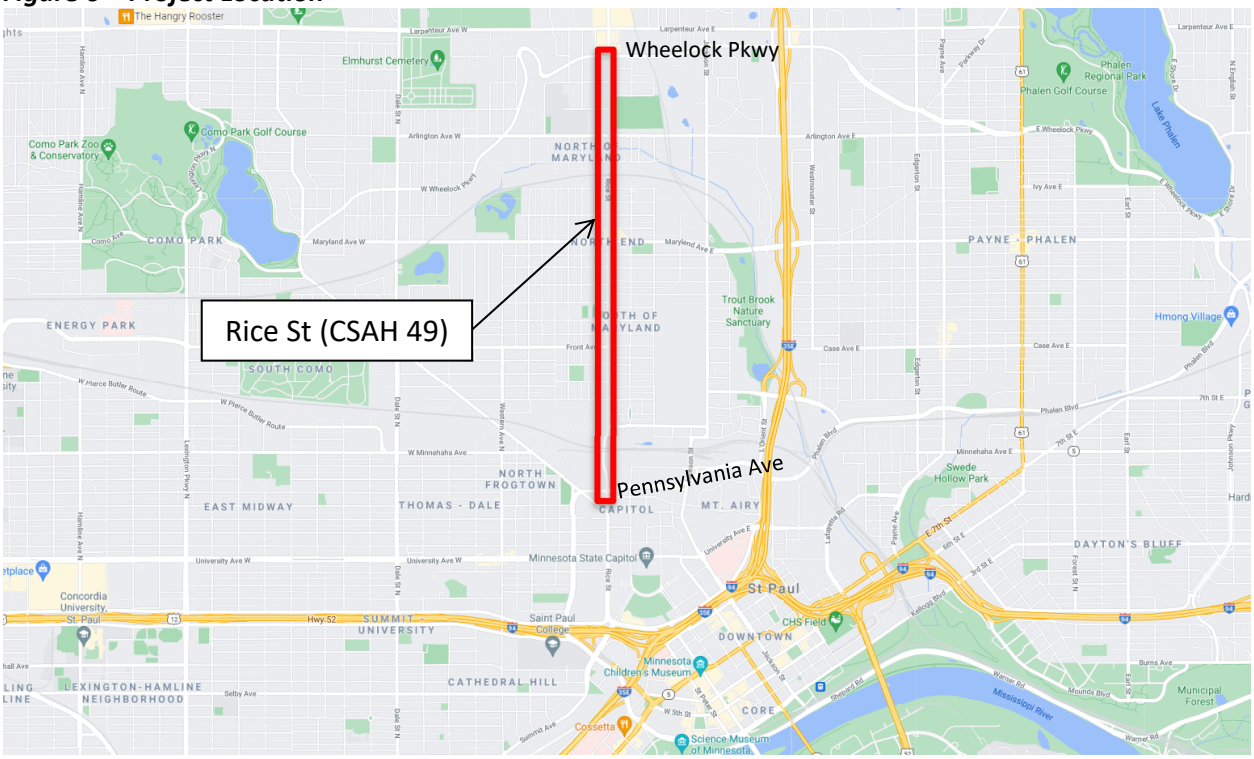
providing more space for pedestrians and bikers. Four to three-lane conversions also typically result in a speed reduction. Once the project is complete, a corridor speed study should be completed by MnDOT to determine the roadway speed limit.

With a center left turn lane, the proposed three lane is anticipated to reduce crashes along Rice St. Clearinghouse crash modification factors (CMFs) were analyzed to determine the anticipated crash reduction with the build alternative. CMF ID 2841 indicates that there is anticipated to be a 47% crash reduction when converting a four-lane undivided roadway to a three lane roadway with center turn lane. The three-lane roadway is anticipated to reduce the total crashes on the corridor by 300 over five years or 60 a year. Other improvements such as the medians, which are recommended at several locations along the corridor, may result in further safety improvement as they provide a traffic calming effect, an improved pedestrian crossing, and controlled access.

Introduction

Rice Street is being analyzed between Wheelock Parkway to Pennsylvania Avenue to create and advance a community supported vision for the Rice St corridor. The corridor is located in the City of St Paul within Ramsey County. See **Figure 6** for the project location.

Figure 6 – Project Location



Rice St serves a diverse mix of residents, users, businesses, and modes of travel. The aging roadway currently shows safety and traffic concerns. The existing crash rate along this corridor nearly three times higher than the statewide average. The safety of pedestrians and bicyclists is especially concerning along the corridor. There have been nearly 50 crashes involving a pedestrian or bicyclist between 2014 and 2018.

The project goals are to promote economic growth and community investment by providing business opportunities, creating an inviting environment, enhancing pedestrian safety, maintaining and augmenting transit service, and improving vehicle safety. The recommended alternative for the corridor is a three-lane section. The recommendation includes a proposed trail on the west side of the corridor, sidewalk on the east side of the corridor, and boulevard space for signing, lighting, natural features, and snow storage throughout.

Existing Conditions Analysis

A. Crash Analysis

1. Intersection Crashes

The previous Rice St Transportation Safety Study referenced 2011-2015 crash data. A crash review was completed for the current study with updated data from January 2014 through September 2019. Only data from the full five years (2014-2018) was analyzed when determining the crash rate and critical

index. Crash data was provided by Ramsey County. MnDOT uses a comparison of the crash rate and the critical rate when determining if there is a safety issue at an intersection or corridor. The crash rate is the number of crashes per million entering vehicles (MEV) for intersections and crashes per million vehicle miles (MVM) for segments. The critical rate is a statistical comparison based on similar intersections or corridors statewide. An observed crash rate greater than the critical rate indicates that the intersection or corridor operates outside of the expected, normal range. The critical index reports the magnitude of this difference. A critical index of less than one indicates that the intersection or corridor is operating within the normal range and a critical index of greater than one indicates that the intersection or corridor is operating outside the normal range. **Table 3** provides a crash summary for each intersection.

Table 3. Intersection Crash Summary (2014-2018)

Intersection along Rice St	Observed Crash Rate	Statewide Average Crash Rate	Critical Crash Rate	Critical Index
Wheelock Pkwy	1.01	0.7	1.08	0.94
Iowa Ave	0.22	0.18	0.41	0.54
Hoyt Ave	0.65	0.18	0.41	1.59
Montana Ave	0.18	0.18	0.41	0.44
Nebraska Ave	0.76	0.7	1.13	0.67
Arlington Ave	1.18	0.7	1.06	1.71
Cottage Ave	0.64	0.18	0.41	1.56
Ivy Ave	0.78	0.18	0.41	1.90
Hyacinth Ave	0.28	0.18	0.41	0.68
Orange Ave	0.28	0.18	0.41	0.68
Hawthorne Ave	0.25	0.18	0.41	0.61
Maryland Ave	2.06	0.7	1.01	2.04
Rose Ave	0.2	0.18	0.42	0.48
Geranium Ave	0.7	0.52	0.9	0.78
Jessamine Ave	0.31	0.18	0.42	0.74
Magnolia Ave	0.39	0.18	0.42	0.93
Cook Ave	0.31	0.18	0.42	0.74
Lawson Ave	0.16	0.18	0.42	0.38
Hatch Ave	0.35	0.18	0.42	0.83
Front Ave	1.3	0.52	0.88	1.48
Litchfield St	0.16	0.18	0.42	0.38
Wayzata St	0.08	0.52	0.9	0.09
Manitoba Ave	0.86	0.18	0.42	2.05
Milford St	0.2	0.18	0.42	0.48
Winnipeg Ave	0.47	0.18	0.42	1.12
Atwater St	0.7	0.52	0.88	0.8
Lyton Pl	0.08	0.18	0.42	0.19
Sycamore St	0.73	0.52	0.86	0.85
Pennsylvania Ave	1.24	0.7	1	1.24

Table 3 shows that several intersections have a critical index greater than one. These include:

- Hoyt Ave at Rice St
    - The observed crash rate of Hoyt Ave at Rice St is 3.6 times higher than the statewide average. There were 18 crashes reported at this intersection in the last five years. Crashes would need to be reduced by 6 over five years for this intersection to perform within the normal range

- Arlington Ave at Rice St
    - The observed crash rate of Arlington Ave at Rice St is 1.7 times higher than the statewide average. There were 69 crashes reported at this intersection in the last five years. Crashes would need to be reduced by 28 over five years for this intersection to perform within the normal range
- Cottage Ave at Rice St
    - The observed crash rate of Cottage Ave at Rice St is 3.6 times higher than the statewide average. There were 18 crashes reported at this intersection in the last five years. Crashes would need to be reduced by 6 over five years for this intersection to perform within the normal range

- **Ivy Ave at Rice St**
    - The observed crash rate of Ivy Ave at Rice St is 4.3 times higher than the statewide average. There were 22 crashes reported at this intersection in the last five years. Crashes would need to be reduced by 10 over five years for this intersection to perform within the normal range
- Maryland Ave at Rice St
    - The observed crash rate of Maryland Ave at Rice St is 2.9 times higher than the statewide average. There were 105 crashes reported at this intersection in the last five years. Crashes would need to be reduced by 53 over five years for this intersection to perform within the normal range
- **Front Ave at Rice St**
    - The observed crash rate of Front Ave at Rice St is 2.5 times higher than the statewide average. There were 37 crashes reported at this intersection in the last five years. Crashes would need to be reduced by 11 over five years for this intersection to perform within the normal range
- **Manitoba Ave at Rice St**
    - The observed crash rate of Manitoba Ave at Rice St is 4.8 times higher than the statewide average. There were 22 crashes reported at this intersection in the last five years. Crashes would need to be reduced by 11 over five years for this intersection to perform within the normal range
- **Winnipeg Ave at Rice St**
    - The observed crash rate of Winnipeg Ave at Rice St is 2.6 times higher than the statewide average. There were 12 crashes reported at this intersection in the last five years. Crashes would need to be reduced by 1 over five years for this intersection to perform within the normal range
- Pennsylvania Ave at Rice St
    - The observed crash rate of Pennsylvania Ave at Rice St is 1.8 times higher than the statewide average. There were 67 crashes reported at this intersection in the last five years. Crashes would need to be reduced by 13 over five years for this intersection to perform within the normal range

The **bolded** intersections were not identified as operating outside the normal range in the previous study. The crash worksheets for each intersection can be found in the **Appendix A**. The intersections operating outside the normal range compared to similar intersections statewide were further analyzed to understand the crash trends.

Hoyt Ave at Rice St

Over the past five years there have been 18 crashes at the intersection of Hoyt Ave at Rice St. The intersection is side street stop controlled with Rice St having the right of way. **Table 4** summarizes the crash types and severity that occurred at the intersection.

Table 4. Hoyt Ave at Rice St Crash Type and Severity

Crash Type	Frequency – Crash Severity
Rear End	5 Property Damage
Pedestrian	1 Serious Injury, 1 Minor Injury, 1 Possible Injury
Right Angle	1 Minor Injury, 2 Property Damage
Sideswipe - Same Direction	2 Property Damage
Right Turn	2 Property Damage
Left Turn	1 Property Damage
Head On	1 Possible Injury
Other	1 Serious Injury

Table 4 shows that rear end crashes were the most common at the intersection, followed by pedestrian and right-angle crashes. There were two serious injury crashes, two minor injury crashes, two possible injury crashes, and twelve property damage only crashes at the intersection in the last five years. The proposed 3-lane section would be anticipated to reduce the number of crashes, especially the rear end, right-angle, sideswipe, left turn, and head-on crashes. Additionally, the reduced crossing length combined with other pedestrian improvements would be anticipated to reduce the pedestrian involved crashes.

Arlington Ave at Rice St

Over the past five years there have been 69 crashes at the intersection of Arlington Ave at Rice St. The intersection is signalized. **Table 5** summarizes the crash types and severity that occurred at the intersection.

Table 5. Arlington Ave at Rice St Crash Type and Severity

Crash Type	Frequency – Crash Severity
Right Angle	1 Serious Injury, 1 Minor Injury, 2 Possible Injury, 16 Property Damage
Rear End	14 Property Damage
Left Turn	2 Possible Injury, 12 Property Damage
Sideswipe - Same Direction	9 Property Damage
Pedestrian	3 Minor Injury, 3 Possible Injury, 2 Non-Injury
Ran off Road	3 Property Damage
Other	1 Property Damage

Table 5 shows that right angle crashes were the most common at the intersection, followed by rear end and left turn crashes. There was one serious injury crash, four minor injury crashes, seven possible injury crashes, and 57 property damage only crashes at the intersection in the last five years. The proposed 3-lane section would be anticipated to reduce the number of crashes, especially the rear end, right-angle, sideswipe, and left turn crashes. Additionally, the reduced crossing length combined with other pedestrian improvements would be anticipated to reduce the pedestrian involved crashes.

Cottage Ave at Rice St

Over the past five years there have been 18 crashes at the intersection of Cottage Ave at Rice St. The intersection is side street stop controlled with Rice St having the right of way. **Table 6** summarizes the crash types and severity that occurred at the intersection.

Table 6. Cottage Ave at Rice St Crash Type and Severity

Crash Type	Frequency – Crash Severity
Rear End	9 Property Damage
Left Turn	2 Property Damage
Sideswipe - Same Direction	2 Property Damage
Pedestrian	2 Non-Injury
Head On	1 Minor Injury
Ran off Road	1 Property Damage
Sideswipe - Opposing	1 Property Damage

Table 6 shows that rear end crashes were the most common at the intersection. There were two pedestrian non-injury crashes. There was one minor injury crash, two possible injury crashes, and 15 property damage only crashes at the intersection in the last five years. The proposed 3-lane section would be anticipated to reduce the number of crashes, especially the rear end, sideswipe, head-on, and left turn crashes. Additionally, the reduced crossing length combined with other pedestrian improvements would be anticipated to reduce the pedestrian involved crashes.

Ivy Ave at Rice St

Over the past five years there have been 22 crashes at the intersection of Ivy Ave at Rice St. The intersection is side street stop controlled with Rice St having the right of way. **Table 7** summarizes the crash types and severity that occurred at the intersection.

Table 7. Ivy Ave at Rice St Crash Type and Severity

Crash Type	Frequency – Crash Severity
Right Angle	1 Minor Injury, 1 Possible Injury, 3 Property Damage
Rear End	1 Possible Injury, 4 Property Damage
Sideswipe - Same Direction	4 Property Damage
Left Turn	3 Property Damage
Ran off Road	2 Property Damage
Bicycle	1 Possible Injury
Right Turn	1 Possible Injury
Other	1 Property Damage

Table 7 shows that right angle and rear end crashes were the most common at the intersection. There were was on bicycle crash which resulted in a possible injury. There was one minor injury crash, four possible injury crashes, and 17 property damage only crashes at the intersection in the last five years. The proposed 3-lane section would be anticipated to reduce the number of crashes, especially the right-angle, rear end, sideswipe, and left turn crashes.

Maryland Ave at Rice St

Over the past five years there have been 105 crashes at the intersection of Maryland Ave at Rice St. The intersection is signalized. **Table 8** summarizes the crash types and severity that occurred at the intersection.

Table 8. Maryland Ave at Rice St Crash Type and Severity

Crash Type	Frequency – Crash Severity
Right Angle	1 Minor Injury, 3 Possible Injury, 25 Property Damage
Rear End	2 Minor Injury, 1 Possible Injury, 26 Property Damage
Left Turn	1 Serious Injury, 1 Minor Injury, 4 Possible Injury, 13 Property Damage
Sideswipe - Same Direction	1 Minor Injury, 12 Property Damage
Pedestrian	1 Serious Injury, 3 Minor Injury, 1 Possible Injury, 1 Non-Injury
Bicycle	1 Minor Injury, 1 Possible Injury
Other	1 Serious Injury, 1 Property Damage
Ran off Road	1 Minor Injury, 1 Property Damage
Head On	1 Possible Injury
Sideswipe - Opposing	1 Property Damage
Right Turn	1 Property Damage

Table 8 shows that right angle and rear end crashes were the most common at the intersection, followed by left turn and sideswipe passing crashes. There were six pedestrian crashes and three bicycle crashes at the intersection. Of the 105 crashes there were 3 serious injury crashes, 10 minor injury crashes, 11 possible injury crashes, and 81 property damage only crashes at the intersection in the last five years. The proposed 3-lane section would be anticipated to reduce the number of crashes, especially the right-angle, rear end, sideswipe, head-on, and left turn crashes. Additionally, the reduced crossing length combined with other pedestrian improvements would be anticipated to reduce the pedestrian involved crashes.

Front Ave at Rice St

Over the past five years there have been 37 crashes at the intersection of Front Ave at Rice St. The intersection is signalized. **Table 9** summarizes the crash types and severity that occurred at the intersection.

Table 9. Front Ave at Rice St Crash Type and Severity

Crash Type	Frequency – Crash Severity
Rear End	1 Possible Injury, 11 Property Damage
Sideswipe - Same Direction	2 Possible Injury, 7 Property Damage
Right Angle	3 Property Damage
Left Turn	3 Property Damage
Ran off Road	3 Property Damage
Pedestrian	2 Possible Injury
Head On	1 Possible Injury, 1 Property Damage
Other	1 Minor Injury, 1 Property Damage
Right Turn	1 Property Damage

Table 9 shows that rear end crashes were the most common at the intersection, followed by sideswipe passing crashes. There were two pedestrian crashes at the intersection. Of the 37 crashes there was one minor injury crash, 6 possible injury crashes, and 30 property damage only crashes at the intersection in the last five years. The proposed 3-lane section would be anticipated to reduce the number of crashes, especially the rear end, right-angle, sideswipe, head-on, and left turn crashes. Additionally, the reduced crossing length combined with other pedestrian improvements would be anticipated to reduce the pedestrian involved crashes.

Manitoba Ave at Rice St

Over the past five years there have been 22 crashes at the intersection of Manitoba Ave at Rice St. The intersection is side street stop controlled with Rice St having the right of way. **Table 10** summarizes the crash types and severity that occurred at the intersection.

Table 10. Manitoba Ave at Rice St Crash Type and Severity

Crash Type	Frequency – Crash Severity
Sideswipe - Same Direction	1 Minor Injury, 5 Property Damage
Rear End	2 Minor Injury, 1 Possible Injury, 2 Property Damage
Pedestrian	1 Minor Injury, 2 Non-Injury
Right Angle	2 Property Damage
Head On	2 Property Damage
Sideswipe - Opposing	1 Property Damage
Right Turn	1 Property Damage
Ran off Road	1 Property Damage
Other	1 Serious Injury

Table 10 shows that sideswipe passing crashes were the most common at the intersection, followed by rear end crashes. There were four minor injury crashes, one possible injury crash, and 17 property damage only crashes at the intersection in the last five years. The proposed 3-lane section would be anticipated to reduce the number of crashes, especially the rear end, right-angle, sideswipe, head-on, and left turn crashes. Additionally, the reduced crossing length combined with other pedestrian improvements would be anticipated to reduce the pedestrian involved crashes.

Winnipeg Ave at Rice St

Over the past five years there have been 12 crashes at the intersection of Winnipeg Ave at Rice St. The intersection is side street stop controlled with Rice St having the right of way. **Table 11** summarizes the crash types and severity that occurred at the intersection.

Table 11. Winnipeg Ave at Rice St Crash Type and Severity

Crash Type	Frequency – Crash Severity
Rear End	1 Minor Injury, 1 Possible Injury, 2 Property Damage
Right Angle	1 Possible Injury, 1 Property Damage
Sideswipe - Same Direction	2 Property Damage
Left Turn	1 Minor Injury
Head On	1 Property Damage
Ran off Road	1 Property Damage
Other	1 Property Damage

Table 11 shows that rear end crashes were the most common at the intersection. There were two minor injury crashes, two possible injury crashes, and eight property damage only crashes at the intersection in the last five years. The proposed 3-lane section would be anticipated to reduce the number of crashes, especially the rear end, right-angle, sideswipe, head-on, and left turn crashes.

Pennsylvania Ave at Rice St

Over the past five years there have been 67 crashes at the intersection of Pennsylvania Ave at Rice St. The intersection is signalized. **Table 12** summarizes the crash types and severity that occurred at the intersection.

Table 12. Pennsylvania Ave at Rice St Crash Type and Severity

Crash Type	Frequency – Crash Severity
Right Angle	1 Minor Injury, 1 Possible Injury, 20 Property Damage
Rear End	1 Minor Injury, 1 Possible Injury, 12 Property Damage
Sideswipe - Same Direction	14 Property Damage
Left Turn	1 Minor Injury, 8 Property Damage
Pedestrian	1 Minor Injury, 1 Possible Injury
Ran off Road	2 Property Damage
Head On	1 Property Damage
Right Turn	1 Property Damage

Table 12 shows that right angle crashes were the most common at the intersection, followed by rear end and sideswipe passing crashes. There were two pedestrian crashes at the intersection. Of the 67 crashes there were four minor injury crashes, three possible injury crashes, and 59 property damage only crashes at the intersection in the last five years. The proposed 3-lane section would be anticipated to reduce the number of crashes, especially the right-angle, rear end, sideswipe, head-on, and left turn crashes. Additionally, the reduced crossing length combined with other pedestrian improvements would be anticipated to reduce the pedestrian involved crashes.

2. Segment Crashes

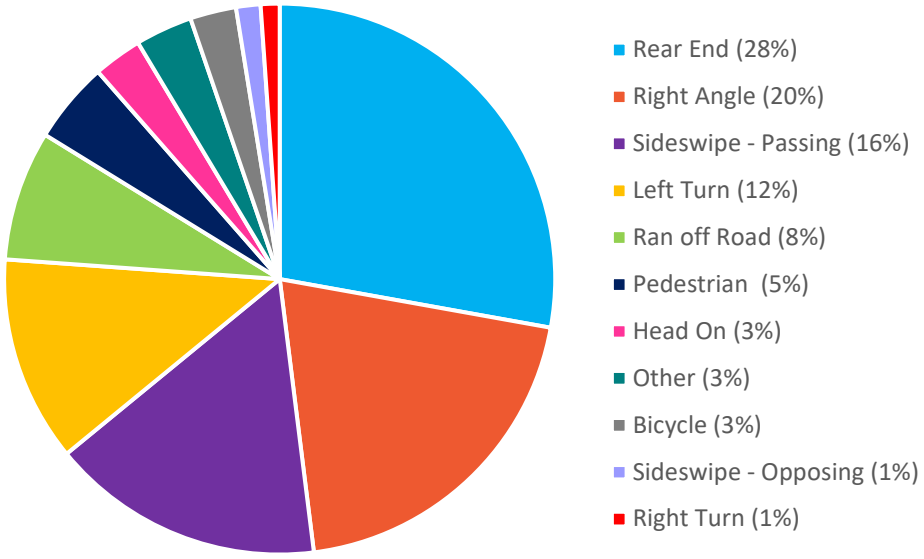
An overall segment crash review was also completed along Rice St between Wheelock Pkwy and Pennsylvania Ave. There were 629 crashes along the corridor (including crashes at the intersections) in the five years of analysis (2014-2018). The observed total crash rate along this corridor is 11.18 crashes per million vehicle miles traveled. The statewide average is 3.8 crashes per million vehicle miles traveled so this segment is experiencing a crash rate that is nearly three times higher than the statewide average. The critical index is a measure of how well a location compares to other equivalent locations with a critical index of less than one indicating that the segment is operating within the normal range and a critical index of greater than one indicating that the segment is operating outside the normal range. The critical index for the corridor was found to be 2.5 which indicates that the segment is operating outside the normal range.

The observed fatal and serious injury crash rate was found to be 17.78 crashes per 100 million vehicle miles traveled. The statewide average is 3.37 crashes per 100 million vehicle miles traveled so this segment fatal and serious injury crash rate is over five times higher than the statewide average. The

fatal and serious injury critical index is 2.4 which indicates that the segment is operating outside the normal range.

Figure 7 below indicates that rear ends were the most common crash type along the corridor accounting for 28% (175) of the 629 crashes. The next most common were right angle crashes accounting for 20% (127) of the 629 crashes, sideswipe same direction crashes accounting for 16% (101) of the 629 crashes, and left turn crashes accounting for 12% (76) of the 629 crashes. These four crash types make up 76% of the crashes. The rear end, sideswipe same direction, and left turn crashes are likely due to the lack of right and left turn lanes with the existing 4-lane undivided roadway and the traffic signals along the corridor. A left turning vehicle in the left lane would be an obstruction to following through vehicles, potentially a source for some rear end crashes. Additionally, slowdowns or stops of left or right turning vehicles can be a source of sideswipe crashes. There were 30 pedestrian crashes and 17 bicycle crashes reported along the corridor in the last five years. More details on the pedestrian and bicycle crashes are included in the "Pedestrian and Bicycle Crash" section on of this report.

Figure 7 – Segment Crash Type (2014-2018)



The crash type is also listed in **Table 13**. The crash severity breakdown of the 629 crashes along the Rice St is shown in **Table 14**.

Table 13. Rice St Corridor Crash Type (2014-2018)

Crash Type	Frequency
Rear End	175
Right Angle	127
Sideswipe - Passing	101
Left Turn	76
Ran off Road	48
Pedestrian	30
Other	21
Head On	18
Bicycle	17
Sideswipe - Opposing	9
Right Turn	7

Table 14. Rice St Corridor Crash Severity (2014-2018)

Crash Severity	Frequency
Fatal	0
Serious Injury	10
Minor Injury	41
Possible Injury	73
Non-Injury	505

Table 14 shows that most crashes resulted in property damage (505 crashes), but there were 10 serious injury crashes, 41 minor injury and 73 possible injury crashes along Rice St in the last five years. There would need to be a 66% reduction in crashes for the corridor to operate within the normal range. Crashes were analyzed by time of year to determine if certain months or seasons had more crashes than others. **Figure 8** shows that the month with the most crashes is September with 70 crashes followed by July with 63 and January with 57. The spike in crashes in September could be related to the start of the school year but the review does not indicate any substantial trends related to time of year.

Figure 8 – Crash Data (2014-2018) By Month

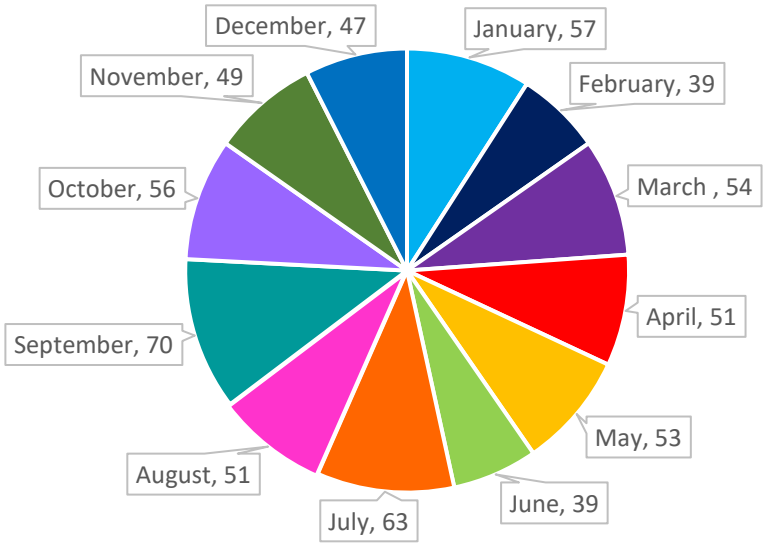
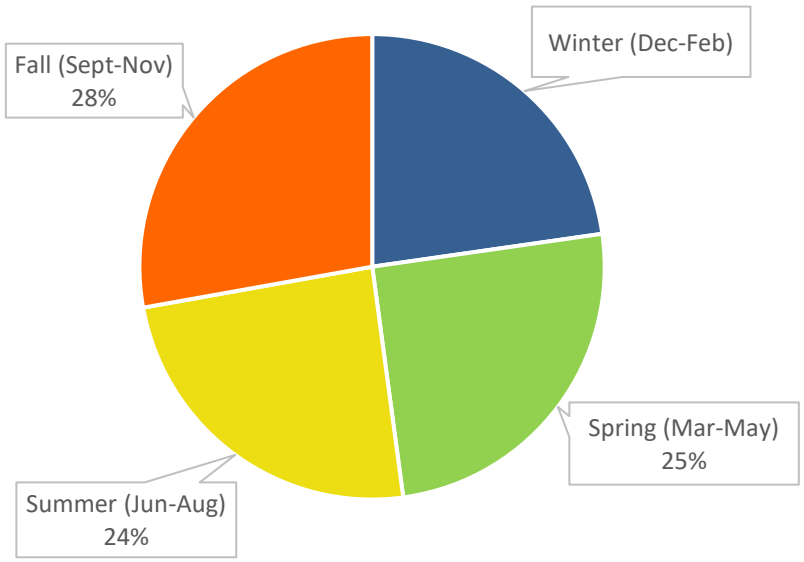


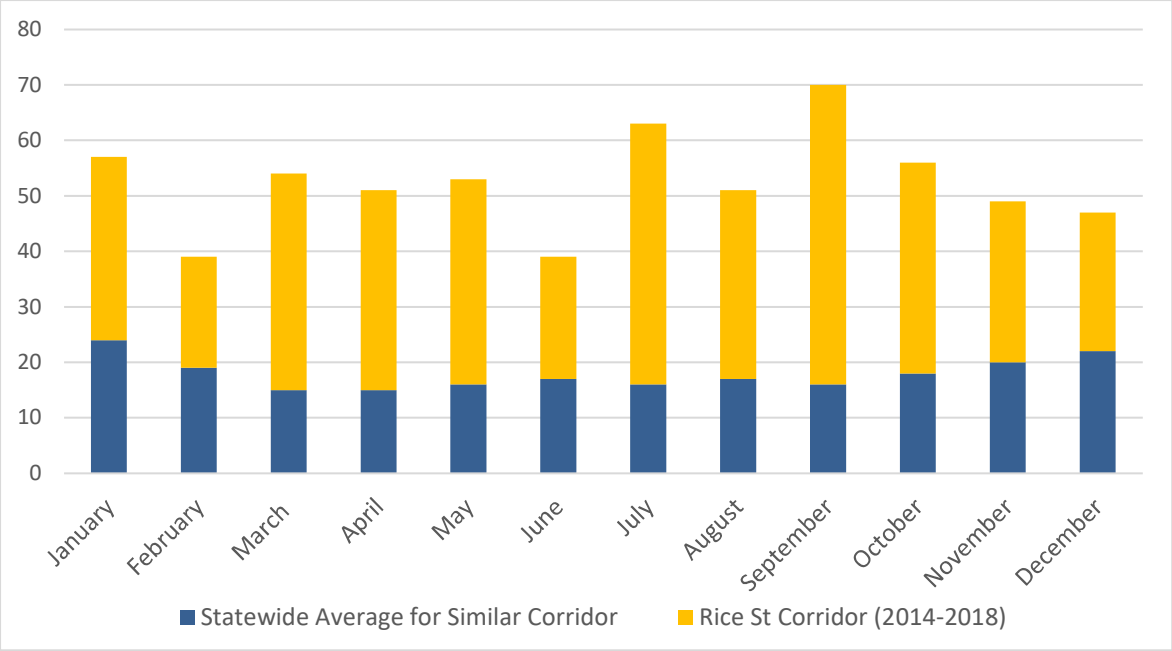
Figure 9 shows the crashes are split mostly even between the four seasons but fall has the most crashes with 28% (175) of the crashes occurring in September, October, and November. The winter has the least number of crashes with 23% (143) of the crashes occurring in December, January, and February.

Figure 9 – Crash Data (2014-2018) By Season



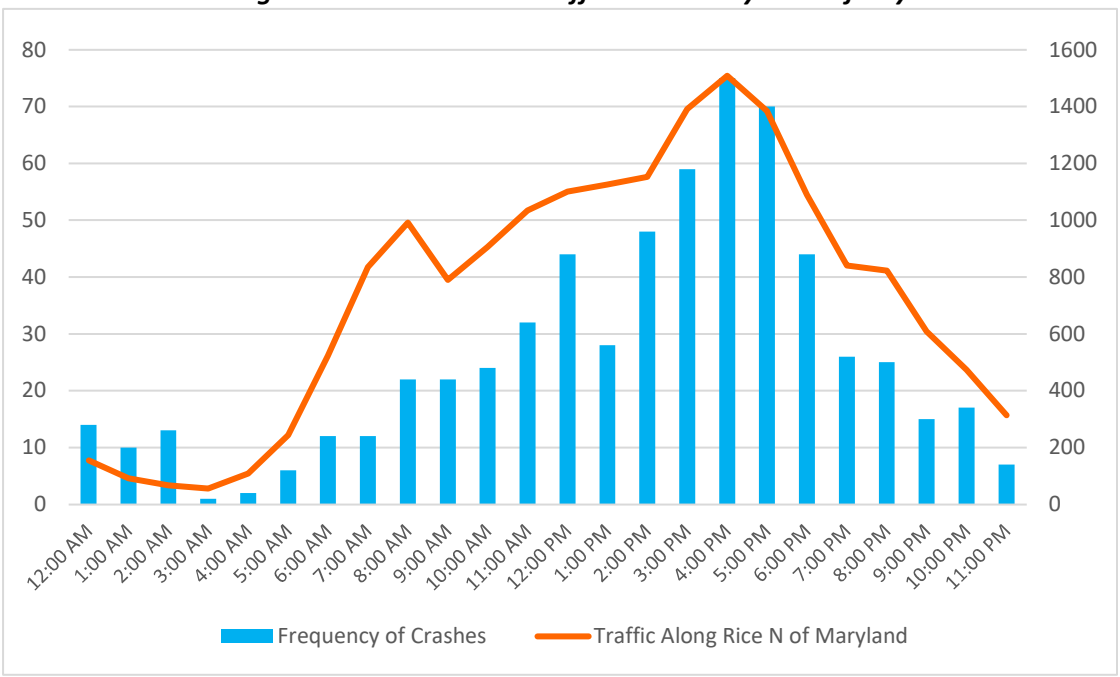
Crashes were also compared by month to the statewide average number of crashes by month along similar corridors. This is shown in **Figure 10** below which indicates that there are more than double the number of crashes per month along Rice St than a similar corridor for every month of the year.

Figure 10 – Crash Data (2014-2018) By Month Compared to Statewide Average



An analysis of the total crashes along Rice St and traffic volumes along Rice St north of Maryland Ave by time of day was completed. **Figure 11** shows a graph comparing the crash data. This indicates that for the most part as traffic volumes go up the number of crashes increase, however, the spike in traffic during the AM peak hour does not appear to correlate with a significant spike in crashes. This also indicates that the peak hour with the most crashes is from 4:00-5:00pm when traffic volumes are highest along Rice St.

Figure 11 – Crashes and Traffic Volumes By Time of Day



Angle (left turn and right angle) crashes and rear end crashes along Rice St were also compared to traffic volumes along Rice St north of Maryland Ave by time of day. **Figures 12** and **13** show the analysis.

Figure 12 – Angle Crashes and Traffic Volumes by Time of Day

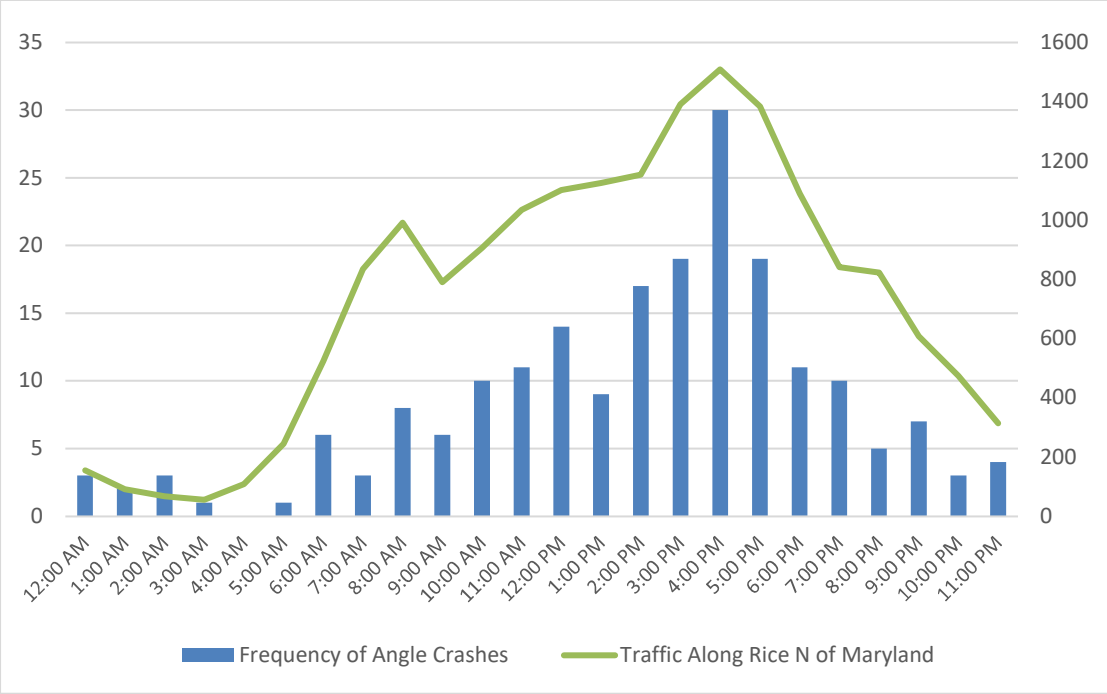


Figure 13 – Rear End crashes and Traffic Volumes by Time of Day

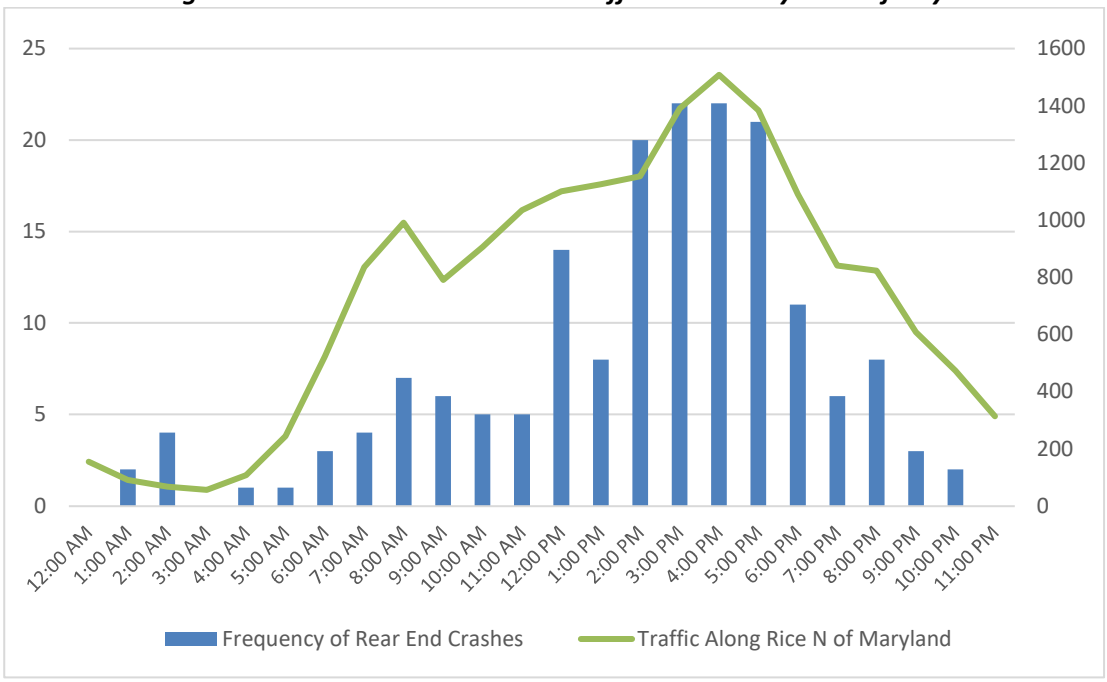


Figure 12 shows the largest spike in angle crashes occurred from 4:00-5:00pm when traffic volumes are highest along Rice St where **Figure 13** shows how rear end crashes are high from 2:00-6:00pm.

3. Pedestrian and Bicycle Crashes

A more thorough review of pedestrian and bicyclist crashes were analyzed using the crash data available at the time the safety review was completed (January 2014-Septmber 2019). **Figure 14** below shows a map of where the pedestrian and bicycle crashes were located along Rice St. The map also shows the locations of schools near the corridor.

Figure 14 – Pedestrian and Bicycle Crashes along Rice St

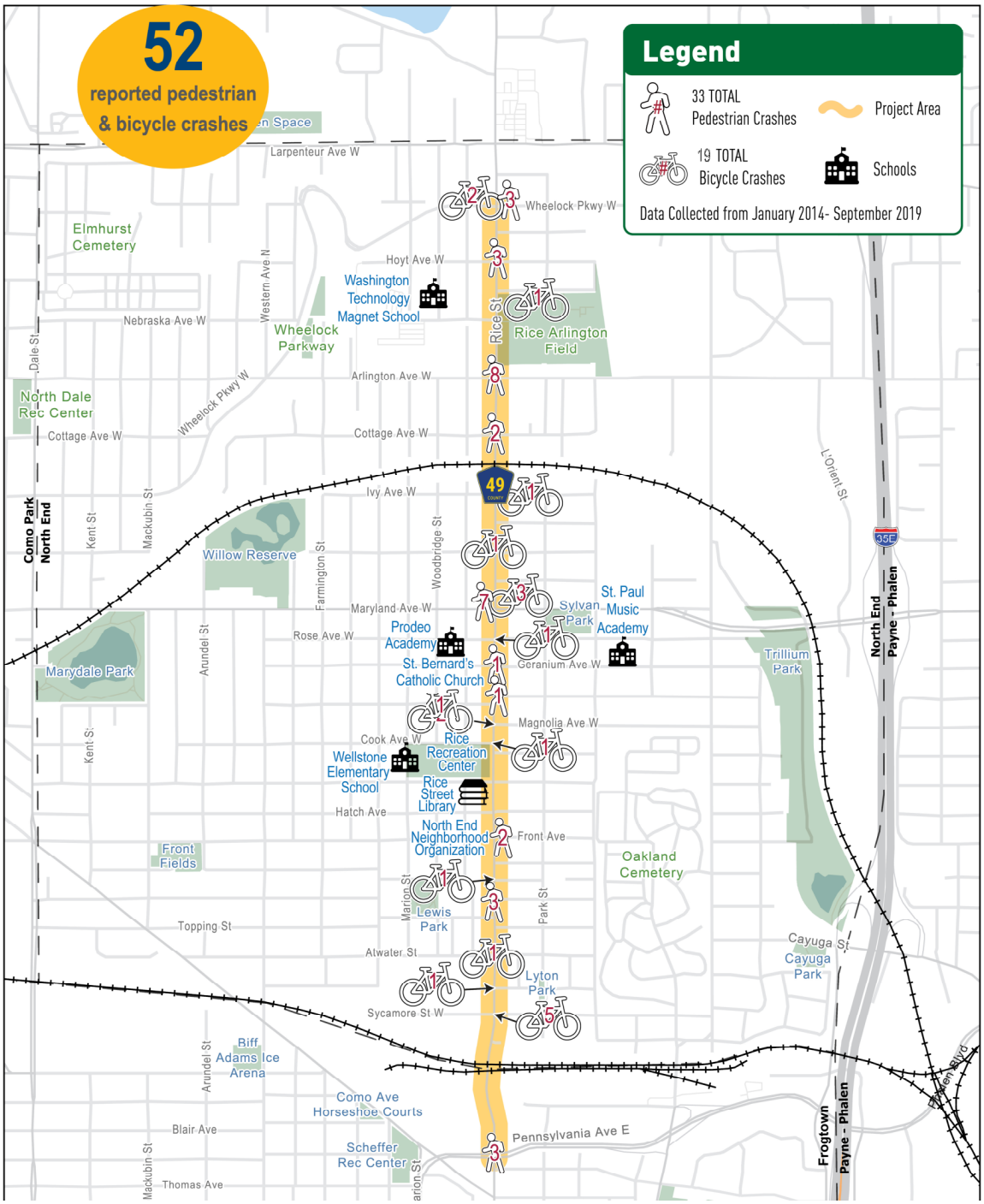


Figure 14 indicates that pedestrian and bicycle crashes are occurring throughout the entire corridor with the majority of the pedestrian and bicyclist involved crashes occurring at the intersections of Maryland Ave and Arlington Ave. 16 of the 52 reported crashes involved a school aged child (18 years of age and under). The breakdown of crash severity is shown in **Table 15** below.

Table 15. Pedestrian and Bicycle Crash Severity

Crash Severity	Frequency
Fatal	0
Serious Injury	4
Minor Injury	14
Possible Injury	20
Non-Injury	14

Two of the serious injury crashes occurred at the intersection of Maryland Ave and Rice St. Both crashes involved pedestrians crossing the roadway against the signal. One of the crashes involved a pedestrian crossing Maryland Ave and the other crash involved the pedestrian crossing Rice St. One of the serious injury crashes occurred at the intersection of Hoyt Ave and Rice St. The pedestrian was crossing Rice St when hit by a vehicle traveling northbound along Rice St. The fourth serious injury crash occurred at the intersection of Wayzata St and Rice St. The crash involved a bicyclist crossing Rice St against the signal.

4. Serious Injury and Fatal Crashes

A ten-year (2012-2021) crash analysis was completed in 2022 at the end of the study to review the location and frequency of fatal and serious injury crashes along the corridor. Over the last ten years there have been 22 crashes that resulted in serious injury and one crash that resulted in fatality. The fatal crash was a pedestrian crash at the intersection of Ivy Ave and Rice St. **Table 16** summarizes the crash type and location of the crashes.

Table 16. Fatal and Serious Injury Crashes (2012-2021)

Location	Number of Crashes	Crash Type
Hoyt Ave at Rice St	3	Pedestrian (2), Rear End
Arlington Ave at Rice St	2	Pedestrian, Left Turn
Ivy Ave at Rice St	2	Pedestrian (2)
Along Rice St South of Ivy Ave	1	Single Vehicle Run off Road
Maryland Ave at Rice St	4	Pedestrian (2), Left Turn, Single Vehicle Run off Road
Along Rice St South of Front Ave	1	Left Turn
Wayzata St at Rice St	1	Bicycle
Manitoba Ave at Rice St	1	Pedestrian
Milford St at Rice St	1	Pedestrian
Atwater St at Rice St	2	Right Angle, Right Turn
Sycamore St at Rice St	1	Sideswipe Passing
Along Rice St South of Sycamore St	1	Head On
Pennsylvania Ave at Rice St	3	Pedestrian, Right Angle (2)

Table 16 shows how 11 of the 23 serious and fatal injury crashes in the last ten years were pedestrian or bicycle crashes. This table also shows how serious injury crashes are not just occurring at a few intersections, rather they are occurring throughout the entire corridor.

B. Data Collection

1. Traffic Counts

Turning movement counts were collected in 2016 for intersections along the Rice St corridor for the Rice Street Transportation Safety Study. These volumes were used for the existing conditions analysis of the current study. Additional counts were collected at select locations in 2021 for comparison to the 2016 counts and for warrant analysis. The 2021 counts were lower than the 2016 counts by approximately 23% during the AM peak hour and 33% during the PM peak hour, likely due to the impacts of the COVID-19 Pandemic.

2. Parking

A parking study was completed along Rice St and side streets that appeared to be heavily utilized for on-street parking. This allowed the project team to understand how much parking is being used along the existing corridor.

On street parking is allowed between Hoyt Ave and Atwater St. On street parking is not allowed during the following times and locations:

- West side of Rice St (Southbound) from 7:00-8:00am
- East side of Rice St (Northbound) from 4:00-6:00pm

Data was collected on the following dates and times:

- Thursday November 7th, 2019: 12:00pm, 1:00pm, and 6:00pm
- Saturday November 9th, 2019: 9:00am, 12:00pm, and 4:00pm
- Tuesday November 12th, 2019: 7:00pm

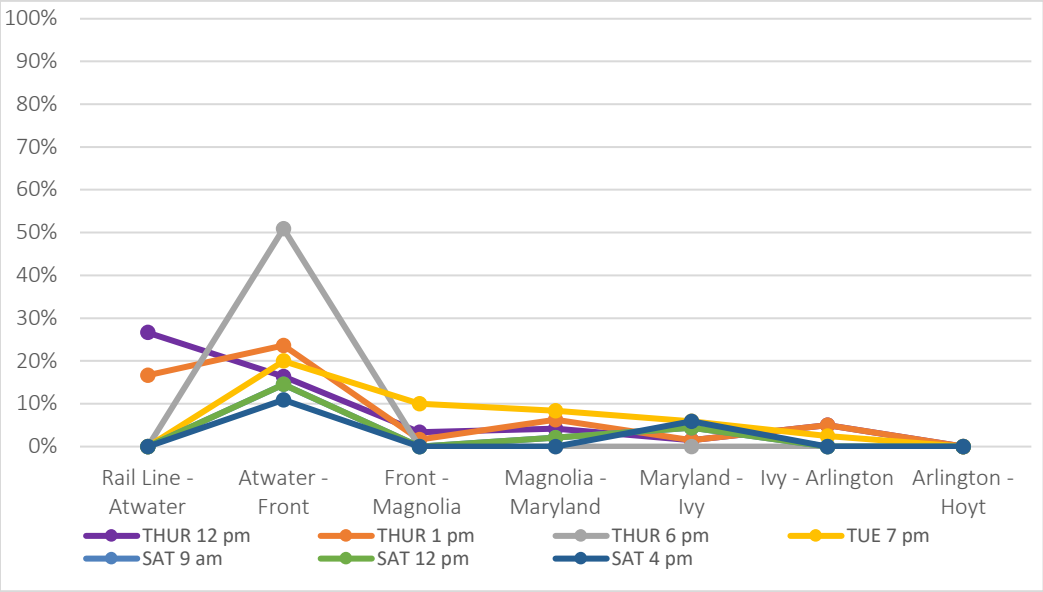
Table 17 summarizes the on street parking data collected along Rice St and **Figure 15** graphs the parking utilization along the corridor.

Table 17. On Street Parking Data Collection

Counts	*Nov. 7*	*Nov. 7*	*Nov. 7*	*Nov. 12*	*Nov. 9*	*Nov. 9*	*Nov. 9*	
Zone	**THUR 12 pm**	**THUR 1 pm**	**THUR 6 pm**	**TUE 7 pm**	**SAT 9 am**	**SAT 12 pm**	**SAT 4 pm**	**Number of Spaces**
Rail Line - Atwater	8	5	0	0	0	0	0	30
Atwater - Front	9	13	14	11	8	8	6	55
Front - Magnolia	2	1	0	6	0	0	0	60
Magnolia - Maryland	2	3	0	4	1	1	0	48
Maryland - Ivy	1	1	0	4	3	3	4	68
Ivy - Arlington	2	2	0	1	0	0	0	40
Arlington - Hoyt	0	0	0	0	0	0	0	54

Note: The 6:00pm count on November 7th was completed during the parking restriction so the number of total spaces was reduced by approximately 50%.

Figure 15 – On Street Parking Utilization Along Rice St



The data in **Table 17** and **Figure 15** indicates that on street parking utilization is minimal during the times collected. Rice St between Atwater St and Front Ave shows at most 50% utilization during the 6:00pm count on Thursday November 7th during the parking restriction (14 spots utilized of the 28 available due to the restriction). The only area where cars were noted to fully utilize Rice St and extend about half a block to one block along the side street is at Rice St and Manitoba Ave (located between Atwater St and Front Ave).

The lack of on street parking utilization could be because current parking restrictions cause confusion as to where on street parking is allowed. There also could be a lack of comfort parking along Rice St since that area vehicles can park is in the outside travel lane. Finally, there could be a lack of parking utilization with many businesses having off street parking available for customers. It is noted that summer parking use could be higher in some different areas of the corridor during specific times, but additional data was not collected due to the COVID-19 Pandemic effects on events and facilities.

With the reconstruction of Rice St, most on street parking would be removed, however, several potential areas for future on-street parking were identified. These areas are listed along with the businesses the potential parking spaces would be adjacent to:

- East side of Rice St between Atwater St and Winnipeg Ave:
  - Winnipeg Grocery
- East side of Rice St between Winnipeg Ave and Manitoba Ave:
  - Real Life Coffee & Yoga
  - Tony's Upholstery
- East side of Rice St between Manitoba Ave and Wayzata St:
  - Restoration Counseling & Community Services
  - Affordable Mattress
  - Peter King Family Foundation
  - Open Cities Health Center
- West side of Rice St between Wayzata St and Milford St
  - Tiger Supermarket
  - North End Appliances

- East side of Rice St between Cook Ave and Lawson Ave
    - Dar's Double Scoop
- West side of Rice St between Magnolia Ave and Cook Ave
    - Xiong Chiropractic
    - Impact Printing
- East side of Rice St between Magnolia Ave and Jessamine Ave
    - Lao Hmong American Coalition
    - Metro Home Health Care
- East side of Rice St between Jessamine Ave and Geranium Ave
    - Big Market Grocery
    - Amore Shoes
    - Greater Grace African Braiding
- East side of Rice St between Geranium Ave and Rose Ave
    - DeLisle Co
    - Remington Auto Repair
- East side of Rice St between Hawthorne Ave and Orange Ave
    - Residential homes
- East side of Rice St between Orange Ave and Hyacinth Ave
    - Penny's Pet Grooming
    - Residential homes
- East side of Rice St between Hyacinth Ave and Ivy Ave
    - Residential homes
- East side of Rice St between Arlington Ave and Nebraska Ave
    - Rice & Arlington Sports Complex

For more information on the parking impacts and recommendations see the "Parking Impacts and Systems" memorandum.

3. Pedestrian Crossing Considerations

Pedestrian counts were analyzed to determine where marked crosswalks are recommended along the corridor. Pedestrian crossing will be marked at signalized intersections so only the unsignalized intersections were analyzed where count data was available. Ramsey County guidance follows MnDOT guidance stating that a minimum volume of 20 pedestrians at any given hour is the initial threshold for consideration of a marked crosswalk. The County also follows guidance from the City of St Paul that school-aged pedestrians shall count as two pedestrians towards the minimum pedestrian volume threshold. The four hours of count data (6:30-8:45 AM & 3:30-5:30 PM) from 2016 counts were analyzed at the following unsignalized intersections or unwarranted signalized intersections:

- Wayzata Ave at Rice St – at most 30 pedestrians cross Rice St in any given hour
- Lawson Ave at Rice St – at most 6 pedestrians cross Rice St in any given hour
- Cook Ave at Rice St – at most 15 pedestrians cross Rice St in any given hour
- Jessamine Ave at Rice St – no pedestrians were counted crossing Rice St in any given hour
- Geranium Ave at Rice St – at most 12 pedestrians cross Rice St in any given hour
- Cottage Ave at Rice St – at most 10 pedestrians cross Rice St in any given hour
- Hoyt Ave at Rice St – at most 8 pedestrians cross Rice St in any given hour

13-hour count data (6:00 AM – 7:00 PM) from December 2021 was also analyzed at the following intersections;

- Hatch Ave at Rice St – at most 6 pedestrians cross Rice St in any given hour
- Lawson Ave at Rice St – at most 10 pedestrians cross Rice St in any given hour (4 of the 10 pedestrians appeared to be school aged children)
- Geranium Ave at Rice St – at most 5 pedestrians cross Rice St in any given hour
- Rose Ave at Rice St – at most 2 pedestrians cross Rice St in any given hour
- Ivy Ave at Rice St – at most 6 pedestrians cross Rice St in any given hour
- Cottage Ave at Rice St – at most 3 pedestrians cross Rice St in any given hour
- Hoyt Ave at Rice St – at most 8 pedestrians cross Rice St in any given hour

The pedestrian volume analysis indicates that only the crossing at Wayzata Ave and Rice St is recommended to be marked. All other unsignalized intersections were found to have less than 20 pedestrians and therefore are not recommended to be marked. Updated pedestrian counts will be completed in the next phase of this project to re-evaluate which crossings should be marked. Given the regional trail connection and dense commercial area at Wayzata, enhanced crossing features may be implemented with the marked crossing.

Other locations where further pedestrian improvements should be considered due to safety concerns include:

- Hoyt Ave at Rice St
- Ivy Ave at Rice St
- Cottage Ave at Rice St

Hoyt Ave at Rice St is a location where there have been three recent pedestrian crashes. The proposed design recommends a 3/4 access at this location (restricting southbound left turns). With a median present in place of the southbound left lane this location provides pedestrians with a two-stage crossing so they can cross just one direction and one lane of traffic at a time.

Ivy Ave at Rice St and Cottage Ave at Rice St are locations where there are sight line concerns due to the grade change with the bridge between the two intersections. Medians are proposed at these intersections as well to improve the safety of the pedestrian crossings.

Medians are also recommended at the T-intersections throughout the corridor which provide improved pedestrian crossings at these locations as well.

4. Origin-Destination Analysis

The data analytics software StreetLight Insight was used to analyze traffic patterns along Rice St. Streetlight Insight is a data aggregation tool which collects GPS and location information from cell phones and other GPS devices through an agreement with projected. First an origin-destination analysis was completed to understand the popular connections along the corridor. **Figures 16** and **17** show the results of this analysis for traffic originating on either end of the corridor. The average weekday traffic throughout 2017 and 2018 was analyzed omitting the months of May through August both years due to construction that impacted the traffic that uses the corridor. The AM data shows traffic patterns from 6:00 – 10:00 AM and the PM data shows traffic patterns from 3:00 – 7:00 PM. The black arrows on **Figures 16** and **17** represent the destinations that were analyzed as a part of the origin-destination analysis. Several lower volume east-west routes were omitted.

Figure 16 – Origin-Destination Analysis for Northbound Rice St Traffic

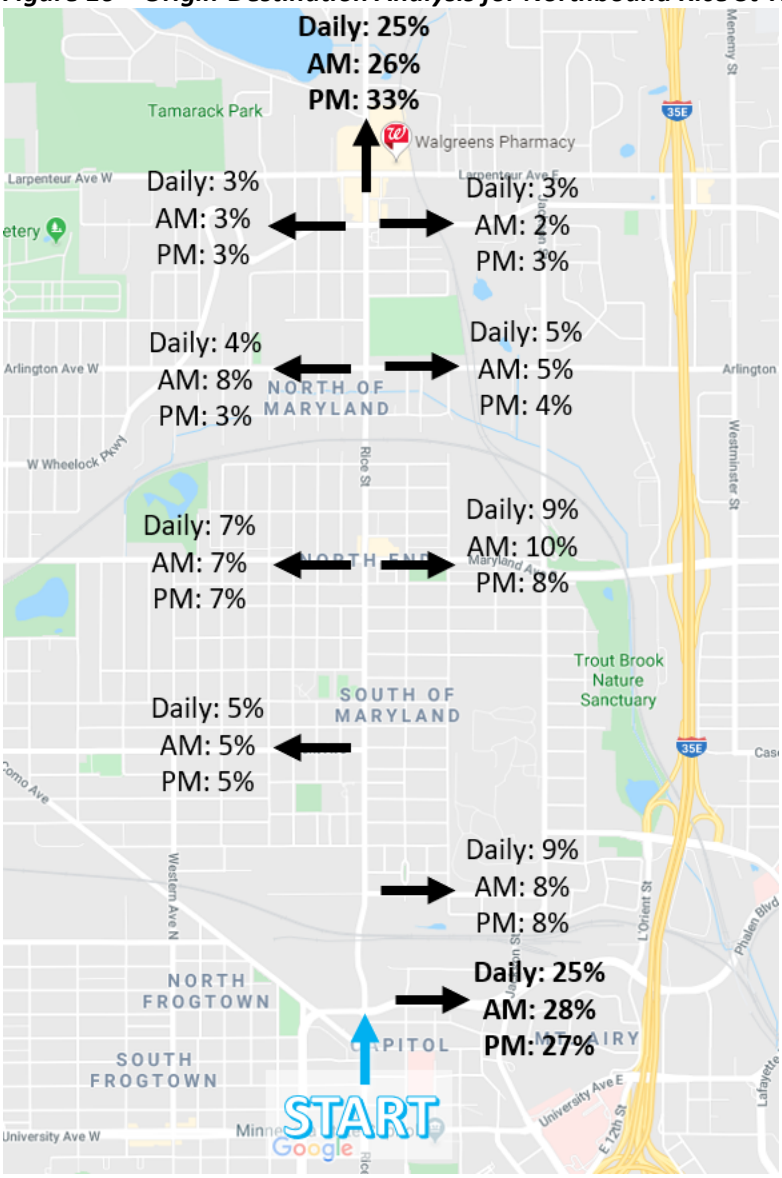


Figure 16 shows how of the traffic originating along Rice St south of Pennsylvania Ave the two most popular destinations included Pennsylvania east of Rice St and Rice St north of Wheelock Pkwy. The traffic patterns during the AM and PM rushes are similar to the daily trends, however, there is more traffic driving the entire length of the project area during the PM rush (33%) than there is in the AM rush (26%) or on average throughout the typical day (25%). This indicates that some vehicles are likely avoiding northbound I-35E during the PM rush by taking alternative north-south routes such as Rice St.

Figure 17 – Origin-Destination Analysis for Southbound Rice St Traffic

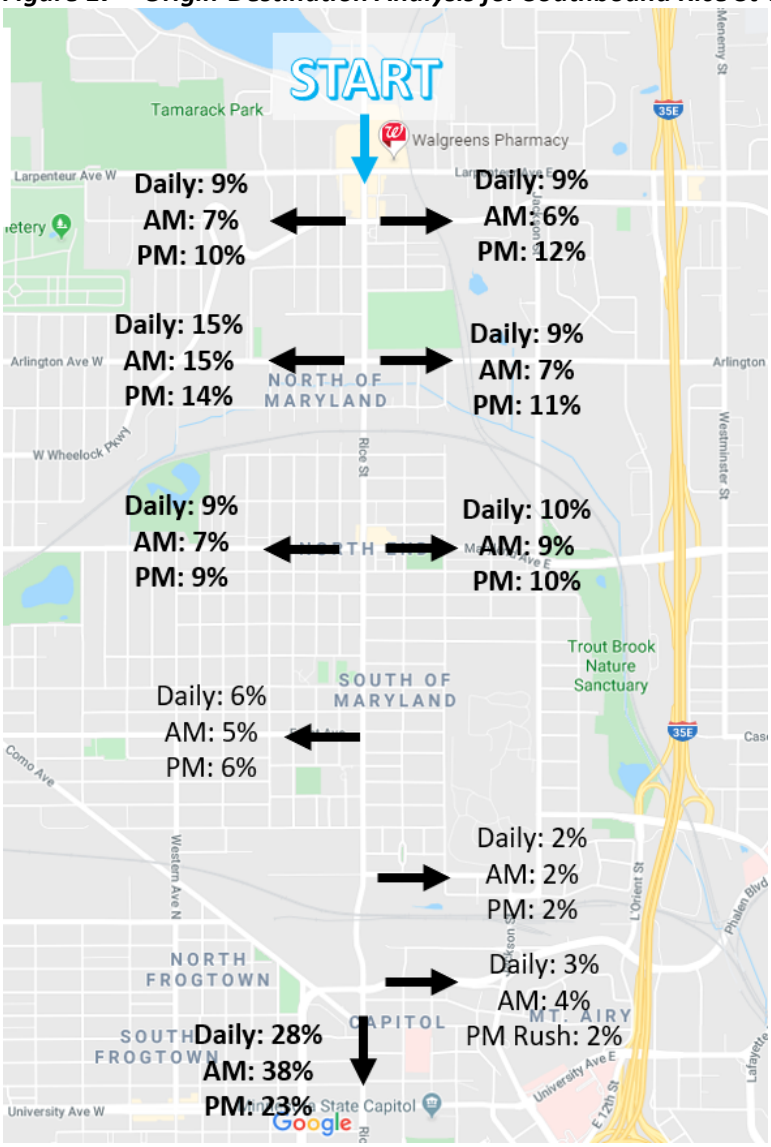


Figure 17 shows how of the traffic originating along Rice St north of Wheelock Pkwy the most popular destination is Rice St south of Pennsylvania Ave. The data indicates that far more traffic drives the entire length of the project area during the AM rush (38%) than there is in the PM rush (23%) or on average throughout the typical day (28%). This indicates some vehicles are likely avoiding southbound I-35E during the AM rush by taking alternative north-south routes such as Rice St. The second most popular destination of traffic along southbound Rice St is Arlington Ave west of Rice St. While similar to the PM, the AM does not have the operational drawbacks from this regional traffic.

StreetLight Insight was also used to analyze the distribution of commuter traffic along north-south routes near and including Rice St. This data is summarized in **Figure 18**.

Figure 18 – Distribution of North/South Commuter Traffic

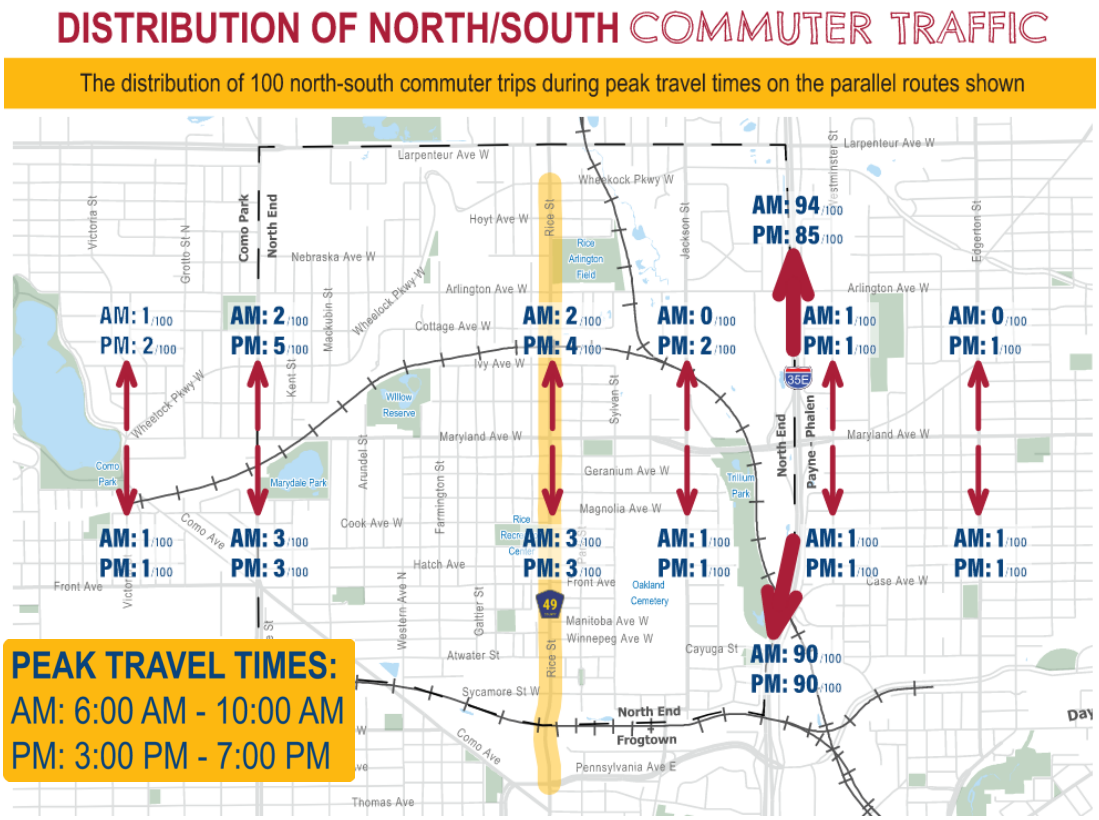


Figure 18 shows how commuter trips along Rice St compare to other major parallel routes including Como Ave, Dale St, Jackson St, I-35E, Westminster St, and Edgerton St. This analysis shows the percentage of regional commuter traffic using each route on a typical weekday.

Looking at just the north facing arrows, which represent northbound traffic, you can see that during the morning peak travel time 94 vehicles out of 100 are taking I-35E, 2 are taking Rice St, and 0-2 vehicles are taking other parallel routes. During the afternoon peak travel time, however, only 85 out of 100 vehicles are taking I-35E, 4 are taking Rice St, 5 are taking Dale St. and 1-2 are taking other parallel routes. This shows that the majority of commuter traffic is taking I-35E during peak travel times, however, during the afternoon rush hour, likely due to congestion along northbound I-35E, some traffic is diverting to other parallel routes.

Looking at the south facing arrows you can see that traffic patterns are consistent between the two peak travel times with 90 out of 100 vehicles taking I-35E and 3 vehicles taking Rice St.

C. Existing Traffic Operations

A level of service (LOS) analysis of the peak hours was completed using the previously collected 2016 turning movement counts in Synchro/SimTraffic. The LOS results are based on average delay per vehicle as calculated by the Highway Capacity Manual (HCM) 6th Edition, which defines the level of service, based on control delay. Control delay is the delay experienced by vehicles slowing down as they are approaching the intersection, the wait time at the intersection, and the time for the vehicle to speed up through the intersection and enter into the traffic stream. The average intersection control delay is a volume weighted average of delay experienced by all motorists entering the intersection on all intersection approaches. Intersections and each intersection approach are given a ranking from LOS A

through LOS F. LOS A indicates the best traffic operation, with vehicles experiencing minimal delays. LOS A through D is generally perceived to be acceptable to drivers. LOS E indicates that an intersection is operating at, or very near, its capacity and that drivers experience considerable delays. LOS F indicates an intersection where demand exceeds capacity and drivers experience substantial delays. It should be noted that individual movements may show a LOS F but this does not indicate unacceptable operations overall for the intersection. A side street movement may experience a long wait time equating to LOS F, especially if there are few vehicles making a specific movement.

The previous study also analyzed the 2016 traffic volumes in Synchro/SimTraffic. The previous models were provided and updated to reflect the most recent conditions along the corridor. The following changes were made:

- Updated the lane configuration between Wheelock Pkwy and Hoyt Ave
- Updated signal timing

The updated signal timing was provided by the City of St Paul. The operational results are summarized in **Table 18.**

Table 18. Existing (2016) Traffic Operational Analysis

Intersection	Peak Hour	Intersection (Delay[1] - LOS)	Limiting Movement[2] (Delay[1] - LOS)	Mvmt	Maximum Queue[3] Avg (ft)	Max (ft)	Approach
Pennsylvania Ave at Rice St	AM	17 - B	33 - C	WBL	100	200	SB
Signalized Intersection	PM	20 - C	78 - E	SBL	150	325	SB
Sycamore St at Rice St	AM	5 - A	33 - C	EBL	50	125	WB/SB
Signalized Intersection	PM	8 - A	34 - C	EBT	75	200	NB
Atwater Ave at Rice St	AM	4 - A	32 - C	EBT	25	150	SB
Signalized Intersection	PM	7 - A	30 - C	WBT	75	175	NB
Wayzata St at Rice St	AM	2 - A	2 - A	NBT/SBT	25	150	SB
Signalized Intersection	PM	3 - A	7 - A	NBR	25	175	NB
Front St at Rice St	AM	6 - A	28 - C	EBL/T	50	125	EB/SB
Signalized Intersection	PM	7 - A	25 - C	EBL	100	175	EB
Lawson Ave at Rice St	AM	1 - A	15 - C	EBL	25	50	EB/NB
Stop Control	PM	1 - A	22 - C	WBT	25	50	NB/SB/EB/WB
Cook St S at Rice St	AM	0 - A	8 - A	WBL	25	50	WB
Stop Control	PM	1 - A	18 - C	WBL	25	50	NB/SB/EB/WB
Cook St N at Rice St	AM	1 - A	11 - B	EBT	25	75	EB
Stop Control	PM	0 - A	16 - C	WBL	25	50	SB/EB/WB
Jessamine Ave S at Rice St	AM	0 - A	12 - B	EBL	25	50	EB
Stop Control	PM	1 - A	17 - C	EBL	25	75	NB
Jessamine Ave N at Rice St	AM	0 - A	8 - A	WBL	25	50	WB
Stop Control	PM	1 - A	20 - C	WBL	25	100	SB
Geranium Ave at Rice St	AM	3 - A	60 - E	WBT	25	200	SB
Signalized Intersection	PM	4 - A	47 - D	WBT	50	200	NB
Maryland Ave at Rice St	AM	17 - B	33 - C	NBL	150	250	SB
Signalized Intersection	PM	26 - C	77 - E	SBL	250	425	NB
Cottage Ave at Rice St	AM	2 - A	14 - B	EBL	25	75	NB
Stop Control	PM	4 - A	19 - C	EBL	25	100	NB
Arlington Ave at Rice St	AM	11 - B	35 - D	WBL	100	225	EB
Signalized Intersection	PM	14 - B	38 - D	WBL	125	275	WB
Nebraska Ave at Rice St	AM	4 - A	41 - D	EBL	50	125	NB
Signalized Intersection	PM	4 - A	41 - D	WBT	50	125	NB
Montana Ave at Rice St	AM	1 - A	12 - B	EBL	25	50	WB
Stop Control	PM	1 - A	20 - C	WBL	25	75	EB
Hoyt Ave at Rice St	AM	1 - A	10 - B	EBL	25	75	EB
Stop Control	PM	4 - A	38 - E	WBT	50	200	NB
Wheelock Pkwy at Rice St	AM	8 - A	44 - D	EBT	75	175	SB
Signalized Intersection	PM	19 - B	42 - D	EBT/WBL	225	400	NB

1. Delay in seconds per vehicle
2. Movement with the highest delay
3. Approach with the longest queue

The queues highlighted in red extend beyond turn lanes and/or adjacent accesses. Since there are several driveway accesses along Rice St and the side streets that are close to the intersections, most intersections show queues which extend beyond driveway accesses.

AM Peak Hour

- All intersections overall operate with LOS A or B
- The westbound through movement at Geranium Ave and Rice St operates with LOS E.
- All other movements operate with LOS D or better

PM Peak Hour

- All intersections overall operate with LOS C or better
- The following movements operate with LOS E:
    - Pennsylvania Ave: Southbound left (due to the high volume and capacity need for northbound through and right)
    - Maryland Ave: Southbound left (due to the high volume and capacity need for northbound through and right)
    - Hoyt Ave: Westbound thru
- All other movements operate with LOS D or better

Detailed operational results are included in **Appendix B**.

D. Warrant Analysis

Traffic Control Signal Warrant Analysis

The MnMUTCD (chapter 4C) states that the investigation of the need for a traffic control signal shall include an analysis of the applicable factors contained in the following traffic signal warrants:

- 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 System
- Warrant 7: Crash Experience
- Warrant 8: Roadway Network
- Warrant 9: Intersection Near a Grade Crossing

A traffic control signal should not be installed unless one or more of the warrants can be met, however the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic signal. Furthermore, a traffic control signal should not be installed unless an engineering study indicates that the traffic control signal will improve the overall safety and operation of the intersection. Finally, the signal should not disrupt the progressive flow of traffic. The jurisdictional agencies also have requirements for signal justification beyond just the warrants based on traffic volume.

A warrant analysis was completed analyzing the existing signalized intersections with 2016 traffic volumes. 24-hour counts were completed with a previous study at the intersections of Rice St at Maryland Ave and Rice St at Arlington Ave. Roughly four hours of count data (6:30-8:45 AM & 3:30-5:30 PM) were available at the following intersections:

- Rice St at Pennsylvania Ave
- Rice St at Sycamore St
- Rice St at Atwater St
- Rice St at Wayzata Ave
- Rice St at Front Ave
- Rice St at Geranium Ave
- Rice St at Nebraska Ave
- Rice St at Wheelock Pkwy

13-hour counts were estimated at locations where only four hours of data was available by comparing the full day count at Rice St and Arlington Ave.

The analysis concluded that following signalized intersections meet warrants and are therefore justified:

- Rice St at Pennsylvania Ave
  - Meets warrants 1A, 1B, 2, and 3
- Rice St at Sycamore St
  - Meets warrants 1B and 2 (minor street right turners included)
- Rice St at Atwater St
  - Meets warrants 1B and 2 (assuming three lane roadway, minor street right turners included)
- Rice St at Front Ave
  - Meets warrants 1B and 2 (assuming three lane roadway)
- Rice St at Maryland Ave
  - Meets warrants 1A, 1B, 2, and 3
- Rice St at Arlington Ave
  - Meets warrants 1B, 2, and 3
- Rice St at Wheelock Pkwy
  - Meets warrants 1B and 2 (assuming three lane roadway, minor street right turners included)

The intersection of Rice St at Nebraska Ave meets warrants 1B, but only if a 60% volume threshold to maintain an existing signal and combined with other factors are applied while also assuming three lane roadway geometry and including minor street right turners. The MnDOT Traffic Engineering Manual states that existing signalized intersections meeting the 80% volume threshold for warrants 1A and 1B should be considered justified. If the intersection meets between 60% and 80% volume thresholds for warrants 1A and 1B the intersection is in a "gray area" and further analysis is needed to determine if the signal should remain. This gray area considers other traffic and safety factors such as proximity to a school. A new count of the intersection when school is in session and weather is warmer is recommended to determine if the signal should remain.

No warrants were found to be met at the intersections of Wayzata Ave at Rice St and Geranium Ave at Rice St. The existing signal at Wayzata Ave is for the pedestrian crossing, however, the 2016 count data shows at most 30 pedestrians crossing Rice St in one hour which is not enough to meet the warrant 4. The intersection has no side street volumes as Wayzata Ave is a one eastbound, so no volume warrants are met at the intersection (warrants 1, 2, and 3). Warrants 5 through 9 are not applicable at the intersection of Wayzata Ave and Rice St. At Geranium and Rice St no volume warrants were found to be met even with traffic diverted from Rose Ave. The diverted traffic was considered as Rice St at Rose Ave is proposed to be converted to a right-in/right-out intersection. The intersection of Geranium Ave at Rice St is located near a school, however, the school crossing warrant (warrant 5) was not found to be met. Warrants 6 through 9 are not applicable at the intersection of Wayzata Ave and Geranium Ave.

Signal warrants were also analyzed at the intersection of Lawson Ave and Rice St as a recreational center is planned for the northwest corner of this intersection, but no signal warrants were found to be met. New count data was collected in December 2021 at the intersections of Wayzata Ave, Geranium Ave, and Lawson Ave at Rice St. With the new count data no signal warrants were found to be met at any of the intersections. The detailed warrant analysis worksheets can be found in **Appendix C**.

Build Conditions Analysis

A. Traffic Forecasting

Traffic forecasting was completed in the previous Rice St Transportation Safety Study. The previous study indicated that traffic growth could occur as areas are redeveloped, due to changes in traffic patterns, or other regional system changes. The traffic forecasting was based on historic AADT, the State Aid project factor for Ramsey County (1.0), and the City of St Paul 2030 Comprehensive Plan. The sources led to a traffic growth rate of 0.6 percent per year to forecast 2037 volumes.

However, reevaluating historic trends show volumes staying the same or decreasing overtime. Analyzing the last 20 years of historic AADT data shows the following growth rates along Rice St:

- 0.15% per year near Pennsylvania Ave
- 0.15% per year near Arlington Ave
- -0.11% per year near Wheelock Pkwy

Or analyzing just the last 10 years of historic AADT data shows the following growth rates along Rice St:

- -1.21% per year near Pennsylvania Ave
- -0.20% per year near Arlington Ave
- 0.52% per year near Wheelock Pkwy

Additionally, turning movement count data that was collected in December 2021 shows much lower traffic volumes along Rice St than the 2016 traffic counts, although the 2021 counts were still low partially due to the COVID-19 Pandemic impacts. **Table 19** shows the peak hour volumes at Rice St and Geranium Ave in 2016 and 2021.

Table 19. Comparison of 2016 and 2021 Peak Hour Turning Movement Count

2016 Count	Rice Street Southbound			Geranium Ave Westbound			Rice Street Northbound			Geranium Ave Eastbound		
Peak Hour	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left
AM	13	572	0	2	2	2	1	301	11	5	0	4
PM	8	469	10	7	7	6	20	1023	15	7	2	8

2021 Count	Rice Street Southbound			Geranium Ave Westbound			Rice Street Northbound			Geranium Ave Eastbound		
Peak Hour	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left	Right	Thru	Left
AM	7	338	6	4	0	3	4	335	5	6	0	6
PM	20	428	7	7	5	4	10	571	8	7	1	12

The 2016 AADTs, forecasted 2037 AADTs from the previous project and, current (2021) AADTs along Rice St are shown in **Table 20** below.

Table 20. Existing and Forecasted AADTs

Location	Year	AADT
Rice St from Wheelock Pkwy to Arlington Ave	2016	17,000
	2037	19,300
	2021	13,500
Rice St from Arlington Ave to Maryland Ave	2016	16,200
	2037	18,400
	2021	13,900
Rice St from Maryland Ave to Pennsylvania Ave	2016	14,700
	2037	16,700
	2021	10,400

Based on the re-evaluated historic AADTs and most recent traffic counts along the corridor flat or no growth was assumed between the 2016 volumes and 2037. Therefore, the traffic analysis was completed analyzing only the 2016 volumes.

B. Preliminary Operational Analysis - SimTraffic

A three-lane roadway is proposed along Rice St throughout the project area. A preliminary analysis of traffic operations with the three-lane section was completed in Synchro/SimTraffic. This analysis indicated that northbound traffic queuing during the PM peak hour is anticipated to be over a quarter mile with 2016 volumes unless 15% of the northbound throughs divert to another parallel corridor. There are approximately 825 northbound through vehicles current at the intersection of Maryland Ave and Rice St so about 125 vehicles would be anticipated to re-route to a parallel route.

C. Detailed Operational Analysis - Vissim

A detailed operational analysis was completed in Vissim. The 2016 volumes were analyzed with the proposed three lane roadway throughout the project limits. The intersections of Wayzata St and Geranium Ave at Rice St were modeled as side street stop controlled intersections since the existing signals were not found to be justified. The signal timing was optimized and the entire corridor was assumed to be coordinated.

Metro Transit provided existing (2019) and future ridership data for the bus stops along the corridor. Average boardings/alightings and dwell times at each stop were provided. The 2019 and future year trends were found to be similar so only the future year data was analyzed. The future average weekday boardings and alightings are shown in **Table 21** below. The AM peak is from 6:00 – 9:00 AM and the PM peak is from 3:00 – 6:30 PM.

Table 21. Metro Transit Average Weekday Boardings and Alightings

Bus Stop	Northbound		Southbound	
	AM Total Boardings/Alightings	PM Total Boardings/Alightings	AM Total Boardings/Alightings	PM Total Boardings/Alightings
Pennsylvania Ave	7	19	7	15
Atwater St	17	8	25	21
Milford St/ Maintoba Ave	11	11	25	30
Litchfield St/Front Ave	18	24	54	58
Lawson Ave	7	13	27	20
Geranium Ave	11	7	35	23
Maryland Ave	8	28	23	29
Orange Ave	1	3	7	12
Ivy Ave	2	3	5	5
Cottage Ave	1	1	7	6
Arlington Ave	12	20	38	53
Nebraska Ave	1	3	21	28
Hoyt Ave	7	8	46	38
Wheelock Pkwy	4	5	10	19

Table 21 indicates that southbound is busier than northbound during both peaks. The busiest bus stop along Rice St in the project area is at Litchfield St/Front Ave followed by Arlington Ave and Hoyt Ave.

The future dwell times were listed as low or medium. Metro Transit defined low and medium dwell times as follows:

- Low dwell times range from 5-10 seconds
- Medium dwell times range from 10-20 seconds

The existing stops that were assumed to be eliminated include the stops at Hatch Ave and at Jessamine Ave/Magnolia Ave. This information was included in the detailed Vissim analysis. The AM and PM peak hour operations are shown in **Table 22**.

Table 22. Build Traffic Operational Analysis

Intersection	Peak Hour	Intersection (Delay[1] - LOS)	Limiting Movement[2] (Delay[1] - LOS)	Mvmt	Maximum Queue[3] Avg (ft)	Max (ft)	Approach
Pennsylvania Ave at Rice St	AM	32 - C	65 - E	NBL	225	1075	SB
Signalized Intersection	PM	64 - E	143 - F	EBL	175	925	SB
Sycamore St at Rice St	AM	14 - B	28 - C	WBT	50	450	SB
Signalized Intersection	PM	65 - E	104 - F	NBR	725	1625	NB
Atwater Ave at Rice St	AM	23 - C	31 - C	WBL/NBL	125	800	SB
Signalized Intersection	PM	36 - D	76 - E	EBL	300	725	NB
Wayzata St at Rice St	AM	2 - A	6 - A	SBL	25	225	SB
Stop Control	PM	28 - D	48 - E	NBR	325	900	NB
Front St at Rice St	AM	22 - C	31 - C	NBL	125	675	SB
Signalized Intersection	PM	51 - D	220 - F	EBL	325	800	EB
Lawson Ave at Rice St	AM	4 - A	35 - E	EBL	25	350	SB
Stop Control	PM	26 - D	150 - F	EBL	275	675	NB
Cook St S at Rice St	AM	2 - A	10 - B	WBR	25	250	NB
Stop Control	PM	14 - B	64 - F	WBR	175	400	NB
Cook St N at Rice St	AM	1 - A	20 - C	EBR	25	125	SB
Stop Control	PM	3 - A	43 - E	WBR	25	125	NB
Jessamine Ave S at Rice St	AM	1 - A	18 - C	EBL	25	50	EB
Stop Control	PM	12 - B	95 - F	EBL	125	450	NB
Jessamine Ave N at Rice St	AM	1 - A	27 - D	WBL	25	50	WB
Stop Control	PM	4 - A	72 - F	WBR	50	150	NB
Geranium Ave at Rice St	AM	3 - A	29 - D	EBL/WBT	25	400	SB
Stop Control	PM	16 - B	153 - F	EBL	150	400	NB
Maryland Ave at Rice St	AM	41 - D	66 - E	SBR	375	1600	SB
Signalized Intersection	PM	59 - E	125 - F	WBL	375	700	NB
Cottage Ave at Rice St	AM	5 - A	46 - E	EBT	25	325	NB
Stop Control	PM	31 - D	335 - F	EBL	375	1675	NB
Arlington Ave at Rice St	AM	20 - C	44 - D	EBL	75	625	SB
Signalized Intersection	PM	44 - D	150 - F	EBL	325	700	NB
Nebraska Ave at Rice St	AM	16 - B	76 - E	WBL	100	375	SB
Signalized Intersection	PM	15 - B	70 - E	EBL	125	700	NB
Montana Ave at Rice St	AM	6 - A	43 - E	EBR	25	350	SB
Stop Control	PM	5 - A	62 - F	WBL	25	300	NB
Hoyt Ave at Rice St	AM	5 - A	21 - C	EBR	25	550	SB
Stop Control	PM	8 - A	81 - F	WBR	25	425	SB
Wheelock Pkwy at Rice St	AM	18 - B	27 - C	EBL/WBT	75	525	SB
Signalized Intersection	PM	37 - D	129 - F	EBL	300	675	NB

1. Delay in seconds per vehicle
2. Movement with the highest delay
3. Approach with the longest queue

The queues highlighted in red extend beyond turn lanes and/or adjacent accesses. Similar to the existing condition, since there are several driveway accesses along Rice St and the side streets that are close to

the intersections, the majority of intersections show queues which extend beyond driveway accesses. Additionally, the queue lengths are only shown up to the length of the distance between intersections that were analyzed. Several queues extend beyond multiple intersections. A more thorough analysis on queue length is provided in a further section.

AM Peak Hour

- All intersections overall operate with LOS C or better except Maryland Ave at Rice St which operates with LOS D
- The following movements that operate with LOS E:
    - Northbound left at Pennsylvania Ave and Rice St
    - Eastbound left at Lawson Ave and Rice St
    - Southbound through and right at Maryland Ave and Rice St
    - Westbound left at Nebraska Ave and Rice St
    - Eastbound through and right at Montana Ave and Rice St
- All other movements operate with LOS D or better

PM Peak Hour

- The following intersections operate with LOS E overall:
    - Pennsylvania Ave at Rice St
    - Sycamore St at Rice St
    - Maryland Ave at Rice St
- All other intersections operate with LOS D or better
- All intersections have a failing limiting movement except
    - Atwater St at Rice St
    - Wayzata St at Rice St
    - Cook Ave N at Rice St
    - Nebraska Ave at Rice St

Detailed operational results are included in **Appendix D**.

Table 22 indicates that operations will remain acceptable during the AM peak hour, however, increased delay and worsening LOS is anticipated during the PM peak. With the acceptable service levels at all intersections except Pennsylvania Ave, Sycamore St, and Maryland Ave in the PM peak, the 3-lane section is considered to operate acceptably. The likelihood for traffic diversion primarily will be due to the impacts at Maryland Ave and the resulting long backup during the PM peak. The preliminary analysis completed in SimTraffic indicated that queues would be excessive unless 15% of the northbound through vehicles diverted to other parallel north-south roadways. An analysis was also completed in Vissim during the PM peak hour with 15% less vehicles along northbound Rice St. The operations are summarized in **Table 23** with three different cycle lengths analyzed.

Table 23. Build Traffic Operational Analysis – PM Peak Sensitivity Analysis

Intersection	Cycle Length	Intersection (Delay[1] - LOS)	Limiting Movement[2] (Delay[1] - LOS)	Mvmt	Maximum Queue[3] Avg (ft)	Max (ft)	Approach
Pennsylvania Ave at Rice St *Signalized Intersection*	140	46 - D	77 - E	EBL	175	925	SB
	120	46 - D	73- E	EBL	150	850	SB
	100	52 - D	104 - F	EBL	150	900	SB
Sycamore St at Rice St *Signalized Intersection*	140	27 - C	66 - E	EBL	200	1075	NB
	120	39 - D	60 - E	NBT	375	1325	NB
	100	63 - E	108 - F	NBT/R	650	1550	NB
Atwater Ave at Rice St *Signalized Intersection*	140	25 - C	70 - E	EBL	150	675	NB
	120	29 - C	47 - D	WBL	200	700	NB
	100	37 - D	53 - D	NBR	275	700	NB
Wayzata St at Rice St *Stop Control*	140	12 - B	21 - C	SBL	125	750	NB
	120	21 - C	45 - E	NBR	225	900	NB
	100	29 - D	59 - F	NBR	300	900	NB
Front St at Rice St *Signalized Intersection*	140	38 - D	155 - F	EBL	200	550	EB
	120	30 - C	71 - E	EBL	175	500	SB
	100	34 - C	61 - E	EBL	50	575	SB
Lawson Ave at Rice St *Stop Control*	140	19 - C	137 - F	EBL	175	675	NB
	120	22 - C	144 - F	EBL	225	675	NB
	100	26 - D	100 - F	EBL	250	675	NB
Cook St S at Rice St *Stop Control*	140	11 - B	50 - F	WBR	125	400	NB
	120	13 - B	62 - F	WBR	150	400	NB
	100	15 - C	56 - F	WBR	175	400	NB
Cook St N at Rice St *Stop Control*	140	3 - A	37 - E	WBR	25	125	NB
	120	3 - A	43 - E	WBR	25	150	NB
	100	4 - A	40 - E	WBR	25	125	NB
Jessamine Ave S at Rice St *Stop Control*	140	9 - A	84 - F	EBL	75	450	NB
	120	13 - B	90 - F	EBL	125	450	NB
	100	16 - C	69 - F	EBL	150	450	NB
Jessamine Ave N at Rice St *Stop Control*	140	3 - A	70 - F	WBR	25	150	NB
	120	4 - A	68 - F	WBR	25	150	NB
	100	5 - A	70 - F	WBR	50	150	NB
Geranium Ave at Rice St *Stop Control*	140	14 - B	161 - F	EBL	125	400	NB
	120	17 - B	134 - F	EBL	150	400	NB
	100	20 - C	135 - F	EBL	175	400	NB
Maryland Ave at Rice St *Signalized Intersection*	140	58 - E	122 - F	WBL	75	725	SB
	120	52 - D	87 - F	EBL	100	800	SB
	100	50 - D	63 - E	NBT	125	850	SB
Cottage Ave at Rice St *Stop Control*	140	12 - B	127 - F	EBL	100	925	NB
	120	14 - B	129 - F	EBL	125	1075	NB
	100	10 - B	85 - F	EBL	75	875	NB
Arlington Ave at Rice St *Signalized Intersection*	140	39 - D	123 - F	EBL	225	700	NB
	120	37 - D	96 - F	EBL	250	700	NB
	100	35 - D	97 - F	EBL	200	700	NB
Nebraska Ave at Rice St *Signalized Intersection*	140	12 - B	65 - E	WBL	75	625	NB
	120	14 - B	49 - D	EBL/WBL	75	650	NB
	100	14 - B	43 - D	WBL	75	575	NB
Montana Ave at Rice St *Stop Control*	140	3 - A	66 - F	WBL	25	225	SB
	120	3 - A	49 - E	EBL/WBL	25	275	NB/SB
	100	4 - A	63 - F	EBL	25	250	NB/SB
Hoyt Ave at Rice St *Stop Control*	140	4 - A	34 - D	WBR	25	400	SB
	120	4 - A	35 - E	WBR	25	400	SB
	100	5 - A	40 - E	WBR	50	300	NB
Wheelock Pkwy at Rice St *Signalized Intersection*	140	26 - C	94 - F	EBT	125	650	NB
	120	27 - C	73 - E	EBL	175	700	NB
	100	26 - C	48 - D	EBL	175	675	NB

1. Delay in seconds per vehicle
2. Movement with the highest delay
3. Approach with the longest queue

Table 23 shows operations improve with 15% less northbound through vehicles during the PM peak. With 120 second cycle length all intersections operate with LOS D or better.

Comparing the limiting movement delay between the three options the following intersections have movements with side street delay of more than two minutes:

140 second cycle:

- Front Ave at Rice St
- Lawson Ave at Rice St
- Geranium Ave at Rice St
- Maryland Ave at Rice St
- Cottage Ave at Rice St
- Arlington Ave at Rice St

120 second cycle:

- Lawson Ave at Rice St
- Geranium Ave at Rice St
- Cottage Ave at Rice St

100 second cycle:

- Geranium Ave at Rice St

This shows how as the cycle length decreases, side street delay decreases. However, as side street delay decreases, traffic queues along Rice St increase. There will need to be a balance between delay and queues to determine the appropriate traffic signal timing for the corridor.

1. Traffic Queuing

A detailed review of traffic queues with each scenario is shown below. Northbound traffic is the dominant movement during the PM peak so northbound queues are shown in **Table 24**.

Table 24. Build PM Peak Northbound Traffic Queues

Option	Location	Average Queue (ft)	Maximum Queue (ft)
100% Volumes (140 Cycle)	NB Rice St at Wheelock Pkwy	475	1,750
15% Reduction (140 Cycle)		125	1,025
15% Reduction (120 Cycle)		175	1,150
15% Reduction (100 Cycle)		225	1,250
100% Volumes (140 Cycle)	NB Rice St at Maryland Ave	1,450	2,825
15% Reduction (140 Cycle)		1,075	2,750
15% Reduction (120 Cycle)		1,325	2,700
15% Reduction (100 Cycle)		1,525	2,775
100% Volumes (140 Cycle)	NB Rice St at Front Ave	900	2,150
15% Reduction (140 Cycle)		300	1,675
15% Reduction (120 Cycle)		550	1,950
15% Reduction (100 Cycle)		800	2,100
100% Volumes (140 Cycle)	NB Rice St at Sycamore St	700	1,825
15% Reduction (140 Cycle)		150	1,075
15% Reduction (120 Cycle)		350	1,450
15% Reduction (100 Cycle)		650	1,775
100% Volumes (140 Cycle)	NB Rice St at Pennsylvania Ave	725	1,875
15% Reduction (140 Cycle)		200	875
15% Reduction (120 Cycle)		250	875
15% Reduction (100 Cycle)		400	1,275

Table 24 shows how traffic queues are longest with the full 2016 PM peak hour volumes. With the reduction in northbound through traffic and keeping the 140 second cycle length the maximum queues are nearly cut in half at Wheelock Pkwy, Sycamore St, and Pennsylvania Ave. As the cycle length is reduced the average and maximum queues increase. The traffic queues along northbound Rice St are longest at Maryland Ave with the average queue approximately a quarter mile in length and the maximum queue about a half a mile in length with each scenario analyzed. Since this maximum queue occurs only one time a day, it is considered to be acceptable.

Southbound traffic is the dominant movement during the AM peak hour so southbound queues are shown in **Table 25** below. No volume reduction or change in cycle length was analyzed with the AM peak hour so only one option is shown.

Table 25. Build AM Peak Southbound Traffic Queues

Location	Average Queue (ft)	Maximum Queue (ft)
SB Rice St at Wheelock Pkwy	50	525
SB Rice St at Maryland Ave	325	1,625
SB Rice St at Front Ave	100	825
SB Rice St at Sycamore St	50	500
SB Rice St at Pennsylvania Ave	225	1,075

Table 25 shows how traffic queues along southbound Rice St are longest at Maryland Ave with the maximum queue about a third of a mile in length. The average queue is only 325 ft (about one block long).

2. Travel Speed

Average travel speed of vehicles along Rice St was also compared with each scenario to the existing condition. The average travel speed for cars/trucks and buses are shown in **Table 26** below. The travel times were calculated based on travel time measurements from the Vissim model for both the existing and build scenarios. The existing condition model assumed vehicles could not use the outside travel lane along northbound Rice St during the AM peak and southbound Rice St during the PM peak as parking is allowed at those times.

Table 26. Average Travel Speed

Peak Hour	Direction	Scenario	Average Speed (MPH) of Cars/Trucks	Average Speed (MPH) of Buses
AM	Southbound	Existing Condition	24	16
		Build	16	14
	Northbound	Existing Condition	25	17
		Build	20	16
PM	Southbound	Existing Condition	11	10
		Build - 100% Volumes	19	15
		Build - 15% Reduction (140 Cycle)	19	15
		Build - 15% Reduction (120 Cycle)	19	15
		Build - 15% Reduction (100 Cycle)	18	15
	Northbound	Existing Condition	17	13
		Build - 100% Volumes	10	9
		Build - 15% Reduction (140 Cycle)	14	13
		Build - 15% Reduction (120 Cycle)	12	11
		Build - 15% Reduction (100 Cycle)	10	9

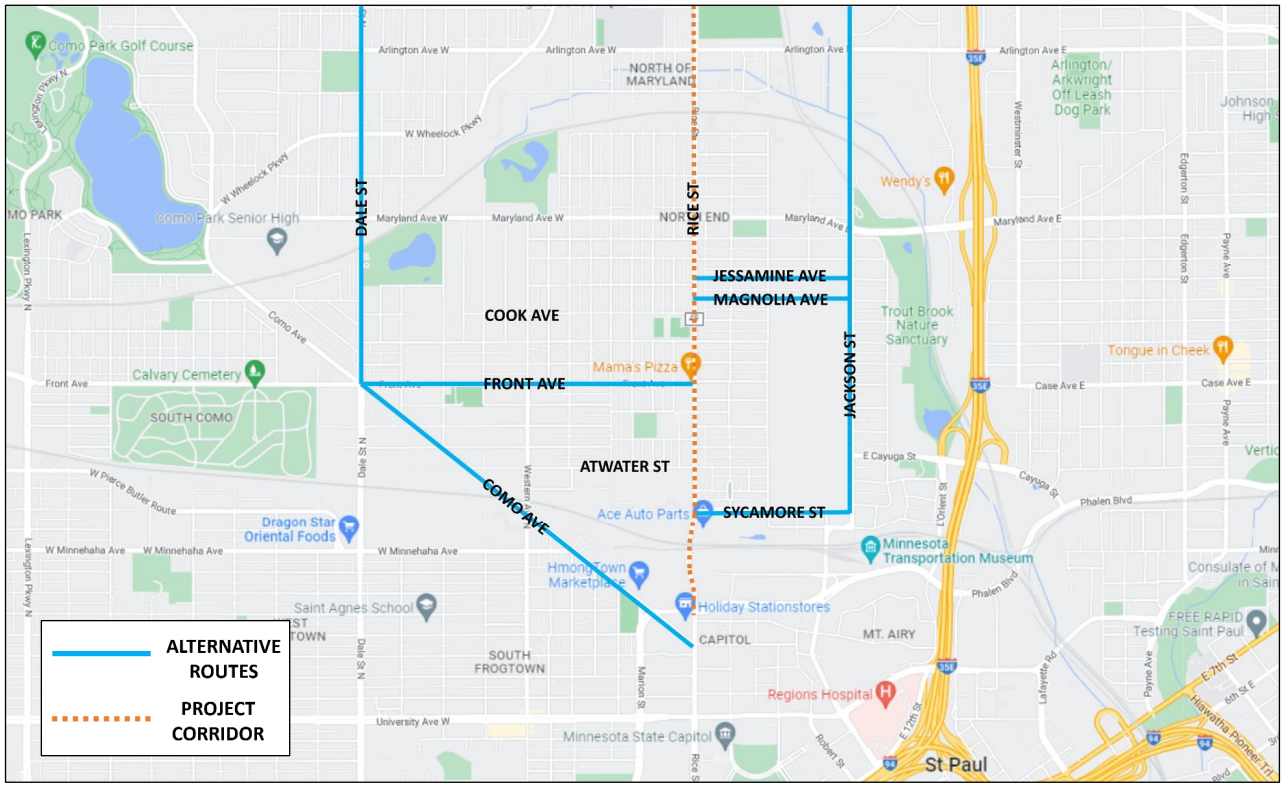
Table 26 shows how during the AM peak hour the average speed of cars and trucks is 5-8 MPH lower than the existing condition along Rice St, but the average speed of buses is only 1-2 MPH lower than the existing condition. During the PM peak hour, southbound average speeds are 5-8 MPH higher for both cars/trucks and buses. This shows an operational benefit with the three-lane section as with a left turn lane through traffic no longer gets stuck behind left turning traffic. Northbound average speeds during the PM peak hour are 3-7 MPH lower than the existing condition for cars/trucks and 0-4 MPH lower for buses.

With only a single through lane under the build scenario the buses and cars/trucks are traveling along the corridor together and are forced to stop behind one another except at the few bus pullouts along the corridor. The reason the average speeds are different is because the buses need to stop along the corridor to let passengers on and off and while it is true that when the buses stop the vehicles behind them must also stop there are far more vehicles than buses. Therefore, most vehicles do not get stuck behind a stopped bus making the average speed faster for vehicles/trucks than it is for buses.

3. Other Considerations

With the Maryland Ave signal along northbound Rice St being the main bottleneck for traffic during the PM peak hour if traffic were to divert to other routes it would likely be near that intersection. The average queue for all scenarios was between roughly 1,000-1,500 ft. Jessamine Ave is roughly 1,000 ft south of Maryland Ave and Cook Ave is roughly 1,500 ft away. The maximum queue is roughly 2,700 ft which is near Front Ave. Based on this traffic destined for locations to the northwest of Rice St that decides to divert would likely take Front Ave over to Dale St to avoid Rice St. Traffic destined for locations to the northeast would likely use Magnolia Ave or Jessamine Ave to get to Jackson St. Traffic might also divert as soon as Sycamore St to get to Jackson St or traffic could avoid the entire project corridor taking Como Ave instead. These routes are highlighted on **Figure 19** below.

Figure 19 – Potential Routes for Traffic that Diverts to other North/South Roadways



To direct drivers around congestion, dynamic message signs are recommended at the following locations:

- Rice St at Pennsylvania Ave
- Rice St at Sycamore St
- Rice St at Front Ave
- Rice St at Arlington Ave
- Rice St at Wheelock Pkwy

D. Build Safety Improvements

The existing corridor operates outside the normal range compared to similar corridors statewide. The corridor crash rate was found to be 11.18 crashes per million vehicle miles where the average crash rate is 3.8 crashes per million vehicle miles. This shows how the existing corridor is experiencing a crash rate that is nearly three times higher than the statewide average. The most common crash types along the corridor were rear end, right angle, sideswipe same direction, and left turn crashes making up 76% of

the crashes. These crashes likely occur due to a lack of turn lanes and lack of left turn phasing at the signalized intersections.

With a center left turn lane, the proposed three lane is anticipated to reduce crashes along Rice St. Clearinghouse crash modification factors were analyzed to determine the anticipated crash reduction with the build alternative. Crash modification factor identification (CMF ID) 2841 indicates that there is a 47% crash reduction converting a four-lane undivided roadway to a three-lane roadway with center turn lane, sometimes referred to as a "road diet". CMF ID 2841 is based on the data published in the "Comparison of empirical Bayes and full Bayes approaches for before-after roadway evaluations" study report by Persuad et. al in 2010. The CMF is included in **Appendix E**. The existing, reduced, and anticipated crash reduction is shown in **Table 27**.

Table 27. Crash Summary

Crash Severity	Existing Crashes (2014-2018)	Five Year Crash Reduction	Anticipated Crashes (Build Condition)
Fatal	0	0	0
Serious Injury	10	5	5
Minor Injury	41	19	22
Possible Injury	73	34	39
Property Damage Only	505	237	268
Total	**629**	**295**	**334**

Table 27 shows how the three-lane roadway is anticipated to reduce about 300 crashes over five years (60 crashes a year). The existing crash rate is 11.18 crashes per million vehicle miles. With the reduction in crashes anticipated with the three-lane corridor the crash rate would be anticipated to be lowered to 5.94 crashes per million vehicle miles, but may be significantly lower given the many other pedestrian and safety improvements on the corridor that are being planned beyond just the change in roadway section.

In addition to a crash reduction, implementing a four to three lane conversion on Rice St would be anticipated to improve safety by reducing the number of through lanes, decreasing crossing distances, simplifying left turns from the side streets, smoothing traffic flow, and calming traffic. Once the project is complete, a corridor speed study should be completed by MnDOT to determine an appropriate roadway speed limit.

Additionally, medians are also recommended at several locations along Rice St to improve further improve safety, provide a traffic calming effect, provide for improved pedestrian crossings, and control access.

Conclusion

Rice St was analyzed between Wheelock Parkway and Pennsylvania Avenue to create and advance a community supported vision for the Rice St corridor that improves safety and other traffic concerns. The recommended alternative for the corridor is a three-lane section. The recommendation includes a proposed trail on the west side of the corridor, sidewalk on the east side of the corridor, and boulevard space for signing, lighting, natural features, and snow storage throughout. Medians are also recommended at locations to improve further improve safety, provide a traffic calming effect, provide for improved pedestrian crossings, and control access.

Crash Analysis

Crash data from 2014-2018 was analyzed and indicates that several intersections have a safety concern. These include:

- Hoyt Ave at Rice St
- Arlington Ave at Rice St
- Cottage Ave at Rice St
- Ivy Ave at Rice St
- Maryland Ave at Rice St
- Front Ave at Rice St
- Manitoba Ave at Rice St
- Winnipeg Ave at Rice St
- Pennsylvania Ave at Rice St

The segment crash rate in the project area is nearly three times higher than the statewide average. There were 30 pedestrian crashes and 17 bicycle crashes along the corridor in the last five years.

Parking

On street parking is currently allowed between Hoyt Ave and Atwater Ave in the outside travel lane except along southbound Rice St from 7:00-8:00am and along northbound Rice St from 4:00-6:00pm. An existing parking inventory was completed along Rice St in November 2019 indicated that on street parking utilization is minimal. With the reconstruction of Rice St, most on street parking would be removed, however, several potential areas for future on-street parking were identified.

Warrant Analysis

A warrant analysis was completed and indicated that the existing signals at Wayzata Ave at Rice St and Geranium Ave at Rice St are not currently justified. Additional data should be collected at Rice St and Nebraska Ave to determine if the existing signal should be maintained. All other existing signals along the corridor were found to be justified.

Pedestrian Crossing Considerations

Pedestrian crossings will be marked at all signalized intersections. The pedestrian volume analysis indicates that the unsignalized crossing at Wayzata Ave and Rice St is recommended to be marked. Medians are recommended at the intersections of Hoyt Ave, Ivy Ave, Cottage Ave, and all T-intersections along the corridor.

Build Traffic Operations

The build operational analysis indicates that operations will remain acceptable during the AM peak hour with the proposed three-lane section, however, increased delay and queuing is anticipated during the PM peak hour. This increase in delay and queuing during the PM peak hour was considered acceptable as safety considerations and improved pedestrian and bicycle facilities are the reasoning for the four to three-lane conversion. Off-peak hours are anticipated to operate with acceptable operations. A three-lane roadway would be expected to have enough capacity to handle the anticipated traffic volumes on Rice St now and in the future, with capacity to handle traffic fluctuations during non-peak hours.

Build Safety Improvements

Implementing a four to three lane conversion on Rice St would be anticipated to increase the safety of the corridor by providing a dedicated left turn lane, reducing the number of through lanes, decreasing crossing distances, and providing more space for pedestrians and bikers. There is anticipated to be a 47% crash reduction by converting the four-lane undivided roadway to a three lane roadway with center turn lane. Other improvements such as the medians may result in further safety improvement as they provide a traffic calming effect, an improved pedestrian crossing movement, and controlled access.

Appendix A: Crash Worksheets

Intersection Safety Screening

Intersection: Rice St at Wheelock Pkwy

Crash Data, 2011-2015.

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	1
Possible Injury	2
Property Damage	31
Total Crashes	34

Intersection Characteristics	
Entering Volume	18,500
Traffic Control	Signals
Environment	Urban
Speed Limit	35 mph

Annual crash cost = $114,320

Statewide Comparison

Signals: high volume, low speed

Total Crash Rate	
Observed	1.01
Statewide Average	0.70
Critical Rate	1.08
Critical Index	**0.94**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.76
Critical Rate	4.17
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 1.01 per MEV; this is 6% below the critical rate. Based on similar statewide intersections, an additional 3 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Iowa Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	1
Possible Injury	0
Property Damage	5
Total Crashes	6

Intersection Characteristics	
Entering Volume	15,100
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	35 mph

Annual crash cost = $41,600

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.22
Statewide Average	0.18
Critical Rate	0.41
Critical Index	**0.54**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.53
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.22 per MEV; this is 46% below the critical rate. Based on similar statewide intersections, an additional 6 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Hoyt Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	2
Non-incapacitating Injury	2
Possible Injury	2
Property Damage	12
Total Crashes	18

Intersection Characteristics	
Entering Volume	15,100
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	35 mph

Annual crash cost = $347,440

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.65
Statewide Average	0.18
Critical Rate	0.41
Critical Index	**1.59**

Fatal & Serious Injury Crash Rate	
Observed	7.25
Statewide Average	0.33
Critical Rate	3.53
Critical Index	**2.05**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.65 per MEV; this is 1.6 times the critical rate. If crashes were reduced by 6 over five years, this intersection would perform within normal range.

The observed fatal and serious injury crash rate for this period is 7.25 per 100 MEV; this is 2.1 times the critical rate.

Intersection Safety Screening

Intersection: Rice St at Montana Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	2
Property Damage	3
Total Crashes	5

Intersection Characteristics	
Entering Volume	15,100
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	35 mph

Annual crash cost = $37,760

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.18
Statewide Average	0.18
Critical Rate	0.41
Critical Index	**0.44**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.53
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.18 per MEV; this is 56% below the critical rate. Based on similar statewide intersections, an additional 7 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Nebraska Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	1
Possible Injury	3
Property Damage	17
Total Crashes	21

Intersection Characteristics	
Entering Volume	15,100
Traffic Control	Signals
Environment	Urban
Speed Limit	35 mph

Annual crash cost = $109,640

Statewide Comparison

Signals: high volume, low speed

Total Crash Rate	
Observed	0.76
Statewide Average	0.70
Critical Rate	1.13
Critical Index	**0.67**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.76
Critical Rate	4.71
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.76 per MEV; this is 33% below the critical rate. Based on similar statewide intersections, an additional 11 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Arlington Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	1
Non-incapacitating Injury	4
Possible Injury	7
Property Damage	57
Total Crashes	69

Intersection Characteristics	
Entering Volume	20,875
Traffic Control	Signals
Environment	Urban
Speed Limit	35 mph

Annual crash cost = $452,840

Statewide Comparison

Signals: high volume, low speed

Total Crash Rate	
Observed	1.81
Statewide Average	0.70
Critical Rate	1.06
Critical Index	**1.71**

Fatal & Serious Injury Crash Rate	
Observed	2.62
Statewide Average	0.76
Critical Rate	3.89
Critical Index	**0.67**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 1.81 per MEV; this is 1.7 times the critical rate. If crashes were reduced by 28 over five years, this intersection would perform within normal range.

The observed fatal and serious injury crash rate for this period is 2.62 per 100 MEV; this is 33% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Cottage Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	1
Possible Injury	2
Property Damage	15
Total Crashes	18

Intersection Characteristics	
Entering Volume	15,400
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	35 mph

Annual crash cost = $90,000

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.64
Statewide Average	0.18
Critical Rate	0.41
Critical Index	**1.56**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.48
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.64 per MEV; this is 1.6 times the critical rate. If crashes were reduced by 6 over five years, this intersection would perform within normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Ivy Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	1
Possible Injury	4
Property Damage	17
Total Crashes	22

Intersection Characteristics	
Entering Volume	15,400
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $126,240

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.78
Statewide Average	0.18
Critical Rate	0.41
Critical Index	**1.90**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.48
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.78 per MEV; this is 1.9 times the critical rate. If crashes were reduced by 10 over five years, this intersection would perform within normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Hyacinth Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	0
Property Damage	8
Total Crashes	8

Intersection Characteristics	
Entering Volume	15,400
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $12,160

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.28
Statewide Average	0.18
Critical Rate	0.41
Critical Index	**0.68**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.48
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.28 per MEV; this is 32% below the critical rate. Based on similar statewide intersections, an additional 4 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Orange Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	3
Property Damage	5
Total Crashes	8

Intersection Characteristics	
Entering Volume	15,400
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $57,400

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.28
Statewide Average	0.18
Critical Rate	0.41
Critical Index	**0.68**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.48
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.28 per MEV; this is 32% below the critical rate. Based on similar statewide intersections, an additional 4 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Hawthorne Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	1
Possible Injury	0
Property Damage	6
Total Crashes	7

Intersection Characteristics	
Entering Volume	15,400
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $43,120

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.25
Statewide Average	0.18
Critical Rate	0.41
Critical Index	**0.61**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.48
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.25 per MEV; this is 39% below the critical rate. Based on similar statewide intersections, an additional 5 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Maryland Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	3
Non-incapacitating Injury	10
Possible Injury	11
Property Damage	81
Total Crashes	105

Intersection Characteristics	
Entering Volume	27,900
Traffic Control	Signals
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $987,720

Statewide Comparison

Signals: high volume, low speed

Total Crash Rate	
Observed	2.06
Statewide Average	0.70
Critical Rate	1.01
Critical Index	**2.04**

Fatal & Serious Injury Crash Rate	
Observed	5.89
Statewide Average	0.76
Critical Rate	3.32
Critical Index	**1.77**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 2.06 per MEV; this is 2.0 times the critical rate. If crashes were reduced by 53 over five years, this intersection would perform within normal range.

The observed fatal and serious injury crash rate for this period is 5.89 per 100 MEV; this is 1.8 times the critical rate.

Intersection Safety Screening

Intersection: Rice St at Rose Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	1
Property Damage	4
Total Crashes	5

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $22,680

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.20
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**0.48**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.20 per MEV; this is 52% below the critical rate. Based on similar statewide intersections, an additional 6 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Geranium Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	3
Property Damage	15
Total Crashes	18

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Signals
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $72,600

Statewide Comparison

Signals: low volume, low speed

Total Crash Rate	
Observed	0.70
Statewide Average	0.52
Critical Rate	0.90
Critical Index	**0.78**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.42
Critical Rate	4.03
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.70 per MEV; this is 22% below the critical rate. Based on similar statewide intersections, an additional 6 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Jessamine Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	0
Property Damage	8
Total Crashes	8

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $12,160

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.31
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**0.74**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.31 per MEV; this is 26% below the critical rate. Based on similar statewide intersections, an additional 3 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Trunk Highway Section Summary

Section: Rice Street from Wheelock Pkwy to Pennslyvania Ave

Crash Data, 2014-2018. Includes crashes at junctions

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	10
Non-incapacitating Injury	41
Possible Injury	73
Property Damage	505
Total Crashes	629

Section Characteristics	
Length	2.000 miles
Volume (ADT)	15,400
Environment	Urban
Median Type	Undivided / No median
Number of Lanes	4

Annual crash cost per mile = $2,256,700

Statewide Comparison *Urban 4-lane Undivided*

Total Crash Rate	
Observed	11.18
Statewide Average	3.80
Critical Rate	4.48
Critical Index	**2.50**

Fatal & Serious Injury Crash Rate	
Observed	17.78
Statewide Average	3.37
Critical Rate	7.40
Critical Index	**2.40**

Intersection Safety Screening

Intersection: Rice St at Magnolia Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	3
Property Damage	7
Total Crashes	10

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $60,440

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.39
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**0.93**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.39 per MEV; this is 7% below the critical rate. Based on similar statewide intersections, an additional 1 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Cook Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	2
Property Damage	6
Total Crashes	8

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $42,320

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.31
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**0.74**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.31 per MEV; this is 26% below the critical rate. Based on similar statewide intersections, an additional 3 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Lawson Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	1
Possible Injury	0
Property Damage	3
Total Crashes	4

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $38,560

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.16
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**0.38**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.16 per MEV; this is 62% below the critical rate. Based on similar statewide intersections, an additional 7 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Hatch Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	1
Possible Injury	4
Property Damage	4
Total Crashes	9

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $106,480

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.35
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**0.83**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.35 per MEV; this is 17% below the critical rate. Based on similar statewide intersections, an additional 2 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Front Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	1
Possible Injury	6
Property Damage	30
Total Crashes	37

Intersection Characteristics	
Entering Volume	15,600
Traffic Control	Signals
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $179,200

Statewide Comparison

Signals: low volume, low speed

Total Crash Rate	
Observed	1.30
Statewide Average	0.52
Critical Rate	0.88
Critical Index	**1.48**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.42
Critical Rate	3.74
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 1.30 per MEV; this is 1.5 times the critical rate. If crashes were reduced by 11 over five years, this intersection would perform within normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Litchfield St

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	0
Property Damage	4
Total Crashes	4

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $6,080

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.16
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**0.38**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.16 per MEV; this is 62% below the critical rate. Based on similar statewide intersections, an additional 7 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Wayzata St

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	1
Non-incapacitating Injury	0
Possible Injury	0
Property Damage	1
Total Crashes	2

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Signals
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $115,520

Statewide Comparison

Signals: low volume, low speed

Total Crash Rate	
Observed	0.08
Statewide Average	0.52
Critical Rate	0.90
Critical Index	**0.09**

Fatal & Serious Injury Crash Rate	
Observed	3.91
Statewide Average	0.42
Critical Rate	4.03
Critical Index	**0.97**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.08 per MEV; this is 91% below the critical rate. Based on similar statewide intersections, an additional 22 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 3.91 per 100 MEV; this is 3% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Manitoba Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	4
Possible Injury	1
Property Damage	17
Total Crashes	22

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $178,440

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.86
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**2.05**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.86 per MEV; this is 2.1 times the critical rate. If crashes were reduced by 11 over five years, this intersection would perform within normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Milford Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	1
Property Damage	4
Total Crashes	5

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $22,680

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.20
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**0.48**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.20 per MEV; this is 52% below the critical rate. Based on similar statewide intersections, an additional 6 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Winnipeg Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	2
Possible Injury	2
Property Damage	8
Total Crashes	12

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $113,360

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.47
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**1.12**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.47 per MEV; this is 1.1 times the critical rate. If crashes were reduced by 1 over five years, this intersection would perform within normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Atwater St

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	1
Non-incapacitating Injury	0
Possible Injury	1
Property Damage	18
Total Crashes	20

Intersection Characteristics	
Entering Volume	15,600
Traffic Control	Signals
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $157,960

Statewide Comparison

Signals: low volume, low speed

Total Crash Rate	
Observed	0.70
Statewide Average	0.52
Critical Rate	0.88
Critical Index	**0.80**

Fatal & Serious Injury Crash Rate	
Observed	3.51
Statewide Average	0.42
Critical Rate	3.74
Critical Index	**0.94**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.70 per MEV; this is 20% below the critical rate. Based on similar statewide intersections, an additional 6 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 3.51 per 100 MEV; this is 6% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Lyton Pl

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	0
Possible Injury	1
Property Damage	1
Total Crashes	2

Intersection Characteristics	
Entering Volume	14,000
Traffic Control	Thru / stop
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $18,120

Statewide Comparison *Urban Thru / Stop*

Total Crash Rate	
Observed	0.08
Statewide Average	0.18
Critical Rate	0.42
Critical Index	**0.19**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.33
Critical Rate	3.73
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.08 per MEV; this is 81% below the critical rate. Based on similar statewide intersections, an additional 9 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Sycamore St

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	1
Non-incapacitating Injury	2
Possible Injury	4
Property Damage	16
Total Crashes	23

Intersection Characteristics	
Entering Volume	17,300
Traffic Control	Signals
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $272,720

Statewide Comparison

Signals: low volume, low speed

Total Crash Rate	
Observed	0.73
Statewide Average	0.52
Critical Rate	0.86
Critical Index	**0.85**

Fatal & Serious Injury Crash Rate	
Observed	3.17
Statewide Average	0.42
Critical Rate	3.49
Critical Index	**0.91**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 0.73 per MEV; this is 15% below the critical rate. Based on similar statewide intersections, an additional 5 crashes over the five years would indicate this intersection operaters outside the normal range.

The observed fatal and serious injury crash rate for this period is 3.17 per 100 MEV; this is 9% below the critical rate. The intersection operates within the normal range.

Intersection Safety Screening

Intersection: Rice St at Pennsylvania Ave

Crash Data, 2014-2018

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Non-incapacitating Injury	4
Possible Injury	3
Property Damage	60
Total Crashes	67

Intersection Characteristics	
Entering Volume	29,500
Traffic Control	Signals
Environment	Urban
Speed Limit	30 mph

Annual crash cost = $277,000

Statewide Comparison

Signals: high volume, low speed

Total Crash Rate	
Observed	1.24
Statewide Average	0.70
Critical Rate	1.00
Critical Index	**1.24**

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.76
Critical Rate	3.22
Critical Index	**0.00**

The observed crash rate is the number of crashes per million entering vehicles (MEV). The critical rate is a statistical comparison based on similar intersections statewide. An observed crash rate greater than the critical rate indicates that the intersection operates outside the expected, normal range. The critical index reports the magnitude of this difference.

The observed total crash rate for this period is 1.24 per MEV; this is 1.2 times the critical rate. If crashes were reduced by 13 over five years, this intersection would perform within normal range.

The observed fatal and serious injury crash rate for this period is 0.00 per 100 MEV; this is 100% below the critical rate. The intersection operates within the normal range.

Appendix B: Detailed Operational Results (Existing Condition)

Project: Rice Street Visioning Study
Scenario: Existing Conditions (Syncrho/SimTraffic)

		Existing AM Peak Hour																		
		Traffic Volumes (veh)				Traffic Delay (sec/veh)					Traffic Queuing (feet)									
		Demand Volumes				Movement (Delay - LOS)			Approach	Intersection	Left Turn			Through			Right Turn		
Intersection	Approach	L	T	R	Total	L	T	R	(Delay - LOS)	(Delay - LOS)	Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Pennsylvania Ave at Rice St *Signalized Intersection*	EB	88	306	9	403	27 - C	17 - B	11 - B	20 - C	17 - B	125	75	125	175	75	125	-	75	125
	WB	68	350	37	455	33 - C	21 - C	13 - B	23 - C		200	50	150	225	100	200	-	100	200
	NB	9	196	75	280	14 - B	10 - B	5 - A	9 - A		-	50	75	85	50	100	-	50	100
	SB	60	432	54	546	18 - B	14 - B	10 - B	15 - B		-	100	200	160	100	200	-	100	200
Sycamore St at Rice St *Signalized Intersection*	EB	6	2	6	14	33 - C	13 - B	5 - A	16 - B	5 - A	-	25	50	240	25	50	-	25	50
	WB	51	7	27	85	30 - C	22 - C	5 - A	22 - C		-	50	125	100	50	125	-	25	75
	NB	7	280	35	322	7 - A	4 - A	3 - A	4 - A		-	25	100	60	25	100	-	25	100
	SB	38	548	6	592	7 - A	3 - A	2 - A	4 - A		-	50	125	250	50	125	-	50	125
Atwater St at Rice St *Signalized Intersection*	EB	17	7	60	84	31 - C	32 - C	6 - A	13 - B	4 - A	-	25	75	210	25	75	-	50	75
	WB	7	9	2	18	32 - C	27 - C	6 - A	28 - C		-	25	75	50	25	75	-	25	25
	NB	27	295	6	328	9 - A	2 - A	2 - A	3 - A		-	25	100	250	25	100	-	25	100
	SB	4	525	24	553	3 - A	3 - A	2 - A	3 - A		-	25	125	50	25	150	-	25	150
Wayzata St at Rice St *Signalized Intersection*	NB	-	294	10	304	-	2 - A	1 - A	2 - A	2 - A	-	-	-	60	25	75	-	25	75
	SB	-	553	-	553	-	2 - A	-	2 - A		-	25	125	25	25	150	-	-	-
Front Ave at Rice St *Signalized Intersection*	EB	59	11	27	97	28 - C	28 - C	6 - A	22 - C	6 - A	-	50	125	25	50	125	-	25	100
	WB	12	18	6	36	26 - C	23 - C	4 - A	20 - C		-	25	100	35	25	100	-	25	50
	NB	32	245	17	294	8 - A	3 - A	1 - A	4 - A		-	25	100	80	25	100	-	25	75
	SB	8	514	67	589	6 - A	4 - A	3 - A	4 - A		-	50	125	40	50	125	-	50	125
Lawson Ave at Rice St *Stop Control*	EB	9	2	7	18	15 - C	8 - A	5 - A	10 - B	1 - A	-	25	50	290	25	50	-	25	50
	WB	-	2	4	6	-	12 - B	3 - A	5 - A		-	25	25	120	25	25	-	25	50
	NB	8	295	7	310	4 - A	1 - A	1 - A	2 - A		-	25	50	125	25	50	-	-	-
	SB	3	582	14	599	2 - A	0 - A	0 - A	1 - A		-	0	25	25	0	25	-	-	-
Cook Ave S at Rice St *Stop Control*	WB	6	-	2	8	8 - A	-	3 - A	7 - A	0 - A	-	25	50	-	-	-	-	25	50
	NB	-	301	7	308	-	0 - A	0 - A	0 - A		-	-	-	225	0	25	-	-	-
	SB	-	593	-	593	-	0 - A	-	0 - A		-	-	-	75	25	25	-	-	-
Cook Ave N at Rice St *Stop Control*	EB	3	1	16	20	10 - B	11 - B	5 - A	6 - A	1 - A	-	25	50	290	25	50	-	25	75
	WB	-	-	4	4	-	-	2 - A	2 - A		-	25	50	-	25	50	-	25	50
	NB	9	290	4	303	4 - A	0 - A	0 - A	1 - A		-	25	50	75	25	50	-	-	-
	SB	2	577	12	591	2 - A	1 - A	0 - A	1 - A		-	25	25	40	25	25	-	-	-
Jessamine Ave S at Rice St *Stop Control*	EB	3	-	9	12	12 - B	-	4 - A	6 - A	0 - A	-	25	50	-	-	-	-	25	50
	NB	4	293	-	297	4 - A	0 - A	-	1 - A		-	25	25	35	25	25	-	-	-
	SB	-	584	7	591	-	0 - A	0 - A	0 - A		-	-	-	-	-	-	-	-	-
Jessamine Ave N at Rice St *Stop Control*	WB	7	-	7	14	8 - A	-	3 - A	6 - A	0 - A	-	25	50	-	-	-	-	25	50
	NB	-	292	5	297	-	0 - A	0 - A	0 - A		-	-	-	-	-	-	-	-	-
	SB	4	583	-	587	2 - A	1 - A	-	2 - A		-	-	-	-	-	-	-	-	-
Geranium Ave at Rice St *Signalized Intersection*	EB	4	-	6	10	42 - D	-	6 - A	22 - C	3 - A	-	25	50	80	25	50	-	25	50
	WB	2	2	2	6	45 - D	60 - E	6 - A	28 - C		-	25	50	60	25	50	-	25	50
	NB	11	284	3	298	6 - A	1 - A	1 - A	2 - A		-	25	75	125	25	100	-	25	100
	SB	0	579	15	594	-	3 - A	4 - A	4 - A		-	25	175	125	25	200	-	25	200
Maryland Ave at Rice St *Signalized Intersection*	EB	92	247	32	371	14 - B	15 - B	6 - A	14 - B	17 - B	150	50	100	75	75	175	-	50	125
	WB	120	332	94	546	13 - B	15 - B	7 - A	14 - B		265	75	125	65	100	200	-	75	175
	NB	17	203	70	290	33 - C	18 - B	11 - B	18 - B		-	75	125	90	75	150	-	75	150
	SB	94	503	101	698	25 - C	20 - C	17 - B	21 - C		-	125	225	75	150	250	-	150	250
Cottage Ave at Rice St *Stop Control*	EB	10	-	51	61	14 - B	-	5 - A	7 - A	2 - A	-	25	50	110	25	50	-	50	75
	WB	4	-	6	10	9 - A	-	4 - A	6 - A		-	25	50	140	25	50	-	25	50
	NB	28	392	5	425	5 - A	2 - A	2 - A	3 - A		-	25	75	475	25	75	-	-	-
	SB	6	644	4	654	3 - A	1 - A	1 - A	2 - A		-	25	25	150	25	25	-	-	-
Arlington Ave at Rice St *Signalized Intersection*	EB	61	62	35	158	32 - C	34 - C	8 - A	28 - C	11 - B	-	100	225	75	100	225	-	50	150
	WB	55	84	71	210	35 - D	34 - C	6 - A	25 - C		-	100	200	25	100	200	-	50	150
	NB	20	342	37	399	13 - B	6 - A	3 - A	7 - A		-	50	125	25	50	125	-	50	125
	SB	75	563	30	668	9 - A	5 - A	3 - A	6 - A		-	50	100	100	50	125	-	50	125
Nebraska Ave at Rice St *Signalized Intersection*	EB	24	-	68	92	41 - D	-	6 - A	16 - B	4 - A	-	25	100	90	25	100	-	50	100
	WB	-	-	2	2	-	-	6 - A	6 - A		-	-	-	-	-	-	-	25	25
	NB	122	350	1	473	8 - A	3 - A	1 - A	5 - A		-	50	125	235	50	125	-	25	100
	SB	1	601	50	652	-	2 - A	1 - A	2 - A		-	25	125	200	25	125	-	25	125
Montana Ave at Rice St *Stop Control*	EB	7	1	31	39	12 - B	11 - B	5 - A	7 - A	1 - A	-	25	50	-	25	50	-	25	75
	WB	7	-	3	10	11 - B	-	3 - A	8 - A		-	25	50	285	25	50	-	25	50
	NB	4	363	9	376	4 - A	1 - A	0 - A	1 - A		-	0	25	50	0	25	-	-	-
	SB	2	614	2	618	2 - A	0 - A	0 - A	1 - A		-	0	25	35	0	25	-	-	-
Hoyt Ave at Rice St *Stop Control*	EB	22	-	44	66	10 - B	-	4 - A	6 - A	1 - A	-	25	75	75	25	75	-	50	75
	WB	7	-	11	18	9 - A	-	3 - A	6 - A		-	25	50	35	25	50	-	25	50
	NB	14	348	11	373	4 - A	0 - A	0 - A	1 - A		-	25	50	50	25	50	-	-	-
	SB	5	566	23	594	2 - A	0 - A	0 - A	1 - A		-	25	25	285	25	25	-	0	25
Wheelock Pkwy at Rice St *Signalized Intersection*	EB	36	7	36	79	38 - D	44 - D	8 - A	24 - C	8 - A	-	50	100	80	50	100	-	25	75
	WB	21	17	37	75	39 - D	39 - D	6 - A	23 - C		-	50	100	100	50	100	-	50	100
	NB	18	352	12	382	9 - A	3 - A	2 - A	4 - A		200	25	50	65	50	125	-	50	125
	SB	9	537	28	574	8 - A	6 - A	4 - A	6 - A		75	25	50	80	75	175	-	75	175

Project: Rice Street Visioning Study
Scenario: Existing Conditions (Syncrho/SimTraffic)

		Existing PM Peak Hour																	
		Traffic Volumes (veh)				Traffic Delay (sec/veh)					Traffic Queuing (feet)								
		Demand Volumes				Movement (Delay - LOS)			Approach	Intersection	Left Turn			Through			Right Turn		
Intersection	Approach	L	T	R	Total	L	T	R	(Delay - LOS)	(Delay - LOS)	Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Pennsylvania Ave at Rice St *Signalized Intersection*	EB	183	702	25	910	35 - D	16 - B	14 - B	20 - C	20 - C	125	100	200	175	125	225	-	125	225
	WB	67	406	106	579	34 - C	15 - B	12 - B	17 - B		200	50	125	225	125	225	-	125	225
	NB	17	596	158	771	24 - C	12 - B	6 - A	11 - B		-	75	100	85	75	100	-	75	100
	SB	75	385	67	527	78 - E	32 - C	17 - B	37 - D		-	150	325	160	150	325	-	150	325
Sycamore St at Rice St *Signalized Intersection*	EB	6	7	11	24	22 - C	34 - C	4 - A	15 - B	8 - A	-	25	50	240	25	50	-	25	50
	WB	58	4	85	147	28 - C	24 - C	7 - A	16 - B		-	50	100	100	50	100	-	50	75
	NB	8	771	105	884	9 - A	6 - A	6 - A	7 - A		-	75	175	60	75	200	-	75	200
	SB	56	479	6	541	17 - B	6 - A	3 - A	8 - A		-	75	125	250	75	150	-	50	150
Atwater St at Rice St *Signalized Intersection*	EB	34	29	60	123	27 - C	27 - C	5 - A	17 - B	7 - A	-	50	125	210	50	125	-	50	75
	WB	24	15	15	54	23 - C	30 - C	8 - A	22 - C		-	50	75	50	50	75	-	25	50
	NB	42	908	10	960	8 - A	6 - A	4 - A	7 - A		-	75	175	250	75	175	-	75	175
	SB	4	449	17	470	13 - B	5 - A	3 - A	6 - A		-	50	125	50	50	125	-	50	125
Wayzata St at Rice St *Signalized Intersection*	NB	-	954	3	957	-	3 - A	7 - A	4 - A	3 - A	-	-	-	60	25	175	-	25	175
	SB	2	470	-	472	6 - A	2 - A	-	3 - A		-	25	100	25	25	125	-	-	-
Front Ave at Rice St *Signalized Intersection*	EB	129	33	54	216	25 - C	24 - C	6 - A	21 - C	7 - A	-	100	175	25	100	175	-	50	125
	WB	20	30	27	77	24 - C	20 - C	7 - A	16 - B		-	50	100	35	50	100	-	25	75
	NB	38	902	14	954	8 - A	4 - A	2 - A	5 - A		-	50	125	80	50	125	-	50	125
	SB	8	398	79	485	12 - B	5 - A	4 - A	5 - A		-	50	100	40	50	125	-	50	125
Lawson Ave at Rice St *Stop Control*	EB	15	3	12	30	15 - C	21 - C	5 - A	11 - B	1 - A	-	25	50	290	25	50	-	25	50
	WB	3	3	11	17	16 - C	22 - C	7 - A	12 - B		-	25	50	120	25	50	-	25	50
	NB	9	1043	6	1058	4 - A	1 - A	1 - A	2 - A		-	25	50	125	25	50	-	-	-
	SB	6	471	13	490	6 - A	0 - A	0 - A	1 - A		-	25	50	25	25	50	-	-	-
Cook Ave S at Rice St *Stop Control*	WB	3	-	9	12	18 - C	-	10 - B	13 - B	1 - A	-	25	50	-	-	-	-	25	50
	NB	-	1060	9	1069	-	1 - A	0 - A	1 - A		-	-	-	225	25	50	-	0	25
	SB	9	486	-	495	8 - A	0 - A	-	1 - A		-	25	50	75	25	50	-	-	-
Cook Ave N at Rice St *Stop Control*	EB	1	-	17	18	-	-	4 - A	4 - A	0 - A	-	0	25	290	0	25	-	25	50
	WB	5	1	9	15	16 - C	-	7 - A	11 - B		-	25	50	-	25	50	-	25	50
	NB	15	1054	0	1069	3 - A	0 - A	-	1 - A		-	25	25	75	25	25	-	0	25
	SB	-	473	9	482	-	1 - A	0 - A	1 - A		-	25	50	40	25	50	-	-	-
Jessamine Ave S at Rice St *Stop Control*	EB	4	-	8	12	17 - C	-	4 - A	9 - A	1 - A	-	25	50	-	-	-	-	25	50
	NB	16	1048	-	1064	5 - A	1 - A	-	2 - A		-	25	75	35	25	75	-	-	-
	SB	-	474	5	479	-	0 - A	0 - A	0 - A		-	-	-	-	-	-	-	-	-
Jessamine Ave N at Rice St *Stop Control*	WB	7	-	12	19	20 - C	-	10 - B	14 - B	1 - A	-	25	50	-	-	-	-	25	50
	NB	-	1037	15	1052	-	0 - A	0 - A	0 - A		-	-	-	-	0	25	-	0	25
	SB	12	472	-	484	9 - A	1 - A	-	2 - A		-	25	100	-	25	100	-	-	-
Geranium Ave at Rice St *Signalized Intersection*	EB	8	2	7	17	44 - D	34 - C	6 - A	27 - C	4 - A	-	25	50	80	25	50	-	25	50
	WB	6	7	6	19	43 - D	47 - D	7 - A	33 - C		-	25	75	60	25	75	-	25	50
	NB	15	1012	22	1049	5 - A	2 - A	2 - A	3 - A		-	50	175	125	50	200	-	50	200
	SB	10	472	8	490	14 - B	5 - A	7 - A	6 - A		-	50	150	125	50	150	-	50	150
Maryland Ave at Rice St *Signalized Intersection*	EB	198	493	29	720	21 - C	22 - C	13 - B	22 - C	26 - C	150	100	200	75	125	225	-	100	200
	WB	129	341	107	577	22 - C	23 - C	15 - B	22 - C		265	75	200	65	125	200	-	100	200
	NB	21	823	182	1026	27 - C	27 - C	26 - C	27 - C		-	225	400	90	250	425	-	250	425
	SB	63	386	110	559	77 - E	30 - C	23 - C	34 - C		-	150	225	75	150	250	-	150	250
Cottage Ave at Rice St *Stop Control*	EB	14	-	28	42	19 - C	-	4 - A	9 - A	4 - A	-	25	50	110	25	50	-	25	50
	WB	4	-	11	15	18 - C	-	6 - A	10 - B		-	25	50	140	25	50	-	25	50
	NB	71	1046	11	1128	8 - A	5 - A	5 - A	6 - A		-	25	100	475	25	100	-	25	75
	SB	6	524	14	544	10 - B	2 - A	1 - A	3 - A		-	25	50	150	25	50	-	0	25
Arlington Ave at Rice St *Signalized Intersection*	EB	51	165	30	246	37 - D	33 - C	7 - A	31 - C	14 - B	-	125	250	75	125	250	-	50	150
	WB	57	109	104	270	38 - D	35 - D	10 - B	26 - C		-	125	275	25	125	275	-	75	150
	NB	39	792	152	983	13 - B	9 - A	6 - A	9 - A		-	100	200	25	100	200	-	100	200
	SB	97	457	57	611	31 - C	9 - A	4 - A	13 - B		-	100	200	100	100	200	-	50	150
Nebraska Ave at Rice St *Signalized Intersection*	EB	13	-	34	47	40 - D	-	5 - A	16 - B	4 - A	-	25	75	90	25	75	-	25	50
	WB	14	11	28	53	39 - D	41 - D	9 - A	25 - C		-	25	100	-	25	100	-	25	50
	NB	62	875	10	947	7 - A	4 - A	3 - A	5 - A		-	50	125	235	50	125	-	50	100
	SB	3	562	23	588	10 - B	2 - A	1 - A	3 - A		-	25	100	200	25	100	-	25	100
Montana Ave at Rice St *Stop Control*	EB	3	-	28	31	13 - B	-	4 - A	5 - A	1 - A	-	25	50	-	25	50	-	25	75
	WB	9	-	2	11	20 - C	-	6 - A	18 - C		-	25	50	285	25	50	-	25	50
	NB	3	886	27	916	3 - A	1 - A	0 - A	1 - A		-	25	50	50	25	50	-	25	50
	SB	3	551	-	554	7 - A	0 - A	-	1 - A		-	25	25	35	25	25	-	-	-
Hoyt Ave at Rice St *Stop Control*	EB	13	1	19	33	17 - C	34 - D	4 - A	11 - B	4 - A	-	25	75	75	25	75	-	25	50
	WB	7	2	9	18	22 - C	38 - E	16 - C	21 - C		-	25	50	35	25	50	-	25	50
	NB	42	835	14	891	9 - A	6 - A	7 - A	7 - A		-	50	175	50	50	200	-	50	200
	SB	12	528	17	557	6 - A	0 - A	0 - A	1 - A		-	25	50	285	25	50	-	-	-
Wheelock Pkwy at Rice St *Signalized Intersection*	EB	89	13	60	162	39 - D	42 - D	10 - B	28 - C	19 - B	-	75	175	80	75	175	-	50	125
	WB	13	39	35	87	42 - D	34 - C	23 - C	31 - C		-	50	150	100	50	150	-	50	100
	NB	33	769	55	857	15 - B	24 - C	17 - B	24 - C		200	50	300	65	225	400	-	225	400
	SB	11	484	62	557	15 - B	8 - A	5 - A	8 - A		75	25	50	80	100	200	-	100	200

Appendix C: Warrant Analysis

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SIGNAL WARRANTS ANALYSIS FOR

Rice St & Pennsylvania Ave

LOCATION: Rice St & Pennsylvania Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

Speed	Approach Description		Lanes
30	Major App1:	EASTBOUND - Pennsylvania Ave	3
30	Major App3:	WESTBOUND - Pennsylvania Ave	3
30	Minor App2:	NORTHBOUND - Rice St	2
30	Minor App4:	SOUTHBOUND - Rice St	2

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 600/900 200/100 200/100

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:30 - 1:30			0	/		/		/	**/**
1:30 - 2:30			0	/		/		/	**/**
2:30 - 3:30			0	/		/		/	**/**
3:30 - 4:30			0	/		/		/	**/**
4:30 - 5:30			0	/		/		/	**/**
5:30 - 6:30			0	/		/		/	**/**
6:30 - 7:30	211	390	601	X/	152	/X	389	X/X	**X/**
7:30 - 8:30	374	484	858	X/	196	/X	490	X/X	**X/**
8:30 - 9:30	452	392	844	X/	246	X/X	409	X/X	**X/**
9:30 - 10:30	390	429	819	X/	268	X/X	382	X/X	**X/**
10:30 - 11:30	451	429	880	X/	325	X/X	413	X/X	**X/**
11:30 - 12:30	537	488	1025	X/X	345	X/X	436	X/X	**X/X**
12:30 - 13:30	531	513	1044	X/X	362	X/X	472	X/X	**X/X**
13:30 - 14:30	580	646	1226	X/X	356	X/X	473	X/X	**X/X**
14:30 - 15:30	651	672	1323	X/X	412	X/X	507	X/X	**X/X**
15:30 - 16:30	849	578	1427	X/X	552	X/X	458	X/X	**X/X**
16:30 - 17:30	912	611	1523	X/X	631	X/X	432	X/X	**X/X**
17:30 - 18:30	793	525	1318	X/X	464	X/X	486	X/X	**X/X**
18:30 - 19:30	594	419	1013	X/X	342	X/X	379	X/X	**X/X**
19:30 - 20:30			0	/		/		/	**/**
20:30 - 21:30			0	/		/		/	**/**
21:30 - 22:30			0	/		/		/	**/**
22:30 - 23:30			0	/		/		/	**/**
23:30 - 0:30			0	/		/		/	**/**

	Met (Hr)	Required (Hr)	
Warrant 1A	**13**	8	**Satisfied**
Warrant 1B	**8**	8	**Satisfied**
Warrant 2	**12**	4	**Satisfied**
Warrant 3	**9**	1	**Satisfied**
Warrant 7	**13**	8	**Satisfied, check accident record**

LOCATION: Rice St & Pennsylvania Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

Speed	Approach Description	Lanes
30	Major App1: EASTBOUND - Pennsylvania Ave	3
30	Major App3: WESTBOUND - Pennsylvania Ave	3
30	Minor App2: NORTHBOUND - Rice St	2
30	Minor App4: SOUTHBOUND - Rice St	2

0.70 FACTOR USED? No
POPULATION < 10,000? No

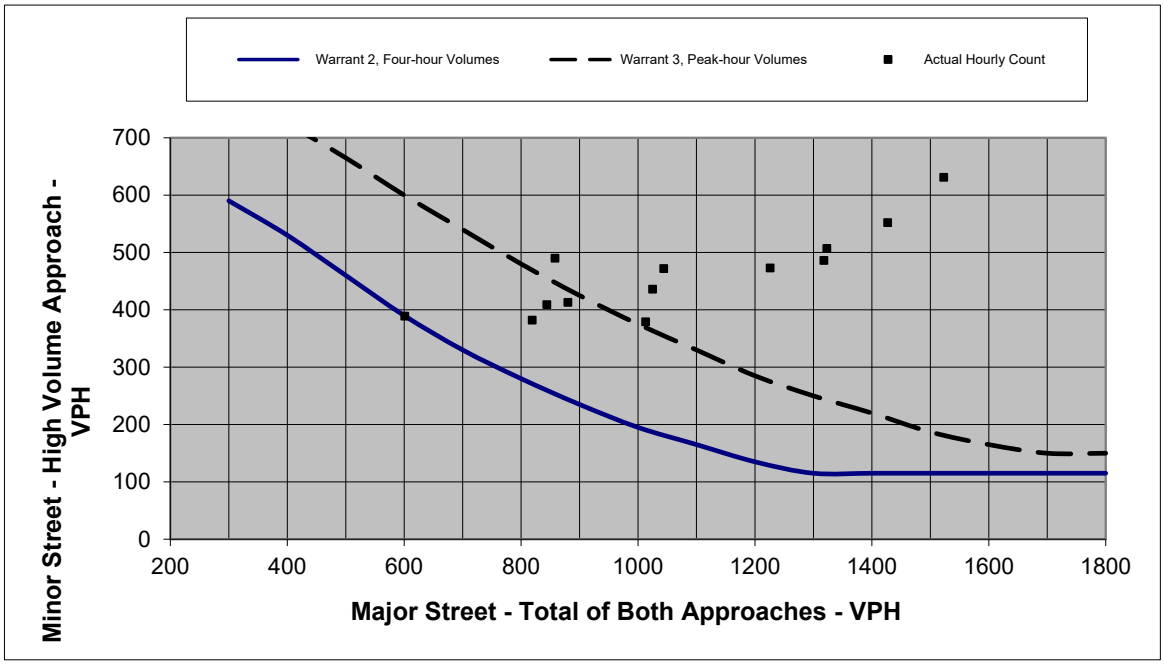

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			0	0
300	590		0	0
400	530	725	0	0
500	460	665	0	0
600	390	600	0	0
700	330	540	0	0
800	280	480	601	389
900	235	425	858	490
1000	195	375	844	409
1100	165	330	819	382
1200	135	285	880	413
1300	115	250	1025	436
1400	115	220	1044	472
1500	115	187	1226	473
1600	115	165	1323	507
1700	115	150	1427	552
1800	115	150	1523	631
			1318	486
			1013	379
			0	0
			0	0
			0	0
			0	0
			0	0

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SIGNAL WARRANTS ANALYSIS FOR
Rice St & Sycamore St
(with minor street rights)

LOCATION: Rice St & Sycamore St
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

Speed	Approach Description		Lanes
30	Major App1:	NORTHBOUND - Rice St	2
30	Major App3:	SOUTHBOUND - Rice St	2
30	Minor App2:	EASTBOUND - Sycamore St	1
30	Minor App4:	WESTBOUND - Sycamore St	1

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 600/900 150/75 150/75

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:30 - 1:30			0	/		/		/	**/**
1:30 - 2:30			0	/		/		/	**/**
2:30 - 3:30			0	/		/		/	**/**
3:30 - 4:30			0	/		/		/	**/**
4:30 - 5:30			0	/		/		/	**/**
5:30 - 6:30			0	/		/		/	**/**
6:30 - 7:30	216	401	617	X/	8	/	89	/X	**/**
7:30 - 8:30	275	576	851	X/	14	/	107	/X	**/**
8:30 - 9:30	331	501	832	X/	18	/	91	/X	**/**
9:30 - 10:30	370	460	830	X/	16	/	133	/X	**/**
10:30 - 11:30	450	503	953	X/X	15	/	107	/X	**/X**
11:30 - 12:30	490	530	1020	X/X	19	/	151	X/X	**X/X**
12:30 - 13:30	505	574	1079	X/X	22	/	138	/X	**/X**
13:30 - 14:30	494	586	1080	X/X	20	/	128	/X	**/X**
14:30 - 15:30	579	612	1191	X/X	21	/	148	/X	**/X**
15:30 - 16:30	757	526	1283	X/X	22	/	130	/X	**/X**
16:30 - 17:30	878	566	1444	X/X	26	/	146	/X	**/X**
17:30 - 18:30	661	588	1249	X/X	17	/	116	/X	**/X**
18:30 - 19:30	472	470	942	X/X	15	/	92	/X	**/X**
19:30 - 20:30			0	/		/		/	**/**
20:30 - 21:30			0	/		/		/	**/**
21:30 - 22:30			0	/		/		/	**/**
22:30 - 23:30			0	/		/		/	**/**
23:30 - 0:30			0	/		/		/	**/**

	Met (Hr)	Required (Hr)	
Warrant 1A	1	8	Not satisfied
Warrant 1B	**9**	8	**Satisfied**
Warrant 2	7	4	**Satisfied**
Warrant 3	0	1	Not satisfied
Warrant 7	**12**	8	**Satisfied, check accident record**

LOCATION: Rice St & Sycamore St
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

Speed	Approach Description	Lanes
30	Major App1: NORTHBOUND - Rice St	2
30	Major App3: SOUTHBOUND - Rice St	2
30	Minor App2: EASTBOUND - Sycamore St	1
30	Minor App4: WESTBOUND - Sycamore St	1

0.70 FACTOR USED? No
POPULATION < 10,000? No

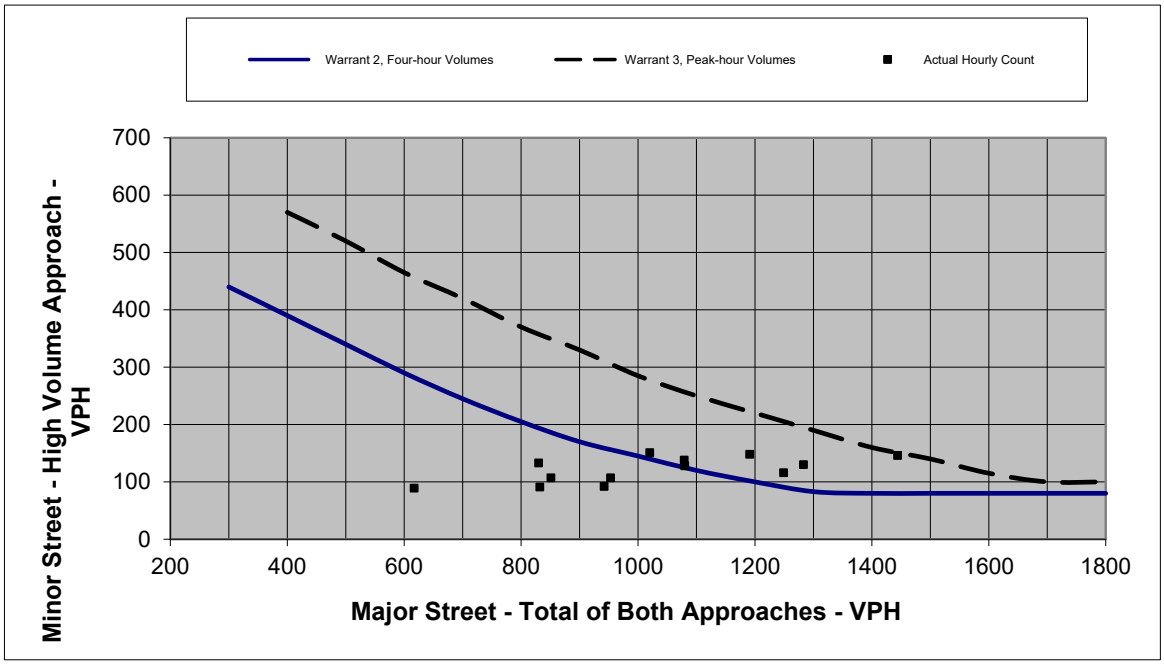

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			0	0
300	440		0	0
400	390	570	0	0
500	340	520	0	0
600	290	465	0	0
700	245	420	0	0
800	205	370	617	89
900	170	330	851	107
1000	145	285	832	91
1100	120	250	830	133
1200	100	220	953	107
1300	83	190	1020	151
1400	80	160	1079	138
1500	80	140	1080	128
1600	80	115	1191	148
1700	80	100	1283	130
1800	80	100	1444	146
			1249	116
			942	92
			0	0
			0	0
			0	0
			0	0
			0	0

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SIGNAL WARRANTS ANALYSIS FOR
Rice St & Atwater Ave
(with minor street rights & 3 lane)

LOCATION: Rice St & Atwater Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

Speed	Approach Description		Lanes
30	Major App1:	NORTHBOUND - Rice St	1
30	Major App3:	SOUTHBOUND - Rice St	1
30	Minor App2:	EASTBOUND - Atwater Ave	1
30	Minor App4:	WESTBOUND - Atwater Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 500/750 150/75 150/75

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:30 - 1:30			0	/		/		/	**/**
1:30 - 2:30			0	/		/		/	**/**
2:30 - 3:30			0	/		/		/	**/**
3:30 - 4:30			0	/		/		/	**/**
4:30 - 5:30			0	/		/		/	**/**
5:30 - 6:30			0	/		/		/	**/**
6:30 - 7:30	223	405	628	X/	60	/	12	/	**/**
7:30 - 8:30	299	548	847	X/X	88	/X	22	/	**/X**
8:30 - 9:30	318	444	762	X/X	106	/X	23	/	**/X**
9:30 - 10:30	341	401	742	X/	88	/X	30	/	**/**
10:30 - 11:30	418	444	862	X/X	85	/X	25	/	**/X**
11:30 - 12:30	435	467	902	X/X	102	/X	33	/	**/X**
12:30 - 13:30	459	506	965	X/X	121	/X	29	/	**/X**
13:30 - 14:30	461	527	988	X/X	109	/X	34	/	**/X**
14:30 - 15:30	521	534	1055	X/X	110	/X	38	/	**/X**
15:30 - 16:30	733	426	1159	X/X	139	/X	55	/	**/X**
16:30 - 17:30	733	447	1180	X/X	122	/X	43	/	**/X**
17:30 - 18:30	591	517	1108	X/X	83	/X	31	/	**/X**
18:30 - 19:30	439	424	863	X/X	76	/X	22	/	**/X**
19:30 - 20:30			0	/		/		/	**/**
20:30 - 21:30			0	/		/		/	**/**
21:30 - 22:30			0	/		/		/	**/**
22:30 - 23:30			0	/		/		/	**/**
23:30 - 0:30			0	/		/		/	**/**

	Met (Hr)	Required (Hr)	
Warrant 1A	0	8	Not satisfied
Warrant 1B	**11**	8	**Satisfied**
Warrant 2	5	4	**Satisfied**
Warrant 3	0	1	Not satisfied
Warrant 7	**13**	8	**Satisfied, check accident record**

LOCATION: Rice St & Atwater Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

0.70 FACTOR USED? No
POPULATION < 10,000? No

Speed	Approach Description	Lanes
30	Major App1: NORTHBOUND - Rice St	1
30	Major App3: SOUTHBOUND - Rice St	1
30	Minor App2: EASTBOUND - Atwater Ave	1
30	Minor App4: WESTBOUND - Atwater Ave	1

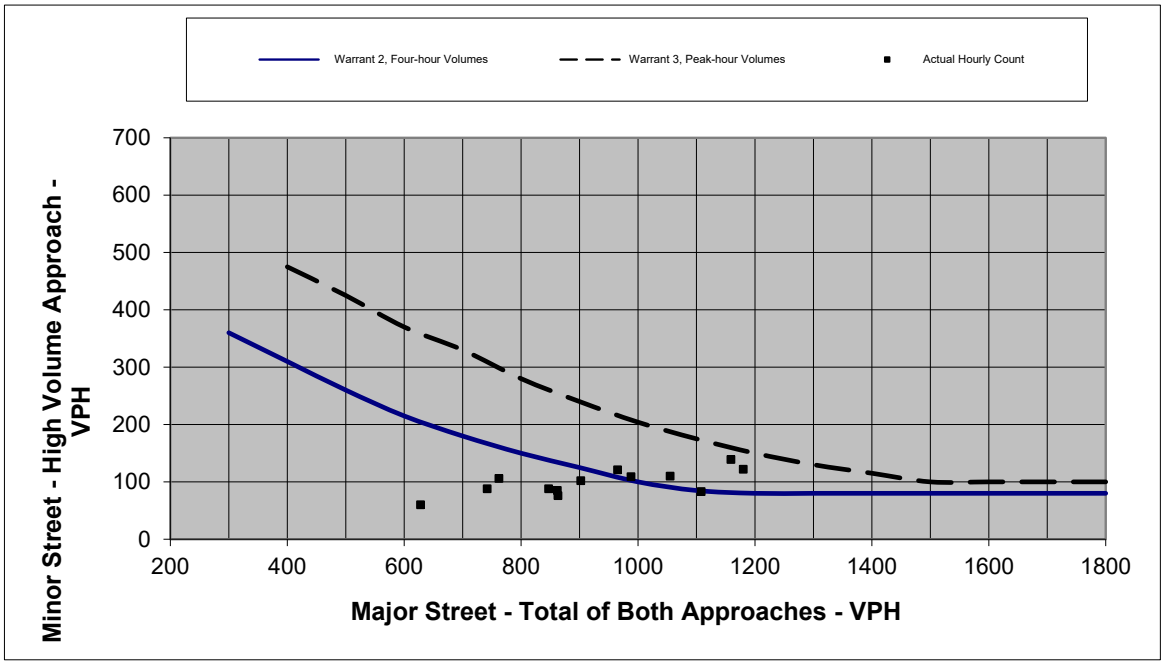

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			0	0
300	360		0	0
400	310	475	0	0
500	260	425	0	0
600	215	370	0	0
700	180	330	0	0
800	150	280	628	60
900	125	240	847	88
1000	100	204	762	106
1100	85	175	742	88
1200	80	150	862	85
1300	80	130	902	102
1400	80	115	965	121
1500	80	100	988	109
1600	80	100	1055	110
1700	80	100	1159	139
1800	80	100	1180	122
			1108	83
			863	76
			0	0
			0	0
			0	0
			0	0
			0	0

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SIGNAL WARRANTS ANALYSIS FOR Rice St & Front Ave
(with 3 lane)

LOCATION: Rice St & Front Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

Speed	Approach Description		Lanes
30	Major App1:	NORTHBOUND - Rice St	1
30	Major App3:	SOUTHBOUND - Rice St	1
30	Minor App2:	EASTBOUND - Front Ave	1
30	Minor App4:	WESTBOUND - Front Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 500/750 150/75 150/75

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:30 - 1:30			0	/		/		/	**/**
1:30 - 2:30			0	/		/		/	**/**
2:30 - 3:30			0	/		/		/	**/**
3:30 - 4:30			0	/		/		/	**/**
4:30 - 5:30			0	/		/		/	**/**
5:30 - 6:30			0	/		/		/	**/**
6:30 - 7:30	139	401	540	X/	24	/	20	/	**/**
7:30 - 8:30	265	575	840	X/X	62	/	29	/	**/**
8:30 - 9:30	299	456	755	X/X	91	/X	27	/	**/X**
9:30 - 10:30	322	418	740	X/	72	/	33	/	**/**
10:30 - 11:30	394	459	853	X/X	97	/X	29	/	**/X**
11:30 - 12:30	411	480	891	X/X	92	/X	36	/	**/X**
12:30 - 13:30	432	520	952	X/X	102	/X	33	/	**/X**
13:30 - 14:30	435	546	981	X/X	108	/X	41	/	**/X**
14:30 - 15:30	491	564	1055	X/X	109	/X	45	/	**/X**
15:30 - 16:30	679	447	1126	X/X	168	X/X	45	/	**X/X**
16:30 - 17:30	719	460	1179	X/X	155	X/X	46	/	**X/X**
17:30 - 18:30	558	549	1107	X/X	117	/X	37	/	**/X**
18:30 - 19:30	414	457	871	X/X	104	/X	26	/	**/X**
19:30 - 20:30			0	/		/		/	**/**
20:30 - 21:30			0	/		/		/	**/**
21:30 - 22:30			0	/		/		/	**/**
22:30 - 23:30			0	/		/		/	**/**
23:30 - 0:30			0	/		/		/	**/**

	Met (Hr)	Required (Hr)	
Warrant 1A	2	8	Not satisfied
Warrant 1B	**10**	8	**Satisfied**
Warrant 2	5	4	**Satisfied**
Warrant 3	0	1	Not satisfied
Warrant 7	**12**	8	**Satisfied, check accident record**

LOCATION: Rice St & Front Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

0.70 FACTOR USED? No
POPULATION < 10,000? No

Speed	Approach Description	Lanes
30	Major App1: NORTHBOUND - Rice St	1
30	Major App3: SOUTHBOUND - Rice St	1
30	Minor App2: EASTBOUND - Front Ave	1
30	Minor App4: WESTBOUND - Front Ave	1

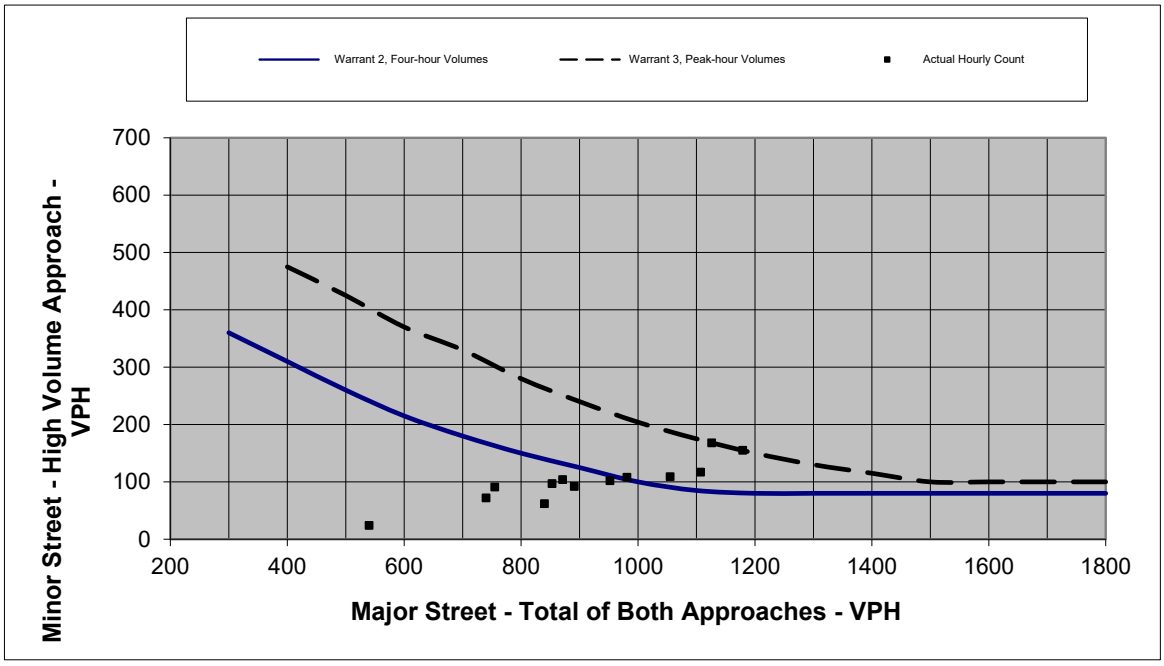

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			0	0
300	360		0	0
400	310	475	0	0
500	260	425	0	0
600	215	370	0	0
700	180	330	0	0
800	150	280	540	24
900	125	240	840	62
1000	100	204	755	91
1100	85	175	740	72
1200	80	150	853	97
1300	80	130	891	92
1400	80	115	952	102
1500	80	100	981	108
1600	80	100	1055	109
1700	80	100	1126	168
1800	80	100	1179	155
			1107	117
			871	104
			0	0
			0	0
			0	0
			0	0
			0	0

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SIGNAL WARRANTS ANALYSIS FOR

Rice St & Maryland Ave

LOCATION: Rice St & Maryland Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

Speed	Approach Description		Lanes
30	Major App1:	NORTHBOUND - Rice St	2
30	Major App3:	SOUTHBOUND - Rice St	2
30	Minor App2:	EASTBOUND - Maryland Ave	3
30	Minor App4:	WESTBOUND - Maryland Ave	3

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 600/900 200/100 200/100

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:00 - 1:00			0	/		/		/	**/**
1:00 - 2:00			0	/		/		/	**/**
2:00 - 3:00			0	/		/		/	**/**
3:00 - 4:00			0	/		/		/	**/**
4:00 - 5:00			0	/		/		/	**/**
5:00 - 6:00			0	/		/		/	**/**
6:00 - 7:00	140	351	491	/	209	X/X	277	X/X	**/**
7:00 - 8:00	203	585	788	X/	263	X/X	441	X/X	**X/**
8:00 - 9:00	312	590	902	X/X	335	X/X	457	X/X	**X/X**
9:00 - 10:00	361	408	769	X/	279	X/X	299	X/X	**X/**
10:00 - 11:00	434	459	893	X/	296	X/X	334	X/X	**X/**
11:00 - 12:00	494	511	1005	X/X	332	X/X	324	X/X	**X/X**
12:00 - 13:00	520	517	1037	X/X	379	X/X	405	X/X	**X/X**
13:00 - 14:00	519	554	1073	X/X	420	X/X	353	X/X	**X/X**
14:00 - 15:00	574	555	1129	X/X	420	X/X	410	X/X	**X/X**
15:00 - 16:00	734	571	1305	X/X	573	X/X	420	X/X	**X/X**
16:00 - 17:00	870	532	1402	X/X	673	X/X	470	X/X	**X/X**
17:00 - 18:00	789	497	1286	X/X	666	X/X	453	X/X	**X/X**
18:00 - 19:00	552	468	1020	X/X	476	X/X	369	X/X	**X/X**
19:00 - 20:00			0	/		/		/	**/**
20:00 - 21:00			0	/		/		/	**/**
21:00 - 22:00			0	/		/		/	**/**
22:00 - 23:00			0	/		/		/	**/**
23:00 - 24:00			0	/		/		/	**/**

	Met (Hr)	Required (Hr)	
Warrant 1A	**12**	8	**Satisfied**
Warrant 1B	**9**	8	**Satisfied**
Warrant 2	**12**	4	**Satisfied**
Warrant 3	**8**	1	**Satisfied**
Warrant 7	**13**	8	**Satisfied, check accident record**

LOCATION: Rice St & Maryland Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

Speed	Approach Description	Lanes
30	Major App1: NORTHBOUND - Rice St	2
30	Major App3: SOUTHBOUND - Rice St	2
30	Minor App2: EASTBOUND - Maryland Ave	3
30	Minor App4: WESTBOUND - Maryland Ave	3

0.70 FACTOR USED? No
POPULATION < 10,000? No

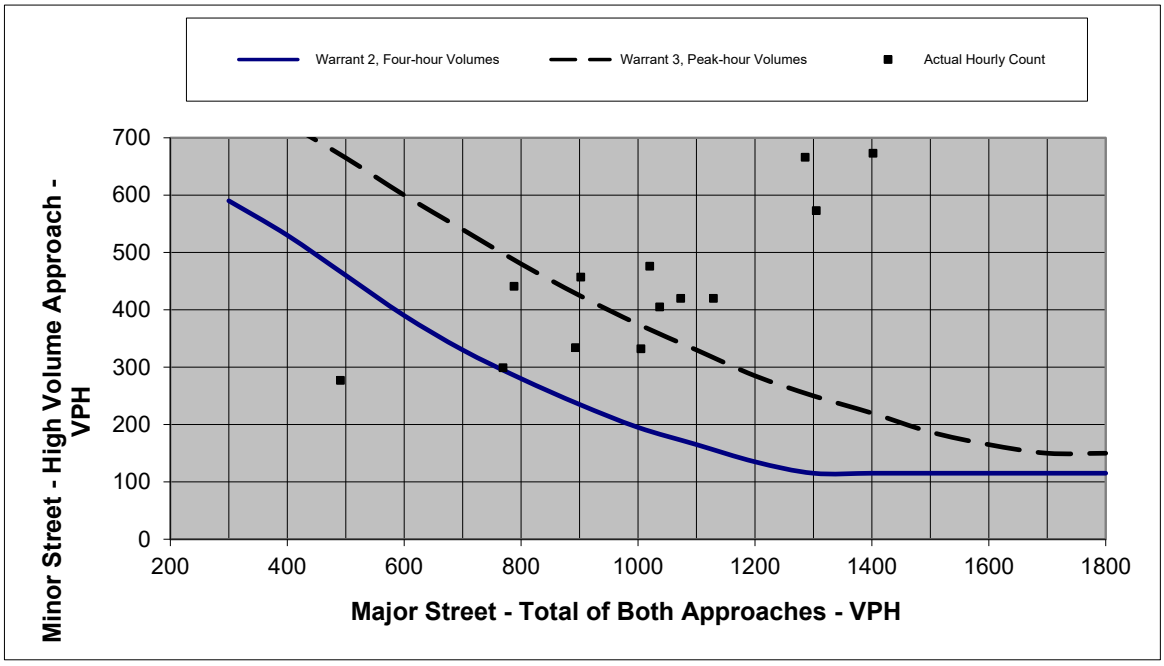

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			0	0
300	590		0	0
400	530	725	0	0
500	460	665	0	0
600	390	600	0	0
700	330	540	0	0
800	280	480	491	277
900	235	425	788	441
1000	195	375	902	457
1100	165	330	769	299
1200	135	285	893	334
1300	115	250	1005	332
1400	115	220	1037	405
1500	115	187	1073	420
1600	115	165	1129	420
1700	115	150	1305	573
1800	115	150	1402	673
			1286	666
			1020	476
			0	0
			0	0
			0	0
			0	0
			0	0

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SIGNAL WARRANTS ANALYSIS FOR

Rice St & Arlington Ave

LOCATION: Rice St & Arlington Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

Speed	Approach Description		Lanes
35	Major App1:	NORTHBOUND - Rice St	2
35	Major App3:	SOUTHBOUND - Rice St	2
30	Minor App2:	EASTBOUND - Arlington Ave	2
30	Minor App4:	WESTBOUND - Arlington Ave	2

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 600/900 200/100 200/100

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:00 - 1:00			0	/		/		/	**/**
1:00 - 2:00			0	/		/		/	**/**
2:00 - 3:00			0	/		/		/	**/**
3:00 - 4:00			0	/		/		/	**/**
4:00 - 5:00			0	/		/		/	**/**
5:00 - 6:00			0	/		/		/	**/**
6:00 - 7:00	170	321	491	/	72	/	69	/	**/**
7:00 - 8:00	275	626	901	X/X	89	/	118	/X	**/X**
8:00 - 9:00	403	619	1022	X/X	118	/X	119	/X	**/X**
9:00 - 10:00	406	460	866	X/	92	/	107	/X	**/**
10:00 - 11:00	460	494	954	X/X	108	/X	106	/X	**/X**
11:00 - 12:00	542	541	1083	X/X	154	/X	115	/X	**/X**
12:00 - 13:00	614	560	1174	X/X	129	/X	131	/X	**/X**
13:00 - 14:00	565	631	1196	X/X	123	/X	116	/X	**/X**
14:00 - 15:00	577	628	1205	X/X	182	/X	173	/X	**/X**
15:00 - 16:00	799	676	1475	X/X	164	/X	157	/X	**/X**
16:00 - 17:00	959	666	1625	X/X	212	X/X	166	/X	**X/X**
17:00 - 18:00	898	621	1519	X/X	201	X/X	129	/X	**X/X**
18:00 - 19:00	640	557	1197	X/X	182	/X	117	/X	**/X**
19:00 - 20:00			0	/		/		/	**/**
20:00 - 21:00			0	/		/		/	**/**
21:00 - 22:00			0	/		/		/	**/**
22:00 - 23:00			0	/		/		/	**/**
23:00 - 24:00			0	/		/		/	**/**

	Met (Hr)	Required (Hr)	
Warrant 1A	2	8	Not satisfied
Warrant 1B	**11**	8	**Satisfied**
Warrant 2	5	4	**Satisfied**
Warrant 3	2	1	**Satisfied**
Warrant 7	**12**	8	**Satisfied, check accident record**

LOCATION: Rice St & Arlington Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/7/2016
OPERATOR: KR

Speed	Approach Description	Lanes
35	Major App1: NORTHBOUND - Rice St	2
35	Major App3: SOUTHBOUND - Rice St	2
30	Minor App2: EASTBOUND - Arlington Ave	2
30	Minor App4: WESTBOUND - Arlington Ave	2

0.70 FACTOR USED? No
POPULATION < 10,000? No

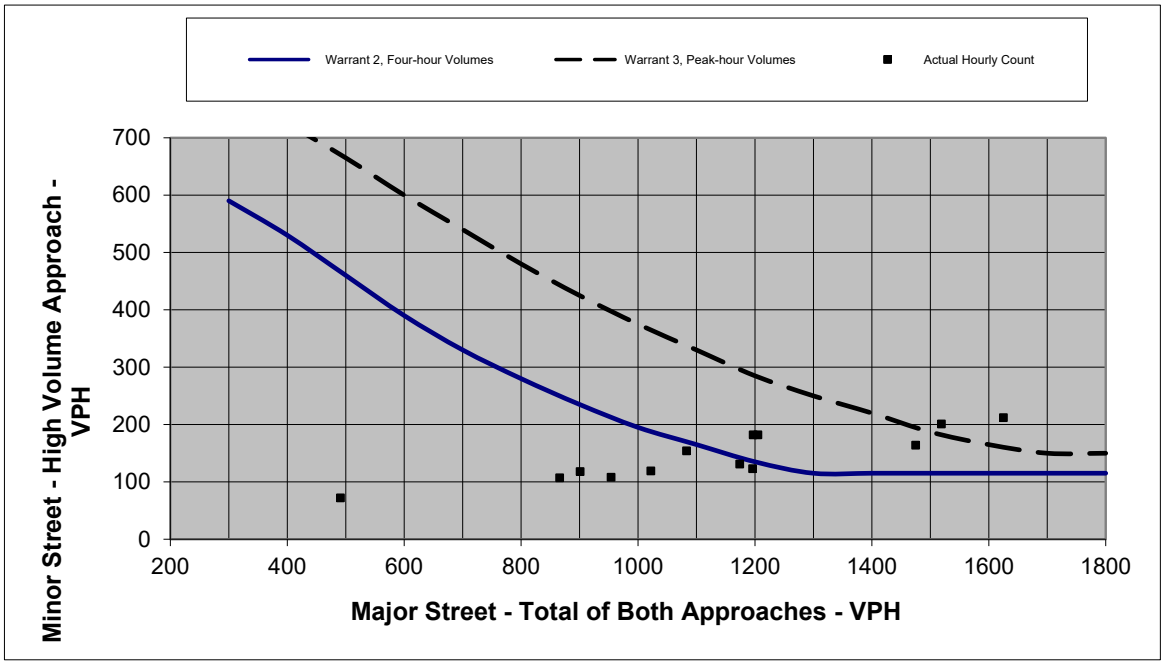

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			0	0
300	590		0	0
400	530	725	0	0
500	460	665	0	0
600	390	600	0	0
700	330	540	0	0
800	280	480	491	72
900	235	425	901	118
1000	195	375	1022	119
1100	165	330	866	107
1200	135	285	954	108
1300	115	250	1083	154
1400	115	220	1174	131
1500	115	187	1196	123
1600	115	165	1205	182
1700	115	150	1475	164
1800	115	150	1625	212
			1519	201
			1197	182
			0	0
			0	0
			0	0
			0	0
			0	0

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SIGNAL WARRANTS ANALYSIS FOR
Rice St & Wheelock Pkwy
(with minor street rights & 3 lane)

LOCATION: Rice St & Wheelock Pkwy
COUNTY: Ramsey
REF. POINT:
DATE: 7/21/2016
OPERATOR: KR

Speed	Approach Description		Lanes
35	Major App1:	NORTHBOUND - Rice St	1
35	Major App3:	SOUTHBOUND - Rice St	1
30	Minor App2:	EASTBOUND - Wheelock Pkwy	1
30	Minor App4:	WESTBOUND - Wheelock Pkwy	1

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 500/750 150/75 150/75

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:30 - 1:30			0	/		/		/	**/**
1:30 - 2:30			0	/		/		/	**/**
2:30 - 3:30			0	/		/		/	**/**
3:30 - 4:30			0	/		/		/	**/**
4:30 - 5:30			0	/		/		/	**/**
5:30 - 6:30			0	/		/		/	**/**
6:30 - 7:30	224	424	648	X/	41	/	29	/	**/**
7:30 - 8:30	360	593	953	X/X	51	/	65	/	**/**
8:30 - 9:30	350	501	851	X/X	85	/X	50	/	**/X**
9:30 - 10:30	380	453	833	X/X	68	/	63	/	**/**
10:30 - 11:30	460	501	961	X/X	75	/X	58	/	**/X**
11:30 - 12:30	489	526	1015	X/X	79	/X	73	/	**/X**
12:30 - 13:30	513	570	1083	X/X	94	/X	73	/	**/X**
13:30 - 14:30	507	597	1104	X/X	89	/X	77	/X	**/X**
14:30 - 15:30	583	604	1187	X/X	88	/X	83	/X	**/X**
15:30 - 16:30	712	563	1275	X/X	115	/X	28	/	**/X**
16:30 - 17:30	769	548	1317	X/X	127	/X	72	/	**/X**
17:30 - 18:30	658	587	1245	X/X	72	/	64	/	**/**
18:30 - 19:30	486	485	971	X/X	69	/	52	/	**/**
19:30 - 20:30			0	/		/		/	**/**
20:30 - 21:30			0	/		/		/	**/**
21:30 - 22:30			0	/		/		/	**/**
22:30 - 23:30			0	/		/		/	**/**
23:30 - 0:30			0	/		/		/	**/**

	Met (Hr)	Required (Hr)	
Warrant 1A	0	8	Not satisfied
Warrant 1B	**8**	8	**Satisfied**
Warrant 2	5	4	**Satisfied**
Warrant 3	0	1	Not satisfied
Warrant 7	**12**	8	**Satisfied, check accident record**

LOCATION: Rice St & Wheelock Pkwy
COUNTY: Ramsey
REF. POINT:
DATE: 7/21/2016
OPERATOR: KR

0.70 FACTOR USED? No
POPULATION < 10,000? No

Speed	Approach Description	Lanes
35	Major App1: NORTHBOUND - Rice St	1
35	Major App3: SOUTHBOUND - Rice St	1
30	Minor App2: EASTBOUND - Wheelock Pkwy	1
30	Minor App4: WESTBOUND - Wheelock Pkwy	1

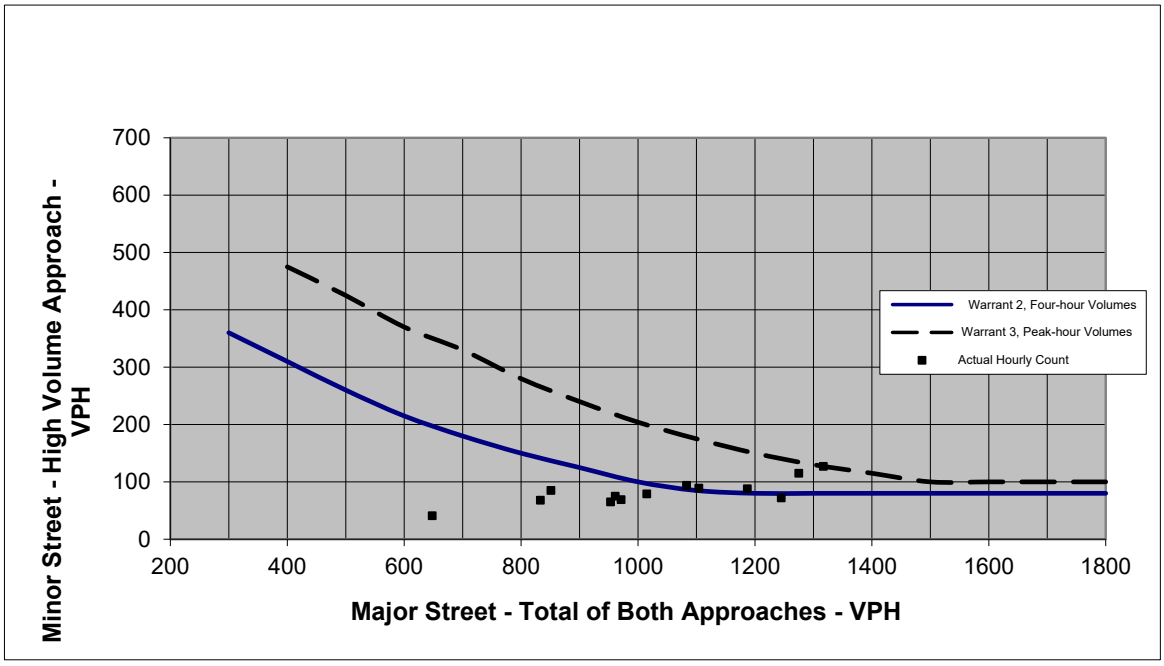

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			0	0
300	360		0	0
400	310	475	0	0
500	260	425	0	0
600	215	370	0	0
700	180	330	0	0
800	150	280	648	41
900	125	240	953	65
1000	100	204	851	85
1100	85	175	833	68
1200	80	150	961	75
1300	80	130	1015	79
1400	80	115	1083	94
1500	80	100	1104	89
1600	80	100	1187	88
1700	80	100	1275	115
1800	80	100	1317	127
			1245	72
			971	69
			0	0
			0	0
			0	0
			0	0
			0	0

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SIGNAL WARRANTS ANALYSIS FOR
Rice St & Nebraska Ave
(with minor street rights & 3 lane)

LOCATION: Rice St & Nebraska Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/12/2016
OPERATOR: KR

Speed	Approach Description		Lanes
35	Major App1:	NORTHBOUND - Rice St	1
35	Major App3:	SOUTHBOUND - Rice St	1
30	Minor App2:	EASTBOUND - Nebraska Ave	1
30	Minor App4:	WESTBOUND - Nebraska Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 60% 300/450 90/45 90/45

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:30 - 1:30			0	/		/		/	**/**
1:30 - 2:30			0	/		/		/	**/**
2:30 - 3:30			0	/		/		/	**/**
3:30 - 4:30			0	/		/		/	**/**
4:30 - 5:30			0	/		/		/	**/**
5:30 - 6:30			0	/		/		/	**/**
6:30 - 7:30	253	448	701	X/X	30	/	0	/	**/**
7:30 - 8:30	389	657	1046	X/X	60	/X	4	/	**/X**
8:30 - 9:30	409	532	941	X/X	62	/X	19	/	**/X**
9:30 - 10:30	430	481	911	X/X	52	/X	25	/	**/X**
10:30 - 11:30	533	532	1065	X/X	48	/X	22	/	**/X**
11:30 - 12:30	537	560	1097	X/X	57	/X	30	/	**/X**
12:30 - 13:30	573	606	1179	X/X	71	/X	31	/	**/X**
13:30 - 14:30	594	632	1226	X/X	62	/X	27	/	**/X**
14:30 - 15:30	646	640	1286	X/X	61	/X	30	/	**/X**
15:30 - 16:30	869	574	1443	X/X	39	/	52	/X	**/X**
16:30 - 17:30	912	536	1448	X/X	51	/X	58	/X	**/X**
17:30 - 18:30	740	620	1360	X/X	40	/X	22	/	**/X**
18:30 - 19:30	560	509	1069	X/X	39	/	20	/	**/**
19:30 - 20:30			0	/		/		/	**/**
20:30 - 21:30			0	/		/		/	**/**
21:30 - 22:30			0	/		/		/	**/**
22:30 - 23:30			0	/		/		/	**/**
23:30 - 0:30			0	/		/		/	**/**

	Met (Hr)	Required (Hr)	
Warrant 1A	0	8	Not satisfied
Warrant 1B	**11**	8	**Satisfied**
Warrant 2	0	4	Not satisfied
Warrant 3	0	1	Not satisfied
Warrant 7	**5**	8	Not satisfied

LOCATION: Rice St & Nebraska Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/12/2016
OPERATOR: KR

Speed	Approach Description	Lanes
35	Major App1: NORTHBOUND - Rice St	1
35	Major App3: SOUTHBOUND - Rice St	1
30	Minor App2: EASTBOUND - Nebraska Ave	1
30	Minor App4: WESTBOUND - Nebraska Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No

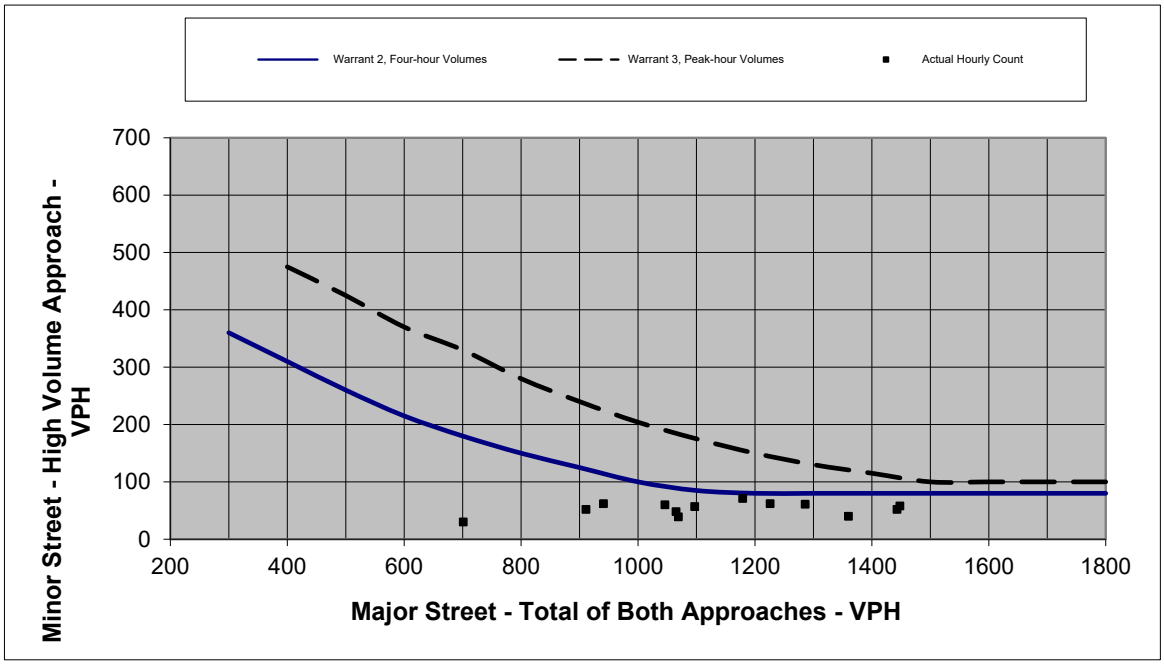

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			0	0
300	360		0	0
400	310	475	0	0
500	260	425	0	0
600	215	370	0	0
700	180	330	0	0
800	150	280	701	30
900	125	240	1046	60
1000	100	204	941	62
1100	85	175	911	52
1200	80	150	1065	48
1300	80	130	1097	57
1400	80	115	1179	71
1500	80	100	1226	62
1600	80	100	1286	61
1700	80	100	1443	52
1800	80	100	1448	58
			1360	40
			1069	39
			0	0
			0	0
			0	0
			0	0
			0	0

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SIGNAL WARRANTS ANALYSIS FOR

Rice St & Geranium Ave

LOCATION: Rice St & Geranium Ave
COUNTY: Ramsey
REF. POINT:
DATE: 10/10/2019
OPERATOR: KR

Speed	Approach Description		Lanes
30	Major App1:	NORTHBOUND - Rice St	1
30	Major App3:	SOUTHBOUND - Rice St	1
30	Minor App2:	EASTBOUND - Geranium Ave	1
30	Minor App4:	WESTBOUND - Geranium Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 60% 300/450 90/45 90/45

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:30 - 1:30			0	/		/		/	/
1:30 - 2:30			0	/		/		/	/
2:30 - 3:30			0	/		/		/	/
3:30 - 4:30			0	/		/		/	/
4:30 - 5:30			0	/		/		/	/
5:30 - 6:30			0	/		/		/	/
6:30 - 7:30	156	408	564	X/X	10	/	9	/	/
7:30 - 8:30	280	576	856	X/X	9	/	2	/	/
8:30 - 9:30	388	468	856	X/X	13	/	7	/	/
9:30 - 10:30	429	421	850	X/X	11	/	9	/	/
10:30 - 11:30	515	468	983	X/X	11	/	8	/	/
11:30 - 12:30	559	492	1051	X/X	13	/	11	/	/
12:30 - 13:30	581	532	1113	X/X	14	/	11	/	/
13:30 - 14:30	564	554	1118	X/X	14	/	11	/	/
14:30 - 15:30	665	558	1223	X/X	13	/	11	/	/
15:30 - 16:30	867	513	1380	X/X	27	/	11	/	/
16:30 - 17:30	1059	468	1527	X/X	18	/	21	/	/
17:30 - 18:30	748	540	1288	X/X	12	/	9	/	/
18:30 - 19:30	543	440	983	X/X	10	/	7	/	/
19:30 - 20:30			0	/		/		/	/
20:30 - 21:30			0	/		/		/	/
21:30 - 22:30			0	/		/		/	/
22:30 - 23:30			0	/		/		/	/
23:30 - 0:30			0	/		/		/	/

	Met (Hr)	Required (Hr)	
Warrant 1A	0	8	Not satisfied
Warrant 1B	0	8	Not satisfied
Warrant 2	0	4	Not satisfied
Warrant 3	0	1	Not satisfied
Warrant 7	0	8	Not satisfied

LOCATION: Rice St & Geranium Ave
COUNTY: Ramsey
REF. POINT:
DATE: 10/10/2019
OPERATOR: KR

Speed	Approach Description	Lanes
30	Major App1: NORTHBOUND - Rice St	1
30	Major App3: SOUTHBOUND - Rice St	1
30	Minor App2: EASTBOUND - Geranium Ave	1
30	Minor App4: WESTBOUND - Geranium Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No

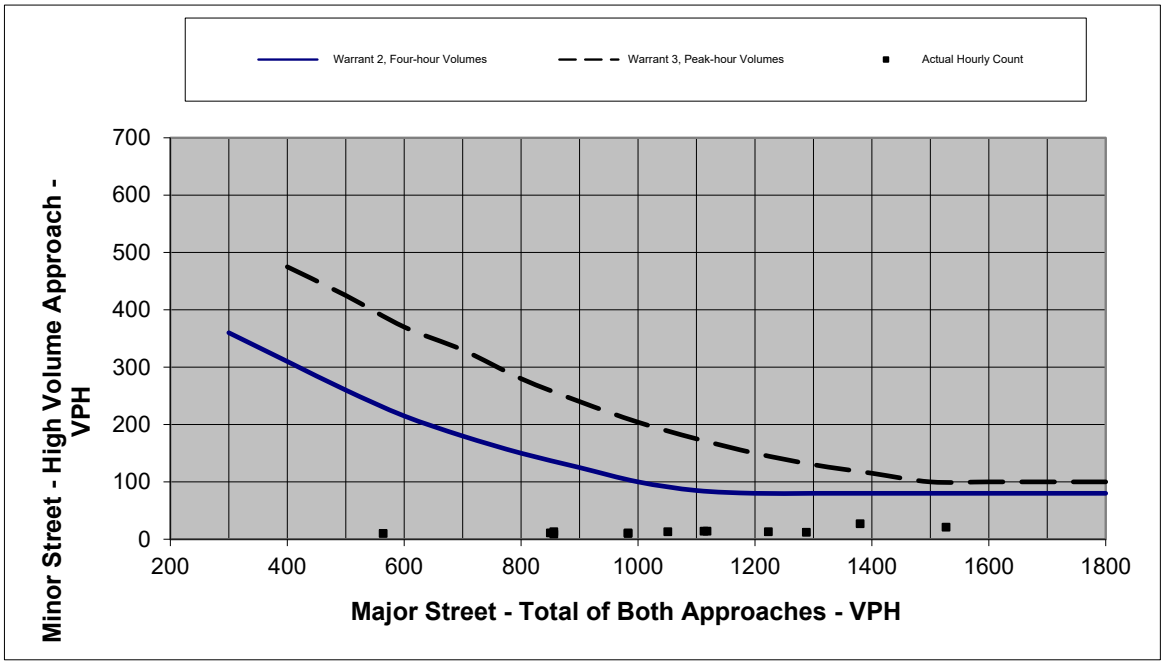

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			0	0
300	360		0	0
400	310	475	0	0
500	260	425	0	0
600	215	370	0	0
700	180	330	0	0
800	150	280	564	10
900	125	240	856	9
1000	100	204	856	13
1100	85	175	850	11
1200	80	150	983	11
1300	80	130	1051	13
1400	80	115	1113	14
1500	80	100	1118	14
1600	80	100	1223	13
1700	80	100	1380	27
1800	80	100	1527	21
			1288	12
			983	10
			0	0
			0	0
			0	0
			0	0
			0	0

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SIGNAL WARRANTS ANALYSIS FOR

Rice St & Geranium Ave

(With Minor Street Rights and Displaced Movements from Rose Ave)

LOCATION: Rice St & Geranium Ave
COUNTY: Ramsey
REF. POINT:
DATE: 12/16/2021
OPERATOR: KR

Speed	Approach Description		Lanes
30	Major App1:	NORTHBOUND - Rice St	1
30	Major App3:	SOUTHBOUND - Rice St	1
30	Minor App2:	EASTBOUND - Geranium Ave	1
30	Minor App4:	WESTBOUND - Geranium Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A Yes

THRESHOLDS 1A/1B: 60% 300/450 90/45 90/45

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:00 - 1:00	47	43	90	/	2	/	2	/	**/**
1:00 - 2:00	32	36	68	/	3	/	0	/	**/**
2:00 - 3:00	16	31	47	/	1	/	1	/	**/**
3:00 - 4:00	12	19	31	/	1	/	1	/	**/**
4:00 - 5:00	28	27	55	/	4	/	2	/	**/**
5:00 - 6:00	71	77	148	/	6	/	2	/	**/**
6:00 - 7:00	136	162	298	/	7	/	6	/	**/**
7:00 - 8:00	216	274	490	X/X	28	/	17	/	**/**
8:00 - 9:00	212	307	519	X/X	13	/	11	/	**/**
9:00 - 10:00	314	343	657	X/X	21	/	15	/	**/**
10:00 - 11:00	300	301	601	X/X	7	/	11	/	**/**
11:00 - 12:00	297	302	599	X/X	22	/	9	/	**/**
12:00 - 13:00	356	311	667	X/X	26	/	12	/	**/**
13:00 - 14:00	382	356	738	X/X	23	/	6	/	**/**
14:00 - 15:00	448	448	896	X/X	46	/X	17	/	**/X**
15:00 - 16:00	510	459	969	X/X	40	/	26	/	**/**
16:00 - 17:00	603	460	1063	X/X	33	/	20	/	**/**
17:00 - 18:00	423	537	960	X/X	28	/	15	/	**/**
18:00 - 19:00	317	327	644	X/X	22	/	8	/	**/**
19:00 - 20:00	227	285	512	X/X	38	/	8	/	**/**
20:00 - 21:00	163	192	355	X/	22	/	7	/	**/**
21:00 - 22:00	154	140	294	/	7	/	3	/	**/**
22:00 - 23:00	121	124	245	/	9	/	4	/	**/**
23:00 - 24:00	88	83	171	/	4	/	3	/	**/**

	Met (Hr)	Required (Hr)	
Warrant 1A	0	8	Not satisfied
Warrant 1B	1	8	Not satisfied
Warrant 2	0	4	Not satisfied
Warrant 3	0	1	Not satisfied
Warrant 7	0	8	Not satisfied

LOCATION: Rice St & Geranium Ave
COUNTY: Ramsey
REF. POINT:
DATE: 12/16/2021
OPERATOR: KR

Speed	Approach Description	Lanes
30	Major App1: NORTHBOUND - Rice St	1
30	Major App3: SOUTHBOUND - Rice St	1
30	Minor App2: EASTBOUND - Geranium Ave	1
30	Minor App4: WESTBOUND - Geranium Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No

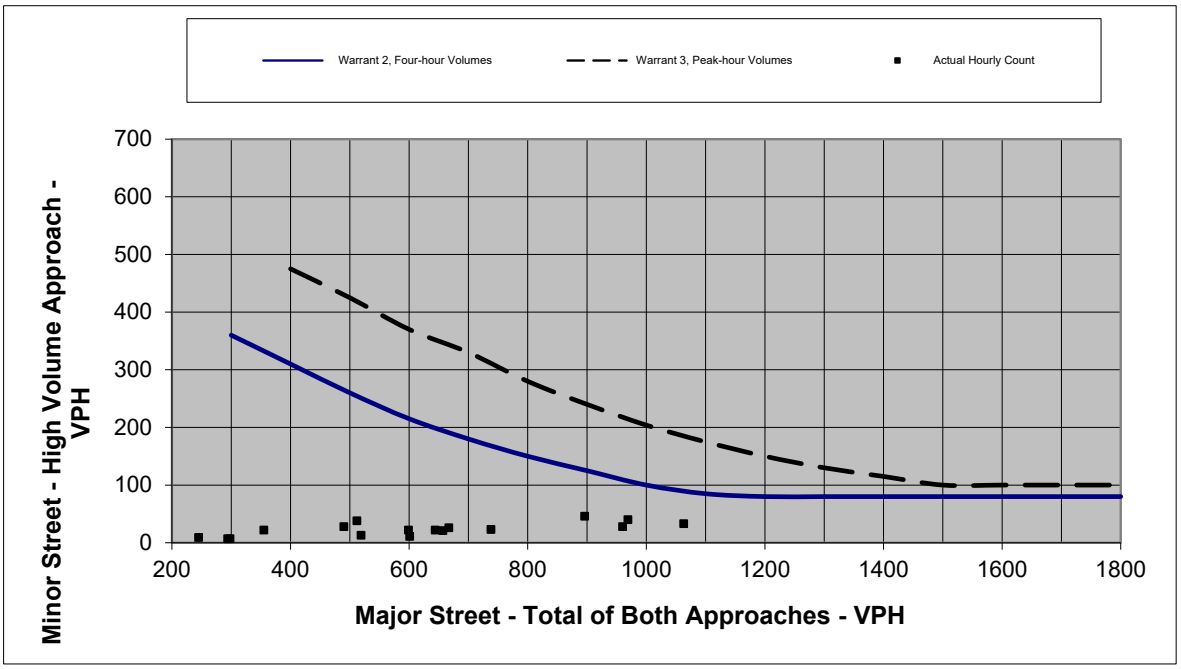

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			90	2
300	360		68	3
400	310	475	47	1
500	260	425	31	1
600	215	370	55	4
700	180	330	148	6
800	150	280	298	7
900	125	240	490	28
1000	100	204	519	13
1100	85	175	657	21
1200	80	150	601	11
1300	80	130	599	22
1400	80	115	667	26
1500	80	100	738	23
1600	80	100	896	46
1700	80	100	969	40
1800	80	100	1063	33
			960	28
			644	22
			512	38
			355	22
			294	7
			245	9
			171	4

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SIGNAL WARRANTS ANALYSIS FOR

Rice St & Lawson Ave

LOCATION: Rice St & Lawson Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/21/2016
OPERATOR: KR

Speed	Approach Description		Lanes
30	Major App1:	NORTHBOUND - Rice St	1
30	Major App3:	SOUTHBOUND - Rice St	1
30	Minor App2:	EASTBOUND - Lawson Ave	1
30	Minor App4:	WESTBOUND - Lawson Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 500/750 150/75 150/75

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:30 - 1:30			0	/		/		/	/
1:30 - 2:30			0	/		/		/	/
2:30 - 3:30			0	/		/		/	/
3:30 - 4:30			0	/		/		/	/
4:30 - 5:30			0	/		/		/	/
5:30 - 6:30			0	/		/		/	/
6:30 - 7:30	140	402	542	X/	6	/	3	/	/
7:30 - 8:30	257	598	855	X/X	21	/	13	/	/
8:30 - 9:30			0	/		/		/	/
9:30 - 10:30			0	/		/		/	/
10:30 - 11:30			0	/		/		/	/
11:30 - 12:30			0	/		/		/	/
12:30 - 13:30			0	/		/		/	/
13:30 - 14:30			0	/		/		/	/
14:30 - 15:30			0	/		/		/	/
15:30 - 16:30	783	465	1248	X/X	17	/	9	/	/
16:30 - 17:30	848	447	1295	X/X	34	/	11	/	/
17:30 - 18:30			0	/		/		/	/
18:30 - 19:30			0	/		/		/	/
19:30 - 20:30			0	/		/		/	/
20:30 - 21:30			0	/		/		/	/
21:30 - 22:30			0	/		/		/	/
22:30 - 23:30			0	/		/		/	/
23:30 - 0:30			0	/		/		/	/

	Met (Hr)	Required (Hr)	
Warrant 1A	0	8	Not satisfied
Warrant 1B	0	8	Not satisfied
Warrant 2	0	4	Not satisfied
Warrant 3	0	1	Not satisfied
Warrant 7	0	8	Not satisfied

LOCATION: Rice St & Lawson Ave
COUNTY: Ramsey
REF. POINT:
DATE: 7/21/2016

OPERATOR: KR

0.70 FACTOR USED? No
POPULATION < 10,000? No

Speed	Approach Description	Lanes
30	Major App1: NORTHBOUND - Rice St	1
30	Major App3: SOUTHBOUND - Rice St	1
30	Minor App2: EASTBOUND - Lawson Ave	1
30	Minor App4: WESTBOUND - Lawson Ave	1

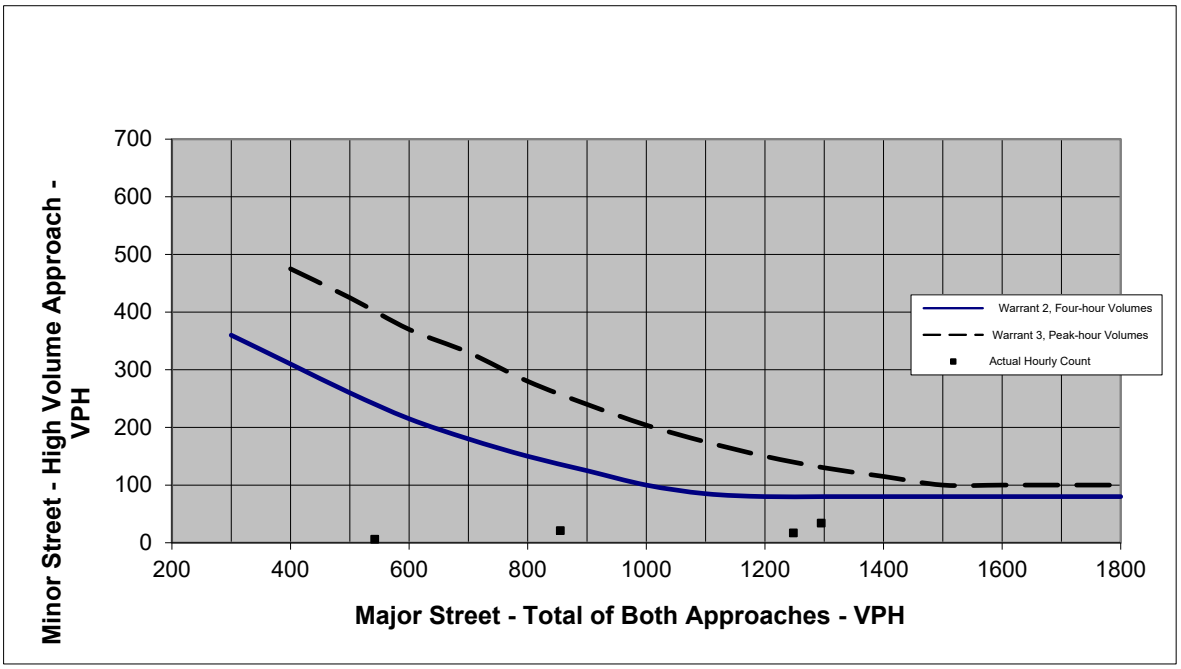

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			0	0
300	360		0	0
400	310	475	0	0
500	260	425	0	0
600	215	370	0	0
700	180	330	0	0
800	150	280	542	6
900	125	240	855	21
1000	100	204	0	0
1100	85	175	0	0
1200	80	150	0	0
1300	80	130	0	0
1400	80	115	0	0
1500	80	100	0	0
1600	80	100	0	0
1700	80	100	1248	17
1800	80	100	1295	34
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0
			0	0

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SIGNAL WARRANTS ANALYSIS FOR
Rice St & Lawson Ave
(with minor street rights)

LOCATION: Rice St & Lawson Ave
COUNTY: Ramsey
REF. POINT:
DATE: 12/14/2021
OPERATOR: KR

Speed	Approach Description		Lanes
30	Major App1:	NORTHBOUND - Rice St	1
30	Major App3:	SOUTHBOUND - Rice St	1
30	Minor App2:	EASTBOUND - Lawson Ave	1
30	Minor App4:	WESTBOUND - Lawson Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No
N/A No

THRESHOLDS 1A/1B: 500/750 150/75 150/75

HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 (	**MET SAME 1A/1B**
0:00 - 1:00	60	53	113	/	4	/	2	/	/
1:00 - 2:00	36	45	81	/	4	/	0	/	/
2:00 - 3:00	26	27	53	/	1	/	1	/	/
3:00 - 4:00	21	10	31	/	3	/	1	/	/
4:00 - 5:00	18	36	54	/	2	/	0	/	/
5:00 - 6:00	51	76	127	/	5	/	2	/	/
6:00 - 7:00	138	168	306	/	13	/	3	/	/
7:00 - 8:00	217	268	485	/	9	/	10	/	/
8:00 - 9:00	219	294	513	X/	8	/	5	/	/
9:00 - 10:00	255	289	544	X/	70	/	12	/	/
10:00 - 11:00	353	290	643	X/	25	/	7	/	/
11:00 - 12:00	354	334	688	X/	17	/	14	/	/
12:00 - 13:00	342	324	666	X/	15	/	14	/	/
13:00 - 14:00	415	321	736	X/	19	/	9	/	/
14:00 - 15:00	428	438	866	X/X	33	/	9	/	/
15:00 - 16:00	541	416	957	X/X	32	/	11	/	/
16:00 - 17:00	502	374	876	X/X	73	/	22	/	/
17:00 - 18:00	461	343	804	X/X	38	/	9	/	/
18:00 - 19:00	279	273	552	X/	28	/	1	/	/
19:00 - 20:00	203	205	408	/	11	/	3	/	/
20:00 - 21:00	159	188	347	/	13	/	3	/	/
21:00 - 22:00	161	169	330	/	13	/	3	/	/
22:00 - 23:00	117	120	237	/	4	/	1	/	/
23:00 - 24:00	83	63	146	/	4	/	4	/	/

	Met (Hr)	Required (Hr)	
Warrant 1A	0	8	Not satisfied
Warrant 1B	0	8	Not satisfied
Warrant 2	0	4	Not satisfied
Warrant 3	0	1	Not satisfied
Warrant 7	1	8	Not satisfied

LOCATION: Rice St & Lawson Ave
COUNTY: Ramsey
REF. POINT:
DATE: 12/14/2021
OPERATOR: KR

Speed	Approach Description	Lanes
30	Major App1: NORTHBOUND - Rice St	1
30	Major App3: SOUTHBOUND - Rice St	1
30	Minor App2: EASTBOUND - Lawson Ave	1
30	Minor App4: WESTBOUND - Lawson Ave	1

0.70 FACTOR USED? No
POPULATION < 10,000? No

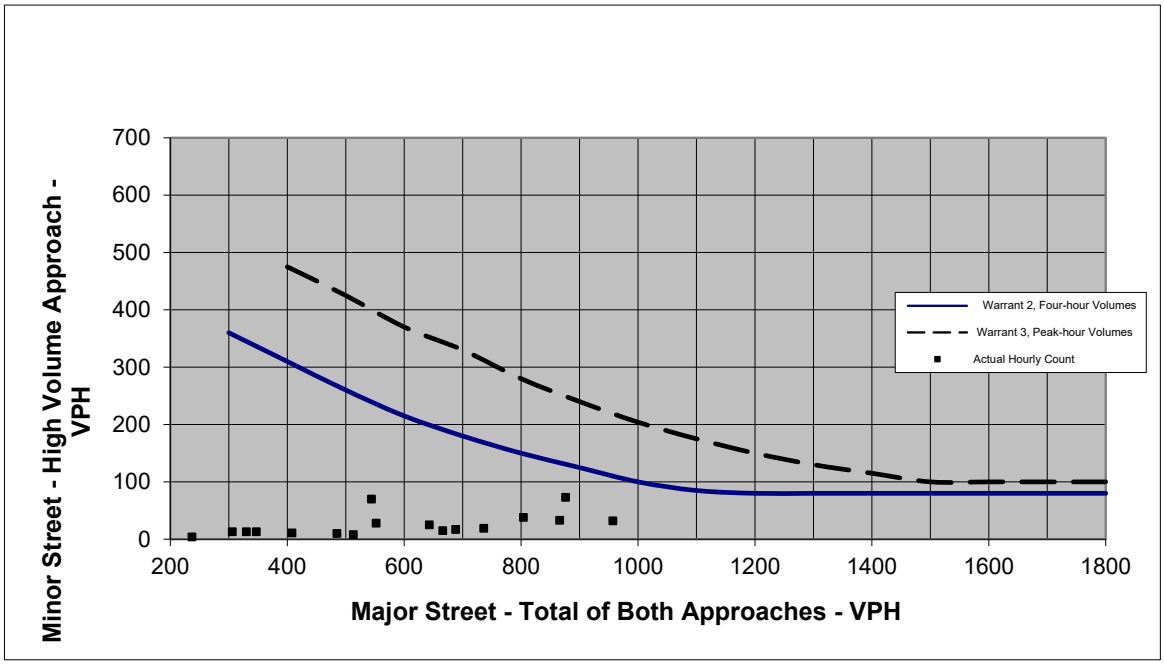

Figure 1. Four Hour and Peak Hour Warrant Analysis

Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2,	Warrant 3, Pe	Major	Actual Hourly Count
200			113	4
300	360		81	4
400	310	475	53	1
500	260	425	31	3
600	215	370	54	2
700	180	330	127	5
800	150	280	306	13
900	125	240	485	10
1000	100	204	513	8
1100	85	175	544	70
1200	80	150	643	25
1300	80	130	688	17
1400	80	115	666	15
1500	80	100	736	19
1600	80	100	866	33
1700	80	100	957	32
1800	80	100	876	73
			804	38
			552	28
			408	11
			347	13
			330	13
			237	4
			146	4

Appendix D: Detailed Operational Results (Build Condition)

Project: Rice Street Visioning Study
Scenario: Build - Three Lane (Vissim)

		Build AM Peak Hour																		
		Traffic Volumes (veh)				Traffic Delay (sec/veh)					Traffic Queuing (feet)									
Intersection	Approach	Demand Volumes				Movement (Delay - LOS)			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn			Through			Right Turn		
		L	T	R	Total	L	T	R			Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Pennsylvania Ave at Rice St *Signalized Intersection*	EB	88	305	9	402	24 - C	23 - C	19 - B	24 - C	32 - C	125	50	150	175	50	150	-	50	150
	WB	68	350	37	455	20 - C	25 - C	21 - C	24 - C		200	50	200	225	50	175	-	50	200
	NB	9	196	75	280	65 - E	25 - C	14 - B	24 - C		-	50	275	85	50	275	-	50	275
	SB	60	432	54	546	42 - D	48 - D	43 - D	47 - D		-	25	100	160	225	1050	-	225	1075
Sycamore St at Rice St *Signalized Intersection*	EB	6	2	6	14	26 - C	22 - C	14 - B	20 - C	14 - B	-	25	50	240	25	50	-	25	50
	WB	51	7	27	85	25 - C	28 - C	9 - A	21 - C		-	25	125	100	25	125	-	25	125
	NB	7	279	35	321	17 - B	14 - B	11 - B	14 - B		-	0	50	60	25	275	-	25	300
	SB	38	489	6	533	16 - B	13 - B	11 - B	14 - B		-	25	75	250	50	450	-	50	450
Atwater St at Rice St *Signalized Intersection*	EB	17	7	60	84	23 - C	25 - C	16 - B	19 - B	23 - C	-	25	100	210	25	100	-	25	100
	WB	7	9	2	18	31 - C	27 - C	7 - A	27 - C		-	25	50	50	25	50	-	25	50
	NB	27	285	6	318	31 - C	17 - B	18 - B	19 - B		-	25	75	250	25	275	-	25	275
	SB	4	525	24	553	20 - C	27 - C	26 - C	27 - C		-	0	50	50	100	800	-	125	800
Wayzata St at Rice St *Stop Control*	NB	-	294	10	304	-	3 - A	3 - A	3 - A	2 - A	-	-	-	60	0	0	-	0	0
	SB	-	553	-	553	6 - A	2 - A	-	2 - A		-	0	25	25	25	225	-	-	-
Front Ave at Rice St *Signalized Intersection*	EB	59	11	27	97	27 - C	23 - C	16 - B	24 - C	22 - C	-	25	100	25	25	100	-	25	100
	WB	12	18	6	36	27 - C	26 - C	7 - A	24 - C		-	25	75	35	25	75	-	25	75
	NB	32	245	17	294	31 - C	14 - B	11 - B	16 - B		-	25	100	80	25	325	-	25	350
	SB	8	514	67	589	18 - B	24 - C	23 - C	24 - C		-	0	25	40	125	675	-	125	675
Lawson Ave at Rice St *Stop Control*	EB	9	2	7	18	35 - E	31 - D	23 - C	31 - D	4 - A	-	25	50	290	25	50	-	25	50
	WB	6	2	4	12	32 - D	34 - D	7 - A	24 - C		-	25	50	120	25	50	-	25	50
	NB	17	295	7	319	15 - C	3 - A	4 - A	4 - A		-	25	50	125	25	250	-	25	250
	SB	3	582	14	599	6 - A	4 - A	4 - A	5 - A		-	0	25	25	25	350	-	25	350
Cook Ave S at Rice St *Stop Control*	WB	-	-	2	2	-	-	10 - B	10 - B	2 - A	-	-	-	-	-	-	-	0	25
	NB	-	301	7	308	-	5 - A	4 - A	5 - A		-	-	-	225	25	250	-	25	250
	SB	-	593	-	593	-	1 - A	-	1 - A		-	-	-	75	25	125	-	-	-
Cook Ave N at Rice St *Stop Control*	EB	-	-	16	16	-	-	20 - C	20 - C	1 - A	-	-	-	290	-	-	-	25	50
	WB	-	-	4	4	-	-	10 - B	10 - B		-	-	-	-	-	-	-	0	25
	NB	-	290	-	290	-	1 - A	0 - A	1 - A		-	-	-	75	25	125	-	0	125
	SB		577	12	589	-	1 - A	1 - A	1 - A		-	-	-	40	25	125	-	25	125
Jessamine Ave S at Rice St *Stop Control*	EB	6		9	15	18 - C	-	17 - C	18 - C	1 - A	-	25	50	-	-	-	-	25	50
	NB	4	293	-	297	6 - A	0 - A	-	1 - A		-	0	25	35	0	0	-	-	-
	SB		582	7	589	-	0 - A	-1 - A	-1 - A		-	-	-	-	0	0	-	0	0
Jessamine Ave N at Rice St *Stop Control*	WB	7	-	7	14	27 - D	-	11 - B	19 - C	1 - A	-	25	50	-	-	-	-	25	50
	NB		291	5	296	-	0 - A	-1 - A	-1 - A		-	-	-	-	0	25	-	0	25
	SB	4	583	-	587	1 - A	0 - A	-	1 - A		-	0	25	-	0	0	-	-	-
Geranium Ave at Rice St *Signalized Intersection*	EB	4	0	6	10	29 - D	-	16 - C	21 - C	3 - A	-	0	50	80	-	-	-	0	50
	WB	2	2	2	6	24 - C	29 - D	9 - A	21 - C		-	0	50	60	0	50	-	0	50
	NB	11	284	3	298	10 - B	2 - A	5 - A	3 - A		-	0	25	125	25	250	-	25	275
	SB	0	579	15	594	1 - A	2 - A	2 - A	2 - A		-	0	0	125	25	350	-	25	400
Maryland Ave at Rice St *Signalized Intersection*	EB	92	247	32	371	29 - C	30 - C	25 - C	30 - C	41 - D	150	25	125	75	25	150	-	25	150
	WB	120	332	94	546	26 - C	32 - C	24 - C	30 - C		265	25	150	65	50	200	-	50	200
	NB	17	203	70	290	29 - C	24 - C	18 - B	23 - C		-	25	75	90	50	325	-	50	350
	SB	94	442	101	637	47 - D	64 - E	66 - E	63 - E		-	25	125	75	375	1600	-	350	1600
Cottage Ave at Rice St *Stop Control*	EB	10	0	51	61	33 - D	46 - E	22 - C	25 - D	5 - A	-	25	100	110	25	100	-	25	100
	WB	4	0	6	10	14 - B	17 - C	12 - B	14 - B		-	25	50	140	0	50	-	0	50
	NB	28	382	5	415	10 - B	6 - A	8 - A	7 - A		-	25	50	475	25	325	-	25	325
	SB	6	643	4	653	6 - A	3 - A	1 - A	4 - A		-	0	25	150	25	225	-	25	225
Arlington Ave at Rice St *Signalized Intersection*	EB	61	62	35	158	44 - D	32 - C	20 - C	34 - C	20 - C	-	25	125	75	25	125	-	25	125
	WB	55	84	71	210	38 - D	35 - D	23 - C	32 - C		-	50	150	25	50	150	-	25	150
	NB	20	341	37	398	16 - B	14 - B	10 - B	14 - B		-	25	50	25	25	400	-	25	400
	SB	75	563	30	668	15 - B	16 - B	15 - B	16 - B		-	25	100	100	75	625	-	75	625
Nebraska Ave at Rice St *Signalized Intersection*	EB	24	0	68	92	34 - C	43 - D	20 - C	24 - C	16 - B	-	25	150	90	25	150	-	25	150
	WB	0	0	2	2	76 - E	49 - D	10 - B	10 - B		-	0	25	-	0	25	-	0	25
	NB	122	350	1	473	27 - C	11 - B	8 - A	15 - B		-	25	150	235	25	325	-	25	325
	SB	1	600	50	651	10 - B	17 - B	16 - B	17 - B		-	0	25	200	100	375	-	100	375
Montana Ave at Rice St *Stop Control*	EB	7	1	31	39	30 - D	35 - E	43 - E	41 - E	6 - A	-	25	75	-	25	75	-	25	75
	WB	14	0	3	17	34 - D	-	10 - B	30 - D		-	25	50	285	-	-	-	25	50
	NB	4	363	9	376	9 - A	1 - A	1 - A	2 - A		-	0	25	50	0	50	-	0	50
	SB	7	613	2	622	5 - A	6 - A	2 - A	6 - A		-	0	25	35	25	350	-	25	350
Hoyt Ave at Rice St *Stop Control*	EB	-	-	44	44	-	-	21 - C	21 - C	5 - A	-	-	-	75	-	-	-	25	75
	WB	-	-	11	11	-	-	7 - A	7 - A		-	-	-	35	-	-	-	0	50
	NB	14	348	11	373	8 - A	2 - A	3 - A	3 - A		-	25	50	50	25	275	-	25	275
	SB	-	566	23	589	-	6 - A	7 - A	7 - A		-	-	-	285	25	550	-	25	550
Wheelock Pkwy at Rice St *Signalized Intersection*	EB	58	7	36	101	27 - C	25 - C	11 - B	21 - C	18 - B	-	25	100	80	25	100	-	25	100
	WB	21	17	37	75	7 - A	27 - C	9 - A	13 - B		-	25	75	100	25	75	-	25	75
	NB	18	351	12	381	26 - C	15 - B	14 - B	16 - B		200	25	50	65	25	400	-	25	400
	SB	9	537	28	574	23 - C	19 - B	18 - B	20 - C		75	25	50	80	75	525	-	75	525

Project: Rice Street Visioning Study
Scenario: Build - Three Lane - 140 Second Cycle (Vissim)

		Build PM Peak Hour - 140 Second Cycle Length																		
		Traffic Volumes (veh)				Traffic Delay (sec/veh)					Traffic Queuing (feet)									
		Demand Volumes				Movement (Delay - LOS)			Approach	Intersection	Left Turn			Through			Right Turn		
Intersection	Approach	L	T	R	Total	L	T	R	(Delay - LOS)	(Delay - LOS)	Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Pennsylvania Ave at Rice St *Signalized Intersection*	EB	183	701	25	909	143 - F	46 - D	40 - D	66 - E	64 - E	125	225	600	175	225	600	-	225	600
	WB	67	406	106	579	45 - D	47 - D	48 - D	47 - D		200	100	325	225	100	325	-	100	325
	NB	17	595	158	770	87 - F	89 - F	94 - F	90 - F		-	375	650	85	375	650	-	375	650
	SB	75	384	67	526	63 - E	46 - D	42 - D	48 - D		-	25	150	160	175	925	-	175	925
Sycamore St at Rice St *Signalized Intersection*	EB	6	7	11	24	72 - E	52 - D	13 - B	37 - D	65 - E	-	25	75	240	25	75	-	25	75
	WB	58	4	85	147	64 - E	70 - E	55 - E	60 - E		-	50	250	100	50	250	-	50	250
	NB	8	771	105	884	39 - D	102 - F	104 - F	102 - F		-	0	25	60	700	1625	-	725	1625
	SB	56	457	6	519	75 - E	9 - A	9 - A	17 - B		-	25	275	250	50	575	-	50	575
Atwater St at Rice St *Signalized Intersection*	EB	34	29	60	123	76 - E	67 - E	34 - C	54 - D	36 - D	-	50	225	210	50	225	-	50	225
	WB	24	15	15	54	72 - E	64 - E	29 - C	58 - E		-	25	125	50	25	125	-	25	125
	NB	42	908	10	960	39 - D	42 - D	43 - D	42 - D		-	25	75	250	300	725	-	300	725
	SB	4	449	17	470	69 - E	18 - B	15 - B	19 - B		-	25	50	50	50	625	-	50	625
Wayzata St at Rice St *Stop Control*	NB		954	3	957	-	43 - E	48 - E	44 - D	28 - D	-	-	-	60	325	900	-	325	900
	SB	2	470		472	23 - C	1 - A	-	2 - A		-	0	25	25	25	150	-	-	-
Front Ave at Rice St *Signalized Intersection*	EB	129	33	54	216	220 - F	216 - F	181 - F	211 - F	51 - D	-	325	800	25	325	800	-	325	800
	WB	20	30	27	77	71 - E	75 - E	33 - C	60 - E		-	25	150	35	25	150	-	25	150
	NB	38	902	14	954	36 - D	33 - C	32 - C	34 - C		-	25	225	80	225	500	-	225	500
	SB	8	398	79	485	52 - D	12 - B	10 - B	13 - B		-	25	50	40	50	425	-	50	425
Lawson Ave at Rice St *Stop Control*	EB	15	3	12	30	150 - F	54 - F	27 - D	95 - F	26 - D	-	25	100	290	25	100	-	25	100
	WB	8	3	11	22	70 - F	64 - F	57 - F	65 - F		-	25	75	120	25	75	-	25	75
	NB	24	1043	6	1073	25 - D	35 - E	17 - C	35 - E		-	0	50	125	275	675	-	275	675
	SB	15	470	13	498	24 - C	3 - A	2 - A	4 - A		-	25	50	25	25	325	-	25	325
Cook Ave S at Rice St *Stop Control*	WB	-		9	9	-	-	64 - F	64 - F	14 - B	-	-	-	-	-	-	-	25	50
	NB		1060	9	1069	-	20 - C	18 - C	20 - C		-	-	-	225	175	400	-	150	375
	SB	-	486		486	-	0 - A	-	0 - A		-	-	-	75	25	100	-	-	-
Cook Ave N at Rice St *Stop Control*	EB	-		17	17	-	-	16 - C	16 - C	3 - A	-	-	-	290	-	-	-	25	75
	WB	-	1	9	10	-	-	43 - E	43 - E		-	-	-	-	-	-	-	25	50
	NB	-	1054		1054	-	4 - A	-1 - A	4 - A		-	-	-	75	25	125	-	25	125
	SB		473	9	482	-	0 - A	1 - A	1 - A		-	-	-	40	0	25	-	0	25
Jessamine Ave S at Rice St *Stop Control*	EB	8		8	16	95 - F	-	15 - C	50 - F	12 - B	-	25	50	-	-	-	-	25	50
	NB	16	1048		1064	14 - B	18 - C	-	18 - C		-	0	50	35	125	450	-	-	-
	SB		474	5	479	-	0 - A	0 - A	0 - A		-	-	-	-	0	0	-	0	0
Jessamine Ave N at Rice St *Stop Control*	WB	7		12	19	32 - D	-	72 - F	54 - F	4 - A	-	25	50	-	-	-	-	25	50
	NB		1037	15	1052	-	4 - A	0 - A	4 - A		-	-	-	-	50	150	-	50	150
	SB	12	472		484	17 - C	0 - A	-	1 - A		-	25	50	-	0	0	-	-	-
Geranium Ave at Rice St *Signalized Intersection*	EB	8	2	7	17	153 - F	81 - F	23 - C	98 - F	16 - C	-	25	75	80	25	75	-	25	75
	WB	6	7	6	19	74 - F	76 - F	75 - F	76 - F		-	25	75	60	25	75	-	25	75
	NB	15	1012	22	1049	12 - B	22 - C	19 - C	22 - C		-	0	50	125	125	350	-	150	400
	SB	10	471	8	489	34 - D	2 - A	3 - A	3 - A		-	25	50	125	25	350	-	25	400
Maryland Ave at Rice St *Signalized Intersection*	EB	198	493	29	720	111 - F	60 - E	55 - E	75 - E	59 - E	150	150	475	75	125	475	-	125	475
	WB	129	341	107	577	125 - F	71 - E	68 - E	83 - F		265	100	375	65	125	350	-	125	350
	NB	21	823	182	1026	42 - D	49 - D	46 - D	49 - D		-	25	50	90	375	700	-	375	700
	SB	63	331	110	504	67 - E	30 - C	26 - C	34 - C		-	25	150	75	75	700	-	75	700
Cottage Ave at Rice St *Stop Control*	EB	14	-	28	42	335 - F	-	82 - F	146 - F	31 - D	-	50	175	110	-	-	-	50	175
	WB	4	-	11	15	23 - C	-	71 - F	58 - F		-	25	50	140	-	-	-	25	50
	NB	17	958	11	986	17 - C	44 - E	48 - E	43 - E		-	25	75	475	375	1675	-	375	1675
	SB	6	523	14	543	36 - E	2 - A	1 - A	3 - A		-	25	50	150	25	150	-	25	150
Arlington Ave at Rice St *Signalized Intersection*	EB	51	165	30	246	150 - F	62 - E	45 - D	79 - E	44 - D	-	75	325	75	75	325	-	75	325
	WB	57	109	104	270	83 - F	69 - E	55 - E	67 - E		-	75	325	25	75	325	-	75	325
	NB	39	792	152	983	27 - C	41 - D	38 - D	41 - D		-	25	75	25	325	700	-	325	700
	SB	97	456	57	610	79 - E	18 - B	14 - B	28 - C		-	50	300	100	75	575	-	75	575
Nebraska Ave at Rice St *Signalized Intersection*	EB	13	-	34	47	70 - E	-	22 - C	37 - D	15 - B	-	25	75	90	-	-	-	25	75
	WB	14	11	28	53	58 - E	55 - E	34 - C	45 - D		-	25	100	-	25	100	-	25	100
	NB	62	875	10	947	21 - C	16 - B	16 - B	17 - B		-	25	75	235	125	700	-	125	700
	SB	3	562	23	588	29 - C	9 - A	9 - A	10 - B		-	0	25	200	50	375	-	50	375
Montana Ave at Rice St *Stop Control*	EB	3	-	28	31	53 - F	-	20 - C	25 - D	5 - A	-	25	50	-	-	-	-	25	50
	WB	13	0	2	15	62 - F	42 - E	44 - E	58 - F		-	25	50	285	25	50	-	25	50
	NB	3	886	27	916	7 - A	6 - A	4 - A	6 - A		-	0	25	50	25	300	-	25	300
	SB	15	551	0	566	18 - C	2 - A	-	3 - A		-	25	50	35	25	275	-	-	-
Hoyt Ave at Rice St *Stop Control*	EB	-	-	19	19	-	-	17 - C	17 - C	8 - A	-	-	-	75	-	-	-	25	50
	WB	-	-	9	9	-	-	81 - F	81 - F		-	-	-	35	-	-	-	25	50
	NB	42	835	14	891	10 - B	11 - B	7 - A	11 - B		-	25	75	50	50	350	-	50	350
	SB	-	528	17	545	-	3 - A	3 - A	3 - A		-	-	-	285	25	425	-	25	425
Wheelock Pkwy at Rice St *Signalized Intersection*	EB	102	13	60	175	129 - F	114 - F	89 - F	114 - F	37 - D	-	125	525	80	125	525	-	125	525
	WB	16	39	35	90	28 - C	56 - E	36 - D	44 - D		-	25	175	100	25	175	-	25	175
	NB	33	769	55	857	40 - D	40 - D	35 - D	40 - D		200	25	100	65	300	675	-	300	700
	SB	11	484	62	557	60 - E	9 - A	8 - A	11 - B		75	25	50	80	25	350	-	25	350

Project: Rice Street Visioning Study

Scenario: Build - Three Lane - 140 Second Cycle and 15% Less NBT Vehicles (Vissim)

		Build PM Peak Hour - 140 Second Cycle Length - 15% Less NBT Vehicles																	
		Traffic Volumes (veh)				Traffic Delay (sec/veh)					Traffic Queuing (feet)								
Intersection	Approach	Demand Volumes				Movement (Delay - LOS)			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn			Through			Right Turn		
		L	T	R	Total	L	T	R			Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Pennsylvania Ave at Rice St *Signalized Intersection*	EB	183	701	25	909	77 - E	42 - D	39 - D	50 - D	46 - D	125	150	550	175	150	550	-	150	550
	WB	67	406	106	579	42 - D	45 - D	41 - D	44 - D		200	75	325	225	75	325	-	75	325
	NB	17	472	158	647	59 - E	43 - D	40 - D	43 - D		-	175	550	85	175	550	-	175	550
	SB	75	384	67	526	50 - D	46 - D	41 - D	46 - D		-	25	150	160	175	925	-	175	925
Sycamore St at Rice St *Signalized Intersection*	EB	6	7	11	24	66 - E	50 - D	13 - B	35 - D	27 - C	-	25	75	240	25	75	-	25	75
	WB	58	4	85	147	58 - E	64 - E	40 - D	49 - D		-	50	225	100	50	225	-	50	225
	NB	8	648	105	761	19 - B	33 - C	28 - C	33 - C		-	0	50	60	200	1075	-	200	1075
	SB	56	457	6	519	52 - D	9 - A	7 - A	14 - B		-	25	175	250	25	525	-	25	525
Atwater St at Rice St *Signalized Intersection*	EB	34	29	60	123	70 - E	67 - E	30 - C	50 - D	25 - C	-	25	200	210	25	200	-	25	200
	WB	24	15	15	54	68 - E	74 - E	24 - C	57 - E		-	25	100	50	25	100	-	25	100
	NB	42	785	10	837	27 - C	24 - C	20 - C	25 - C		-	25	50	250	150	675	-	150	675
	SB	4	449	17	470	30 - C	17 - B	17 - B	18 - B		-	0	50	50	50	600	-	50	600
Wayzata St at Rice St *Stop Control*	NB		831	3	834	-	18 - C	19 - C	19 - B	12 - B	-	-	-	60	125	750	-	125	750
	SB	2	470		472	21 - C	1 - A	-	2 - A		-	0	25	25	25	150	-	-	-
Front Ave at Rice St *Signalized Intersection*	EB	129	33	54	216	155 - F	151 - F	101 - F	142 - F	38 - D	-	200	550	25	200	550	-	200	550
	WB	20	30	27	77	111 - F	90 - F	38 - D	78 - E		-	50	225	35	50	225	-	50	225
	NB	38	779	14	831	27 - C	22 - C	21 - C	23 - C		-	25	75	80	125	500	-	125	500
	SB	8	398	79	485	26 - C	12 - B	10 - B	12 - B		-	25	50	40	50	525	-	50	525
Lawson Ave at Rice St *Stop Control*	EB	15	3	12	30	137 - F	51 - F	27 - D	88 - F	19 - C	-	25	100	290	25	100	-	25	100
	WB	8	3	11	22	90 - F	66 - F	44 - E	69 - F		-	25	75	120	25	75	-	25	75
	NB	24	920	6	950	19 - C	24 - C	15 - C	24 - C		-	25	50	125	175	675	-	175	675
	SB	15	470	13	498	22 - C	3 - A	2 - A	4 - A		-	25	50	25	25	325	-	25	325
Cook Ave S at Rice St *Stop Control*	WB	-		9	9	-	-	50 - F	50 - F	11 - B	-	-	-	-	-	-	-	25	50
	NB		937	9	946	-	17 - C	13 - B	17 - C		-	-	-	225	125	400	-	125	375
	SB	-	486		486	-	0 - A	-	0 - A		-	-	-	75	25	100	-	-	-
Cook Ave N at Rice St *Stop Control*	EB	-		17	17	-	-	15 - C	15 - C	3 - A	-	-	-	290	-	-	-	25	50
	WB	-	1	9	10	-	-	37 - E	37 - E		-	-	-	-	-	-	-	25	50
	NB	-	931		931	-	3 - A	-	3 - A		-	-	-	75	25	125	-	-	-
	SB		473	9	482	-	0 - A	1 - A	1 - A		-	-	-	40	0	50	-	0	50
Jessamine Ave S at Rice St *Stop Control*	EB	8		8	16	84 - F	-	14 - B	44 - E	9 - A	-	25	50	-	-	-	-	25	50
	NB	16	925		941	13 - B	13 - B	-	13 - B		-	25	50	35	75	450	-	-	-
	SB		474	5	479	-	0 - A	0 - A	0 - A		-	-	-	-	0	0	-	0	0
Jessamine Ave N at Rice St *Stop Control*	WB	7		12	19	37 - E	-	70 - F	56 - F	3 - A	-	25	50	-	-	-	-	25	50
	NB		914	15	929	-	3 - A	0 - A	3 - A		-	-	-	-	25	150	-	25	150
	SB	12	472		484	12 - B	0 - A	-	1 - A		-	25	50	-	0	0	-	-	-
Geranium Ave at Rice St *Signalized Intersection*	EB	8	2	7	17	161 - F	92 - F	15 - C	99 - F	14 - B	-	25	75	80	25	75	-	25	75
	WB	6	7	6	19	106 - F	66 - F	79 - F	81 - F		-	25	75	60	25	75	-	25	100
	NB	15	889	22	926	8 - A	18 - C	16 - C	18 - C		-	0	25	125	100	350	-	125	400
	SB	10	471	8	489	30 - D	2 - A	3 - A	3 - A		-	25	50	125	25	325	-	25	375
Maryland Ave at Rice St *Signalized Intersection*	EB	198	493	29	720	96 - F	62 - E	59 - E	72 - E	58 - E	150	125	450	75	125	475	-	125	475
	WB	129	341	107	577	122 - F	70 - E	67 - E	81 - F		265	100	375	65	125	375	-	125	375
	NB	21	700	182	903	41 - D	47 - D	46 - D	47 - D		-	25	75	90	325	700	-	350	700
	SB	63	331	110	504	61 - E	31 - C	27 - C	34 - C		-	25	150	75	75	725	-	75	725
Cottage Ave at Rice St *Stop Control*	EB	14	0	28	42	127 - F	-	24 - C	51 - F	12 - B	-	25	100	110	-	-	-	25	100
	WB	4	0	11	15	20 - C	-	53 - F	45 - E		-	25	50	140	-	-	-	25	50
	NB	17	835	11	863	11 - B	17 - C	16 - C	17 - C		-	25	75	475	100	925	-	100	925
	SB	6	523	14	543	14 - B	2 - A	1 - A	3 - A		-	0	25	150	25	100	-	25	100
Arlington Ave at Rice St *Signalized Intersection*	EB	51	165	30	246	123 - F	58 - E	46 - D	71 - E	39 - D	-	75	275	75	75	275	-	75	275
	WB	57	109	104	270	76 - E	63 - E	50 - D	61 - E		-	75	300	25	75	300	-	75	300
	NB	39	669	152	860	24 - C	35 - D	32 - C	35 - D		-	25	75	25	225	700	-	225	700
	SB	97	456	57	610	60 - E	18 - B	16 - B	25 - C		-	50	200	100	75	475	-	75	475
Nebraska Ave at Rice St *Signalized Intersection*	EB	13	0	34	47	59 - E	-	18 - B	30 - C	12 - B	-	25	75	90	-	-	-	25	75
	WB	14	11	28	53	65 - E	59 - E	30 - C	45 - D		-	25	100	-	25	100	-	25	100
	NB	62	752	10	824	18 - B	11 - B	9 - A	12 - B		-	25	100	235	75	625	-	75	625
	SB	3	562	23	588	19 - B	8 - A	9 - A	9 - A		-	0	25	200	50	375	-	50	375
Montana Ave at Rice St *Stop Control*	EB	3	0	28	31	61 - F	-	17 - C	23 - C	3 - A	-	25	50	-	-	-	-	25	75
	WB	13	0	2	15	66 - F	47 - E	24 - C	61 - F		-	25	50	285	25	50	-	25	50
	NB	3	763	27	793	4 - A	2 - A	1 - A	2 - A		-	0	25	50	25	225	-	25	225
	SB	15	551	0	566	14 - B	1 - A	-	2 - A		-	25	50	35	25	125	-	-	-
Hoyt Ave at Rice St *Stop Control*	EB	-	1	19	20	-	-	16 - C	16 - C	4 - A	-	-	-	75	-	-	-	25	50
	WB	-	2	9	11	-	-	34 - D	34 - D		-	-	-	35	-	-	-	25	50
	NB	42	712	14	768	9 - A	4 - A	3 - A	5 - A		-	25	75	50	25	250	-	25	250
	SB	-	528	17	545	-	3 - A	3 - A	3 - A		-	-	-	285	25	400	-	25	400
Wheelock Pkwy at Rice St *Signalized Intersection*	EB	102	13	60	175	93 - F	94 - F	57 - E	81 - F	26 - C	-	100	375	80	100	375	-	100	375
	WB	16	39	35	90	20 - C	51 - D	30 - C	38 - D		-	25	150	100	25	150	-	25	150
	NB	33	646	55	734	31 - C	24 - C	19 - B	24 - C		200	25	75	65	125	650	-	125	650
	SB	11	484	62	557	56 - E	9 - A	8 - A	10 - B		75	25	50	80	25	375	-	25	375

Project: Rice Street Visioning Study

Scenario: Build - Three Lane - 120 Second Cycle and 15% Less NBT Vehicles (Vissim)

		Build PM Peak Hour - 120 Second Cycle Length - 15% Less NBT Vehicles																	
		Traffic Volumes (veh)				Traffic Delay (sec/veh)					Traffic Queuing (feet)								
Intersection	Approach	Demand Volumes				Movement (Delay - LOS)			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn			Through			Right Turn		
		L	T	R	Total	L	T	R			Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Pennsylvania Ave at Rice St *Signalized Intersection*	EB	183	701	25	909	73 - E	37 - D	29 - C	45 - D	46 - D	125	150	475	175	150	475	-	150	475
	WB	67	406	106	579	36 - D	41 - D	38 - D	40 - D		200	75	300	225	75	300	-	75	300
	NB	17	472	158	647	67 - E	56 - E	51 - D	56 - E		-	225	550	85	225	550	-	225	550
	SB	75	384	67	526	55 - E	42 - D	38 - D	44 - D		-	25	150	160	150	825	-	150	850
Sycamore St at Rice St *Signalized Intersection*	EB	6	7	11	24	49 - D	43 - D	13 - B	30 - C	39 - D	-	25	50	240	25	50	-	25	50
	WB	58	4	85	147	46 - D	47 - D	35 - D	40 - D		-	50	225	100	50	225	-	50	225
	NB	8	648	105	761	31 - C	60 - E	54 - D	59 - E		-	0	50	60	375	1325	-	375	1325
	SB	56	457	6	519	58 - E	8 - A	9 - A	14 - B		-	25	175	250	25	500	-	25	500
Atwater St at Rice St *Signalized Intersection*	EB	34	29	60	123	45 - D	47 - D	21 - C	35 - D	29 - C	-	25	150	210	25	150	-	25	150
	WB	24	15	15	54	49 - D	44 - D	22 - C	40 - D		-	25	100	50	25	100	-	25	100
	NB	42	785	10	837	35 - D	33 - C	36 - D	34 - C		-	25	75	250	200	675	-	200	700
	SB	4	449	17	470	33 - C	20 - C	19 - B	21 - C		-	25	50	50	75	575	-	75	575
Wayzata St at Rice St *Stop Control*	NB		831	3	834	-	33 - D	45 - E	34 - C	21 - C	-	-	-	60	225	900	-	225	900
	SB	2	470		472	14 - B	1 - A	-	2 - A		-	0	25	25	25	150	-	-	-
Front Ave at Rice St *Signalized Intersection*	EB	129	33	54	216	71 - E	62 - E	40 - D	63 - E	30 - C	-	75	375	25	75	375	-	75	375
	WB	20	30	27	77	60 - E	47 - D	25 - C	43 - D		-	25	150	35	25	150	-	25	150
	NB	38	779	14	831	36 - D	30 - C	32 - C	31 - C		-	25	100	80	175	500	-	175	500
	SB	8	398	79	485	37 - D	14 - B	12 - B	15 - B		-	25	50	40	50	450	-	50	450
Lawson Ave at Rice St *Stop Control*	EB	15	3	12	30	144 - F	49 - E	39 - E	96 - F	22 - C	-	25	100	290	25	100	-	25	125
	WB	8	3	11	22	59 - F	49 - E	31 - D	47 - E		-	25	75	120	25	75	-	25	75
	NB	24	920	6	950	22 - C	30 - D	15 - C	30 - D		-	25	50	125	225	675	-	225	675
	SB	15	470	13	498	17 - C	3 - A	3 - A	4 - A		-	25	50	25	25	350	-	25	350
Cook Ave S at Rice St *Stop Control*	WB	-		9	9	-	-	62 - F	62 - F	13 - B	-	-	-	-	-	-	-	25	50
	NB		937	9	946	-	19 - C	17 - C	19 - C		-	-	-	225	150	400	-	150	375
	SB	-	486		486	-	0 - A	-	0 - A		-	-	-	75	25	100	-	-	-
Cook Ave N at Rice St *Stop Control*	EB	-		17	17	-	-	16 - C	16 - C	3 - A	-	-	-	290	-	-	-	25	75
	WB	-	1	9	10	-	-	43 - E	43 - E		-	-	-	-	-	-	-	25	50
	NB	-	931		931	-	4 - A	-	4 - A		-	-	-	75	25	150	-	-	-
	SB		473	9	482	-	0 - A	1 - A	1 - A		-	-	-	40	0	50	-	0	50
Jessamine Ave S at Rice St *Stop Control*	EB	8		8	16	90 - F	-	19 - C	50 - F	13 - B	-	25	50	-	-	-	-	25	50
	NB	16	925		941	15 - C	19 - C	-	19 - C		-	0	50	35	125	450	-	-	-
	SB		474	5	479	-	0 - A	0 - A	0 - A		-	-	-	-	0	0	-	0	0
Jessamine Ave N at Rice St *Stop Control*	WB	7		12	19	33 - D	-	68 - F	53 - F	4 - A	-	25	50	-	-	-	-	25	50
	NB		914	15	929	-	5 - A	1 - A	5 - A		-	-	-	-	50	150	-	50	150
	SB	12	472		484	13 - B	0 - A	-	1 - A		-	25	50	-	0	0	-	-	-
Geranium Ave at Rice St *Signalized Intersection*	EB	8	2	7	17	134 - F	75 - F	15 - C	80 - F	17 - C	-	25	75	80	25	75	-	25	75
	WB	6	7	6	19	44 - E	55 - F	83 - F	64 - F		-	25	75	60	25	75	-	25	75
	NB	15	889	22	926	13 - B	23 - C	21 - C	23 - C		-	0	50	125	125	350	-	150	400
	SB	10	471	8	489	23 - C	2 - A	5 - A	3 - A		-	25	50	125	25	325	-	25	375
Maryland Ave at Rice St *Signalized Intersection*	EB	198	493	29	720	87 - F	51 - D	50 - D	61 - E	52 - D	150	100	425	75	100	425	-	100	425
	WB	129	341	107	577	62 - E	53 - D	46 - D	54 - D		265	50	250	65	75	300	-	75	300
	NB	21	700	182	903	49 - D	55 - E	51 - D	55 - E		-	25	75	90	375	700	-	375	700
	SB	63	331	110	504	63 - E	35 - D	32 - C	38 - D		-	25	125	75	100	800	-	100	800
Cottage Ave at Rice St *Stop Control*	EB	14	0	28	42	129 - F	-	23 - C	53 - F	14 - B	-	25	100	110	-	-	-	25	125
	WB	4	0	11	15	23 - C	-	45 - E	40 - E		-	25	50	140	-	-	-	25	50
	NB	17	835	11	863	12 - B	20 - C	19 - C	20 - C		-	25	75	475	125	1075	-	125	1075
	SB	6	523	14	543	12 - B	2 - A	2 - A	3 - A		-	0	25	150	25	175	-	25	175
Arlington Ave at Rice St *Signalized Intersection*	EB	51	165	30	246	96 - F	49 - D	34 - C	57 - E	37 - D	-	50	225	75	50	225	-	50	225
	WB	57	109	104	270	64 - E	54 - D	42 - D	52 - D		-	75	250	25	75	250	-	75	250
	NB	39	669	152	860	25 - C	37 - D	35 - D	37 - D		-	25	75	25	250	700	-	250	700
	SB	97	456	57	610	58 - E	18 - B	16 - B	25 - C		-	50	200	100	50	525	-	50	525
Nebraska Ave at Rice St *Signalized Intersection*	EB	13	0	34	47	49 - D	-	20 - C	28 - C	14 - B	-	25	75	90	-	-	-	25	75
	WB	14	11	28	53	49 - D	44 - D	27 - C	36 - D		-	25	100	-	25	100	-	25	100
	NB	62	752	10	824	19 - B	13 - B	13 - B	14 - B		-	25	100	235	75	650	-	75	650
	SB	3	562	23	588	20 - C	11 - B	12 - B	12 - B		-	0	25	200	50	375	-	50	375
Montana Ave at Rice St *Stop Control*	EB	3	0	28	31	49 - E	-	19 - C	23 - C	3 - A	-	25	50	-	-	-	-	25	50
	WB	13	0	2	15	49 - E	44 - E	19 - C	47 - E		-	25	50	285	25	50	-	25	50
	NB	3	763	27	793	9 - A	3 - A	2 - A	3 - A		-	0	25	50	25	275	-	25	275
	SB	15	551	0	566	14 - B	2 - A	-	3 - A		-	25	50	35	25	200	-	-	-
Hoyt Ave at Rice St *Stop Control*	EB	-	1	19	20	-	-	15 - C	15 - C	4 - A	-	-	-	75	-	-	-	25	50
	WB	-	2	9	11	-	-	35 - E	35 - E		-	-	-	35	-	-	-	25	50
	NB	42	712	14	768	9 - A	5 - A	4 - A	6 - A		-	25	75	50	25	225	-	25	225
	SB	-	528	17	545	-	3 - A	2 - A	3 - A		-	-	-	285	25	400	-	25	400
Wheelock Pkwy at Rice St *Signalized Intersection*	EB	102	13	60	175	73 - E	66 - E	43 - D	62 - E	27 - C	-	75	350	80	75	350	-	75	350
	WB	16	39	35	90	19 - B	44 - D	27 - C	34 - C		-	25	150	100	25	150	-	25	150
	NB	33	646	55	734	35 - D	32 - C	27 - C	32 - C		200	25	75	65	175	700	-	175	700
	SB	11	484	62	557	48 - D	10 - B	8 - A	11 - B		75	25	50	80	50	400	-	50	400

Project: Rice Street Visioning Study

Scenario: Build - Three Lane - 100 Second Cycle and 15% Less NBT Vehicles (Vissim)

		Build PM Peak Hour - 100 Second Cycle Length - 15% Less NBT Vehicles																		
		Traffic Volumes (veh)				Traffic Delay (sec/veh)					Traffic Queuing (feet)									
Intersection	Approach	Demand Volumes				Movement (Delay - LOS)			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn			Through			Right Turn		
		L	T	R	Total	L	T	R			Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Pennsylvania Ave at Rice St *Signalized Intersection*	EB	183	701	25	909	104 - F	34 - C	30 - C	49 - D	52 - D	125	175	525	175	175	525	-	175	525
	WB	67	406	106	579	36 - D	42 - D	44 - D	42 - D		200	75	325	225	75	325	-	75	325
	NB	17	472	158	647	91 - F	75 - E	65 - E	74 - E		-	275	550	85	275	550	-	275	550
	SB	75	384	67	526	52 - D	44 - D	41 - D	45 - D		-	25	150	160	150	900	-	150	900
Sycamore St at Rice St *Signalized Intersection*	EB	6	7	11	24	50 - D	32 - C	11 - B	25 - C	63 - E	-	25	50	240	25	50	-	25	50
	WB	58	4	85	147	42 - D	31 - C	43 - D	43 - D		-	50	225	100	50	225	-	50	225
	NB	8	648	105	761	51 - D	108 - F	106 - F	108 - F		-	0	50	60	650	1550	-	650	1550
	SB	56	457	6	519	58 - E	11 - B	11 - B	17 - B		-	25	200	250	50	525	-	50	525
Atwater St at Rice St *Signalized Intersection*	EB	34	29	60	123	38 - D	36 - D	18 - B	28 - C	37 - D	-	25	150	210	25	150	-	25	150
	WB	24	15	15	54	40 - D	34 - C	20 - C	33 - C		-	25	75	50	25	75	-	25	75
	NB	42	785	10	837	46 - D	48 - D	53 - D	48 - D		-	25	75	250	275	700	-	275	700
	SB	4	449	17	470	41 - D	22 - C	20 - C	23 - C		-	25	50	50	75	650	-	75	650
Wayzata St at Rice St *Stop Control*	NB		831	3	834	-	48 - E	59 - F	49 - D	29 - D	-	-	-	60	300	900	-	300	900
	SB	2	470		472	20 - C	1 - A	-	2 - A		-	0	25	25	25	200	-	-	-
Front Ave at Rice St *Signalized Intersection*	EB	129	33	54	216	61 - E	56 - E	32 - C	54 - D	34 - C	-	75	400	25	75	400	-	75	400
	WB	20	30	27	77	39 - D	36 - D	20 - C	32 - C		-	25	100	35	25	100	-	25	100
	NB	38	779	14	831	45 - D	39 - D	37 - D	40 - D		-	25	175	80	225	500	-	225	500
	SB	8	398	79	485	32 - C	17 - B	14 - B	17 - B		-	25	50	40	50	550	-	50	575
Lawson Ave at Rice St *Stop Control*	EB	15	3	12	30	100 - F	46 - E	19 - C	65 - F	26 - D	-	25	75	290	25	75	-	25	75
	WB	8	3	11	22	54 - F	44 - E	38 - E	47 - E		-	25	50	120	25	50	-	25	50
	NB	24	920	6	950	26 - D	39 - E	22 - C	39 - E		-	25	50	125	250	675	-	250	675
	SB	15	470	13	498	18 - C	3 - A	2 - A	4 - A		-	25	50	25	25	325	-	25	325
Cook Ave S at Rice St *Stop Control*	WB	-		9	9	-	-	56 - F	56 - F	15 - C	-	-	-	-	-	-	-	25	50
	NB		937	9	946	-	24 - C	20 - C	24 - C		-	-	-	225	175	400	-	150	375
	SB	-	486		486	-	0 - A	-	0 - A		-	-	-	75	25	100	-	-	-
Cook Ave N at Rice St *Stop Control*	EB	-		17	17	-	-	18 - C	18 - C	4 - A	-	-	-	290	-	-	-	25	75
	WB	-	1	9	10	-	-	40 - E	40 - E		-	-	-	-	-	-	-	25	50
	NB	-	931		931	-	5 - A	-	5 - A		-	-	-	75	25	125	-	-	-
	SB		473	9	482	-	1 - A	1 - A	1 - A		-	-	-	40	0	75	-	0	75
Jessamine Ave S at Rice St *Stop Control*	EB	8		8	16	69 - F	-	15 - C	39 - E	16 - C	-	25	50	-	-	-	-	25	50
	NB	16	925		941	17 - C	26 - D	-	26 - D		-	0	50	35	150	450	-	-	-
	SB		474	5	479	-	0 - A	0 - A	0 - A		-	-	-	-	0	0	-	0	0
Jessamine Ave N at Rice St *Stop Control*	WB	7		12	19	30 - D	-	70 - F	52 - F	5 - A	-	25	50	-	-	-	-	25	50
	NB		914	15	929	-	6 - A	3 - A	6 - A		-	-	-	-	50	150	-	50	150
	SB	12	472		484	14 - B	0 - A	-	1 - A		-	25	50	-	0	0	-	-	-
Geranium Ave at Rice St *Signalized Intersection*	EB	8	2	7	17	135 - F	74 - F	14 - B	84 - F	20 - C	-	25	50	80	25	50	-	25	50
	WB	6	7	6	19	66 - F	52 - F	71 - F	63 - F		-	25	75	60	25	75	-	25	75
	NB	15	889	22	926	13 - B	29 - D	28 - D	29 - D		-	0	25	125	150	350	-	175	400
	SB	10	471	8	489	25 - D	2 - A	3 - A	3 - A		-	25	50	125	25	350	-	25	425
Maryland Ave at Rice St *Signalized Intersection*	EB	198	493	29	720	59 - E	43 - D	39 - D	48 - D	50 - D	150	75	350	75	75	350	-	75	350
	WB	129	341	107	577	48 - D	44 - D	38 - D	44 - D		265	50	225	65	75	250	-	75	250
	NB	21	700	182	903	53 - D	63 - E	61 - E	63 - E		-	25	75	90	425	700	-	425	700
	SB	63	331	110	504	58 - E	41 - D	37 - D	43 - D		-	25	125	75	125	800	-	125	800
Cottage Ave at Rice St *Stop Control*	EB	14	0	28	42	85 - F	-	16 - C	35 - E	10 - B	-	25	75	110	-	-	-	25	75
	WB	4	0	11	15	21 - C	-	41 - E	36 - E		-	25	50	140	-	-	-	25	50
	NB	17	835	11	863	10 - B	14 - B	13 - B	14 - B		-	25	75	475	75	875	-	75	875
	SB	6	523	14	543	20 - C	2 - A	2 - A	3 - A		-	25	25	150	25	275	-	25	275
Arlington Ave at Rice St *Signalized Intersection*	EB	51	165	30	246	97 - F	49 - D	31 - C	57 - E	35 - D	-	75	250	75	75	250	-	75	250
	WB	57	109	104	270	63 - E	50 - D	38 - D	49 - D		-	75	275	25	75	275	-	50	275
	NB	39	669	152	860	23 - C	34 - C	32 - C	34 - C		-	25	75	25	200	700	-	200	700
	SB	97	456	57	610	59 - E	15 - B	12 - B	22 - C		-	50	200	100	50	450	-	50	450
Nebraska Ave at Rice St *Signalized Intersection*	EB	13	0	34	47	37 - D	-	19 - B	25 - C	14 - B	-	25	75	90	-	-	-	25	75
	WB	14	11	28	53	43 - D	37 - D	21 - C	30 - C		-	25	75	-	25	75	-	25	75
	NB	62	752	10	824	18 - B	13 - B	12 - B	14 - B		-	25	75	235	75	575	-	75	575
	SB	3	562	23	588	19 - B	12 - B	12 - B	13 - B		-	0	25	200	50	375	-	50	375
Montana Ave at Rice St *Stop Control*	EB	3	0	28	31	63 - F	-	17 - C	24 - C	4 - A	-	25	50	-	-	-	-	25	50
	WB	13	0	2	15	45 - E	47 - E	30 - D	45 - E		-	25	50	285	25	50	-	25	50
	NB	3	763	27	793	6 - A	4 - A	3 - A	4 - A		-	0	25	50	25	250	-	25	250
	SB	15	551	0	566	10 - B	2 - A	-	3 - A		-	25	50	35	25	225	-	-	-
Hoyt Ave at Rice St *Stop Control*	EB	-	1	19	20	-	-	15 - C	15 - C	5 - A	-	-	-	75	-	-	-	25	50
	WB	-	2	9	11	-	-	40 - E	40 - E		-	-	-	35	-	-	-	0	50
	NB	42	712	14	768	9 - A	7 - A	7 - A	8 - A		-	25	50	50	50	300	-	50	300
	SB	-	528	17	545	-	2 - A	3 - A	3 - A		-	-	-	285	25	250	-	25	250
Wheelock Pkwy at Rice St *Signalized Intersection*	EB	102	13	60	175	48 - D	46 - D	26 - C	41 - D	26 - C	-	50	250	80	50	250	-	50	250
	WB	16	39	35	90	13 - B	29 - C	25 - C	25 - C		-	25	125	100	25	125	-	25	125
	NB	33	646	55	734	45 - D	33 - C	28 - C	34 - C		200	25	100	65	175	650	-	175	675
	SB	11	484	62	557	41 - D	11 - B	10 - B	12 - B		75	25	75	80	50	375	-	50	375

Appendix E: Crash Modification Factor

CMF / CRF Details

CMF ID: 2841

Converting four-lane roadways to three-lane roadways with center turn lane (road diet)

Description: Conversion of road segments from a four-lane to a three-lane cross-section with two-way left-turn lanes (also known as road diets).

Prior Condition: Four-lane undivided roadway

Category: Roadway

Study: *Comparison of empirical Bayes and full Bayes approaches for before-after road safety evaluations*, Persaud et. al, 2010

Star Quality Rating:	★★★★★

Crash Modification Factor (CMF)	
Value:	0.53
Adjusted Standard Error:	
Unadjusted Standard Error:	0.02

Crash Reduction Factor (CRF)	
Value:	47 *(This value indicates a **decrease** in crashes)*

Adjusted Standard Error:	
Unadjusted Standard Error:	2

Applicability

Crash Type:	All
Crash Severity:	All
Roadway Types:	Not Specified
Number of Lanes:	4
Road Division Type:	Undivided
Speed Limit:	
Area Type:	Urban and suburban
Traffic Volume:	
Time of Day:	All

If countermeasure is intersection-based

Intersection Type:	
Intersection Geometry:	
Traffic Control:	
Major Road Traffic Volume:	
Minor Road Traffic Volume:	

Development Details

Date Range of Data Used:	1982 to 2004
Municipality:	

State:	
Country:	
Type of Methodology Used:	2
Sample Size Used:	
Before Sample Size Used:	263
After Sample Size Used:	67

Other Details

Included in Highway Safety Manual?	No
Date Added to Clearinghouse:	Mar-21-2011
Comments:	When this CMF was initially entered in the Clearinghouse, it was incorrectly entered as a CMF of 0.47. In March 2015, this was corrected to be 0.53, as presented in the original paper. In February 2021, the area type for this CMF was changed from suburban to urban/suburban to account for the fact that the treatment sites were largely located in small urban areas.

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