Intersection Control Evaluation Report

TH 19 (College Drive) - S. 4th Street to Bruce Street

Marshall, Minnesota

S.P. No. 4204-40
S.A.P. No. 139-111-007
S.A.P. No. 139-112-006
S.A.P. No. 139-115-004
S.A.P. No. 139-122-007
S.A.P. No. 139-124-005

MNT08 151024 | July 14, 2020

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

Graham Johnson, PE (MN), PTOE

Date: 7/14/2020 License No.: 45429

Approved By:

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Date: 2020.07.20 16:24:34 -05'00'

MnDOT District 8 Traffic Engineer Date

Todd Broadwell Digitally signed by Todd Broadwell
Date: 2020.07.20 14:40:47 -05'00'

MnDOT District 8 State Aid Engineer Date

7-17-2020

City of Marshall Engineer Date

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Table of Contents

Contents (continued)

List of Tables

List of Figures

List of Appendices

Intersection Control Evaluation Report

TH 19 (College Drive) - S. 4th Street to Bruce Street

Prepared by Short Elliott Hendrickson Inc. for the Minnesota Department of Transportation (MnDOT) District 8, in cooperation with the City of Marshall.

1 Background and Description

Trunk Highway 19 (TH 19), also known as College Drive, is an east-west minor arterial roadway in the City of Marshall. TH 19 spans from the South Dakota Border in the west to just east of New Prague with daily traffic volumes ranging from 2,900 to 9,500 vehicle per day (vpd) in the project study area.

The planned project will include full reconstruction of TH 19 from S 4th Avenue to approximately Bruce Street and is anticipated to be constructed in 2025. This project is intended to maintain or improve traffic operations and safety along the corridor, improve pedestrian facilities to meet ADA standards, while considering cost effectiveness, right-of-way impacts, and community support for each potential alternative.

1.1 Overview

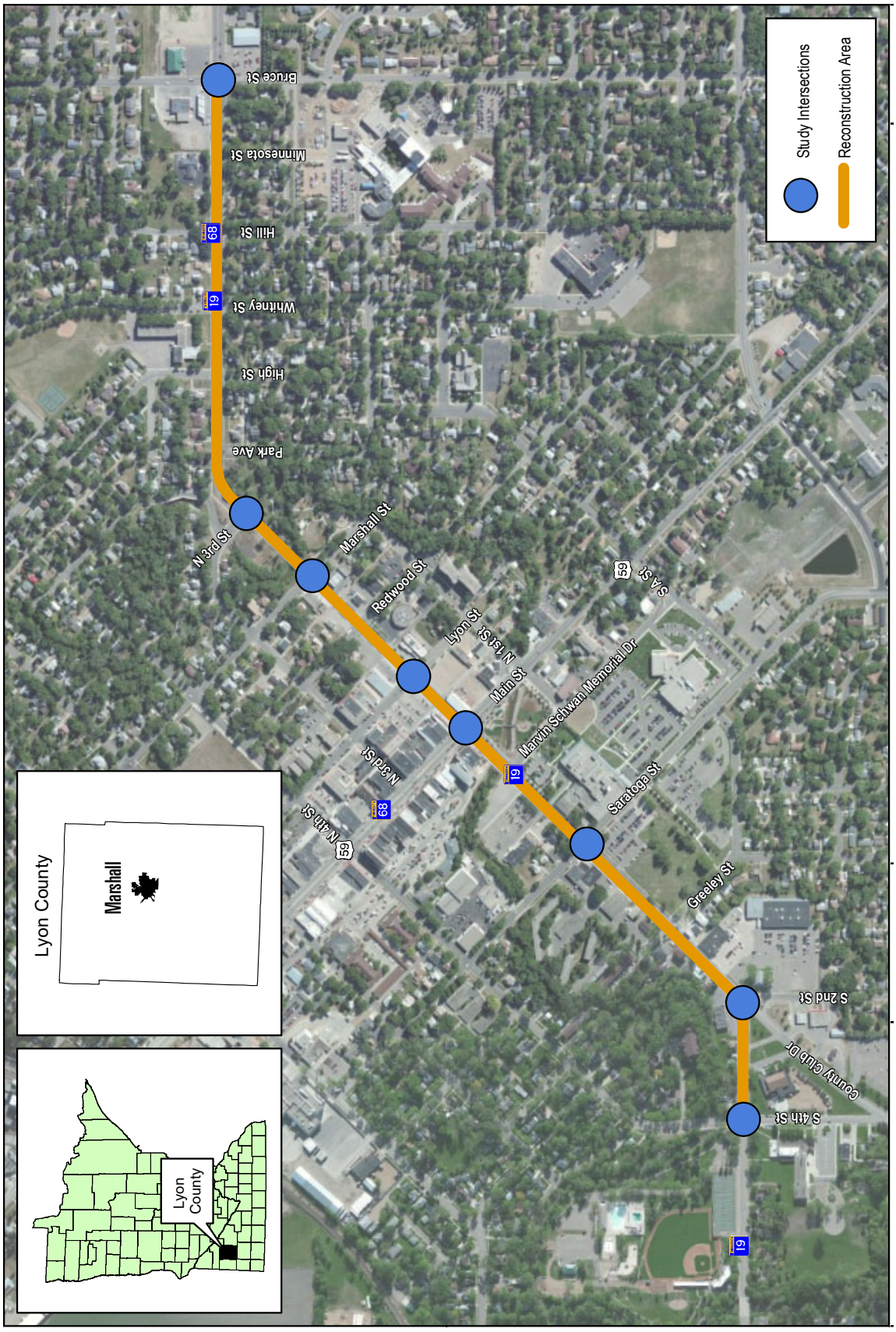
The primary purpose of this study is to determine the optimal type of intersection control needed for the eight study intersections along TH 19 from S 4th Avenue to Bruce Street.

- TH 19 at S 4th Street (MSAS 124) (minor stop control)
- TH 19 at Country Club Drive (MSAS 122)/S 2nd Street (traffic signal control)
- TH 19 at Saratoga Street (MSAS 111) (traffic signal control)
- TH 19 at US 59 (Main Street) (traffic signal control)
- TH 19 at Lyon Street (traffic signal control)
- TH 19 at Marshall Street (minor stop control)
- TH 19 at N 3rd Street (MSAS 112) (minor stop control)
- TH 19 at Bruce Street (MSAS 115) (traffic signal control)

The Minnesota Department of Transportation (MnDOT) Intersection Control Evaluation (ICE) is an objective process used to investigate and determine the optimal type of traffic control that should be provided at each intersection to serve the existing conditions and future needs. The investigation includes analyzing traffic operations during the AM, mid-day, and PM peak hours for the existing year (2019) and forecast year (2045) traffic conditions. The evaluations include assessing traffic control volume warrants, intersection and roadway safety, and traffic operations.

The range of traffic control options includes a No Build scenario, with no change to the existing control conditions, and viable traffic control changes for each intersection, including all-way stop control, traffic signal control, roundabout control, minor street stop control, or potential access reduction such as right-in/right out (RI/RO) or 3/4 access intersection control. **Figure 1** depicts the study intersections and reconstruction area in a location map.

Figure 1 – Location Map



2 Existing Conditions

TH 19 is a 2-lane urban roadway west of Greeley Street and a 3-lane urban roadway east of Greeley Street through the project area; there is on-street parallel parking on both sides of the street for the majority of the project area. The posted speed limit is 30 mph.

There are currently five signalized intersections included and an additional three minor street stop controlled intersections included in the eight study intersections. There are also additional minor street stop controlled intersections that were not directly analyzed, but may be included in the recommendations.

Outside of the project area, TH 19 continues west to South Dakota and east to New Prague.

2.1 Crash History

Ten and one-half years of crash data, from January 1, 2009 through June 30, 2019, was provided by MnDOT. The type and severity of crashes were reviewed and crash rates were calculated for each study intersection. Crash information is summarized in **Table 1** for the study intersections and **Table 2** for study segments; a total of 241 crashes occurred.

The crash rate at each intersection is expressed as a number of crashes per million entering vehicles (MEV). The critical crash rate is a statistical value that is unique to each intersection and is based on vehicular exposure and the statewide average crash rate for similar intersections. An intersection with a crash rate higher than the critical rate can indicate a safety concern at the intersection and the site should be reviewed.

Crash severity is separated into five categories based on injuries sustained during the crash.

- Fatal – Crash that results in a death
- Severity A – Crash that results in an incapacitating injury or serious injury
- Severity B – Crash that results in a non-incapacitating injury or minor injury
- Severity C – Crash that results in possible injury
- Property Damage – Crash that results in property damage only; with no injuries

The following trends are evident from all crashes along TH 19 (all 241 crashes):

- Approximately 34% of crashes along the TH 19 corridor are rear end crashes, these crashes could be due to congestion through the downtown area.
- Approximately 35% of crashes were right angle/left turn crashes along the TH 19 corridor, which could indicate that vehicles are disregarding traffic control, failing to yield, or trying to use gaps that are not long enough.
- There seems to a higher percentage of crashes during the mid-day peak period (11 am to 1 pm, 20%) and the PM peak period (3 pm to 6 pm, 29%).
- Fridays had the highest percentage (23%) of crashes, there is no definitive pattern of higher crashes on any other given weekday.
- 79% of crashes along TH 19 were coded as daylight hours, lighting along the corridor does not seem to be a problem.
- 89% of crashes along TH 19 occurred in either clear or cloudy conditions, which are generally considered good weather conditions.
  - 11% of crashes occurred with poor weather conditions such as rain, snow, ice, etc.

2.1.1 Intersection Crashes

As shown in **Table 1**, a total of 204 crashes occurred at the 8 study intersection in the 10.5-year analysis period. There were no fatal crashes, though there was one serious injury crash reported at the intersection of TH 19 at Saratoga Street. This crash involved a pedestrian who was under the influence of alcohol and disregarding the traffic control being hit by a westbound vehicle late in the evening.

Based on the observed crash rates in comparison to the calculated critical rate, the TH 19 intersections at S 4th Street, Main Street, Marshall Street, and Bruce Street are above the calculated critical rate (see **Table 1**); this is an indication of a potential safety concern at the intersections.

Table 1 – Intersection Crash History (2009-June 2019)

TH 19 at:	Crash Severity					Crash Rates	
	Fatal & Severity A	Severity B	Severity C	Property Damage	Total	Intersection Rate	Critical Rate
S 4th St	0	4	4	12	20	**0.96**	**0.46**
Country Club Dr	0	1	1	7	9	0.30	0.90
Saratoga St	1	4	3	16	24	0.53	0.83
Main St	0	3	5	58	66	**0.96**	**0.77**
Lyon St	0	0	2	12	14	0.36	0.85
Marshall St	0	1	5	14	20	**0.52**	**0.39**
N 3rd St	0	0	0	2	42	0.05	0.39
Bruce St	0	2	10	37	49	**0.91**	**0.81**
TOTAL	**1**	**15**	**32**	**161**	**204**	n/a	n/a

The following trends are evident for each study intersection along TH 19:

- TH 19 at S 4th Street (minor stop)
  - 18 of the 20 crashes were right angle crashes, likely the result of vehicles on the minor street trying to use gaps that were not large enough during times when traffic volumes are high.
  - Of the 18 right angle crashes, 14 involved a vehicle from the minor street failing to yield to a westbound vehicle. This could be the result of the high speed right turn movement at the Country Club Drive intersection. As the signal typically rests with a green phase for southbound TH 19, it allows vehicles to approach the S 4th Street intersection at a higher speed than expected.
  - There was 1 crash that involved a pedestrian that was hit when a southbound vehicle failed to yield to a pedestrian in the crosswalk (severity B).
- TH 19 at Country Club Drive/S 2nd Street (traffic signal)
  - 8 of the 9 crashes were rear end crashes.
  - 6 of the rear ends involved northeast bound and southwest bound traffic, which are the main signal phase for the intersection, therefore potentially caused by an unexpected phase change.

- TH 19 at Saratoga Street (traffic signal)
  - 12 of the 24 crashes were right angle/left turn crashes (2 sideswipe and 1 head on involved left turning vehicles).
  - 5 of the 24 crashes were rear end crashes, all of which were on TH 19.
  - There were 2 crashes that involved pedestrians and 1 crash involving a bike at this intersection. One pedestrian crash involved a vehicle turning left from Saratoga Street onto TH 19 to go west failing to yield to the pedestrian. The other two crashes were the result of the pedestrian/bike failing to yield to vehicles/disregarding the traffic control. One pedestrian crash was a severity A and the other two ped/bike crashes were severity B.
- TH 19 at Main Street (traffic signal)
  - 30 of the 66 crashes were rear end crashes, indicating that there is likely congestion at this intersection. 15 of the rear end crashes involved eastbound TH 19 traffic, 7 involved southbound US 59 traffic, with westbound and northbound each having 4 rear end crashes.
  - 12 of the 66 crashes were right angle/left turn crashes with 7 indicating a left turn movement and 6 indicated a disregard for traffic control or failure to yield.
  - There was 1 crash that involved a bike, the bike disregarded the traffic control and failed to yield to vehicles (severity B).
- TH 19 at Lyon Street (traffic signal)
  - 11 of the 14 crashes were rear end crashes; all of the rear ends involved TH 19 traffic with 7 eastbound and 4 westbound.
  - 11 of the 14 crashes involved driver distraction or disregard of control.
- TH 19 at Marshall Street (minor stop)
  - 12 of the 20 crashes were right angle crashes. Of note, 7 of the 12 right angle crash narratives specifically mentioned the bridge east of this intersection obstructing the view of vehicles making a turn off of Marshall Street in either direction. This results in a sight distance issue where vehicles are unaware whether they have an acceptable gap or not.
  - 17 of the 20 crashes included failure to yield or disregard of control.
  - 10 of the 20 crashes occurred between 3pm and 6 pm during the PM peak period.
- TH 19 at N 3rd Street (minor stop)
  - With only 2 crashes, both weather related, over the previous 10 years there have been no crash patterns at this intersection.
- TH 19 at Bruce Street (traffic signal)
  - 16 of the 49 crashes were rear end crashes.
  - 21 of the 49 crashes were right angle/left turn crashes. 15 of these directly involved driver distraction or failure to yield.

2.1.2 Segment Crashes

An additional 37 crashes occurred along the project corridor not at the study intersections. These include crashes at minor, non-study intersections and along roadway segments. None of the roadway segments or non-study intersections along the corridor have sustained crash problems. **Table 2** shows a summary of the crashes along the segments of TH 19 between study intersections.

Table 2 – Segment Crash History (2009 – June 2019)

From	To	Crash Severity					Crash Rates	
		Fatal & Severity A	Severity B	Severity C	Property Damage	Total	Segment Rate	Critical Rate
S 4th St	Country Club	0	0	0	1	1	0.79	4.53
Country Club	Saratoga St	0	0	1	7	8	1.17	3.80
Saratoga St	Main St	0	0	0	4	4	0.79	3.88
Main St	Lyon St	0	0	0	4	4	1.67	4.74
Lyon St	Marshall St	0	1	0	2	3	0.65	3.96
Marshall St	N 3rd St	0	0	0	0	0	0.00	4.46
N 3rd St	Minnesota St	0	0	1	11	15	1.16	3.19
Minnesota St	Bruce St	0	0	0	2	2	0.78	5.74
TOTAL		**0**	**1**	**5**	**31**	**37**	n/a	n/a

The following trends are evident for the crashes along segments between non-study intersections along TH 19:

- 20 of the 37 segment crashes occurred at minor, non-study intersections. No minor intersection had more than 6 crashes during the previous 10.5 years.
- A majority of the segment crashes that did not occur at minor intersections involved either businesses accesses or parked vehicles, however, no individual segment or business access has been shown to have a safety issue.
- There is a higher percentage of crashes during the PM peak period (3 pm to 6 pm, 36%).

2.2 Existing Traffic Volumes

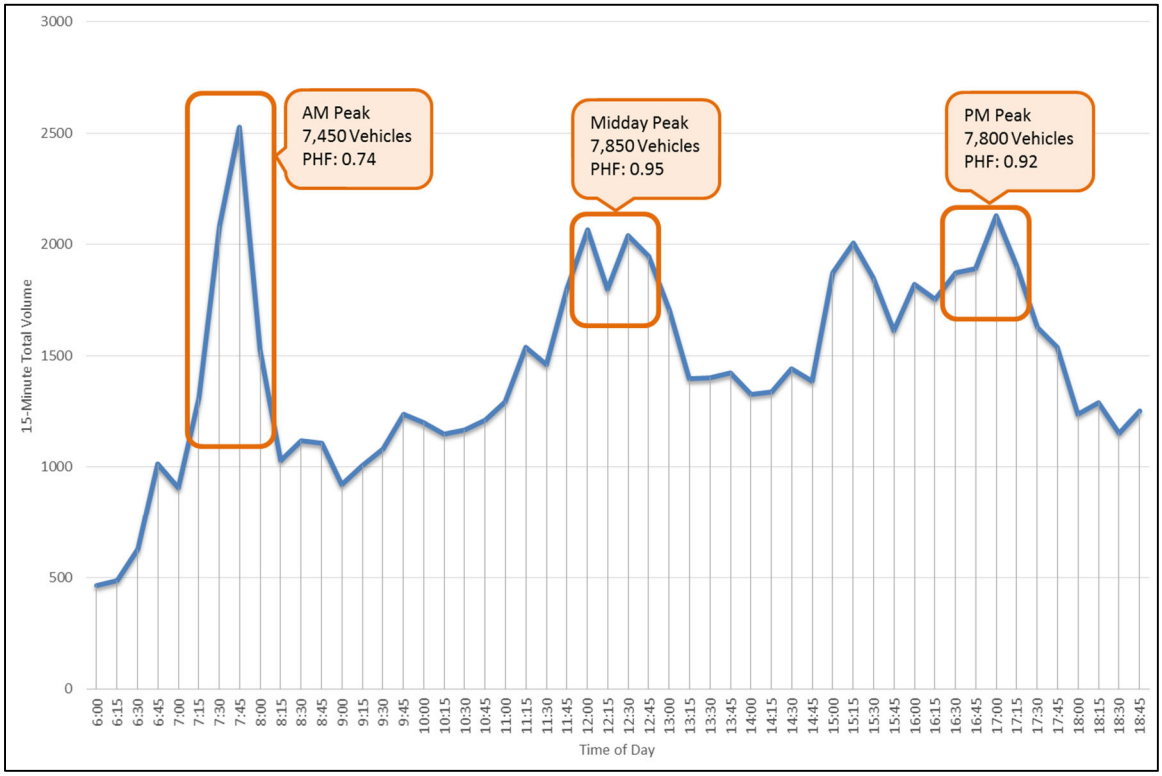
Intersection turning movement counts were collected in May 2019 with a total of 13-hours of data (6 am – 7 pm) obtained at all study intersections. The AM peak hour was determined to be 7:15 to 8:15 am, the mid-day peak was 12:00 to 1:00 pm, and the PM peak was 4:30 to 5:30 pm.

Passenger vehicles, single unit trucks, buses, heavy vehicles, pedestrians, and bicyclists were all counted. The intersection daily volumes range from approximately 1.5% to 3% single unit trucks, 0.5% to 1% buses, and 1% to 3% heavy vehicle demands.

The mid-day and PM peak hours have higher hourly traffic demands than the AM peak hour, although the AM peak hour has the highest 15-minute traffic demands of the day. The large 15-minute peak in traffic demands during the AM peak compared to the rest of the AM peak hour results in a fairly low peak hour factor (PHF) of 0.74 as compared to the PHFs of the mid-day and PM peak hours of 0.95 and 0.92, respectively. The PHF is the hourly volume during the peak hour divided by the peak 15-minute traffic volume multiplied by four; the PHF is a measure of traffic demand fluctuations within the peak hour (Hourly Volume/ (Peak 15-min x 4)).

Figure 2 represents the summation of all traffic data collected at the eight study intersections represented as a line graph by time of day; this is the total 15-minute demands for all intersections.

Figure 2 – 2019 Existing TH 19 Corridor Volume Graph



The existing 2019 vehicle turning movement volumes, roadway geometrics, and intersection control are shown in **Figure 3**; the existing pedestrian volumes are shown in **Figure 4**.

Figure 3 – Existing (2019) Traffic Volumes

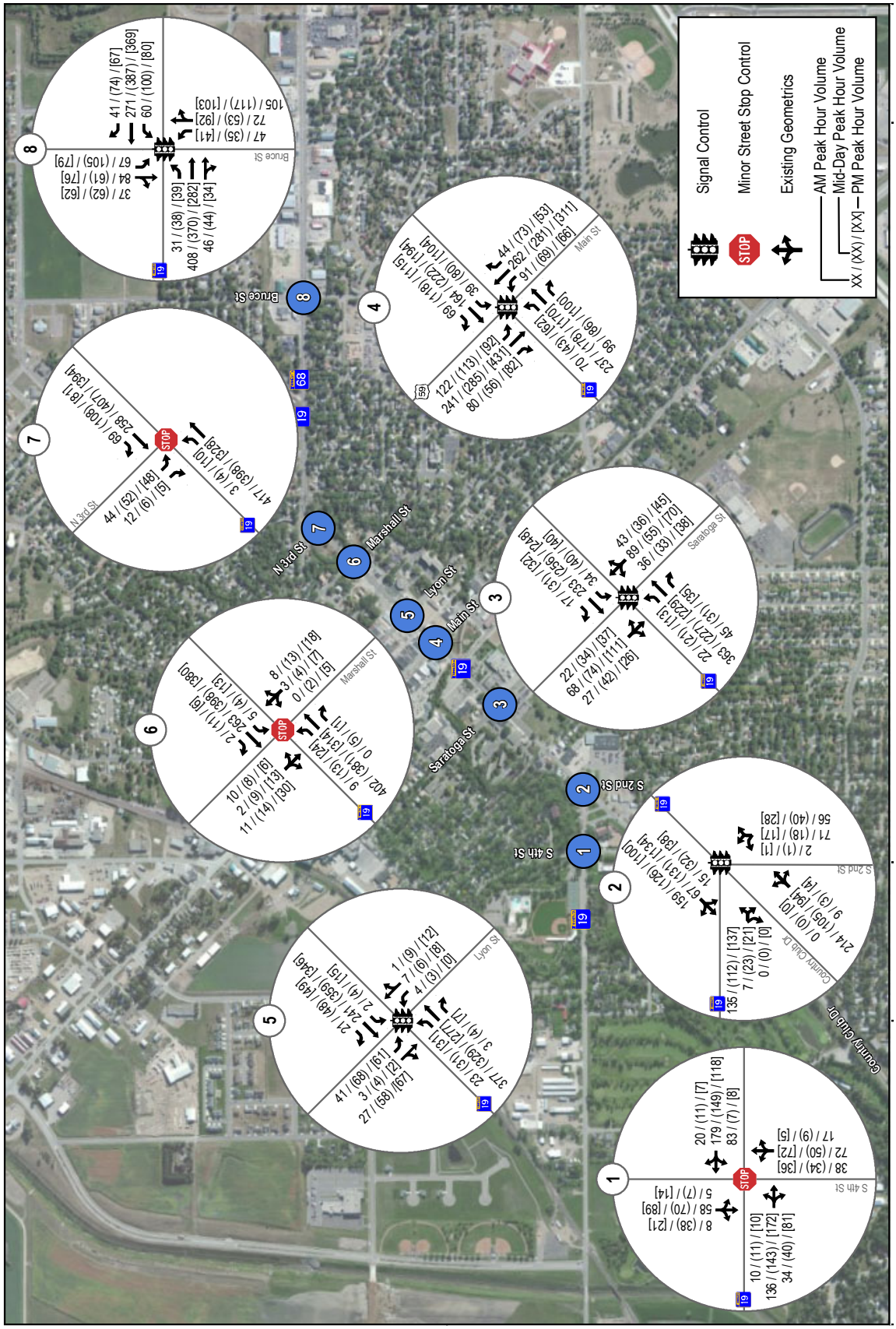
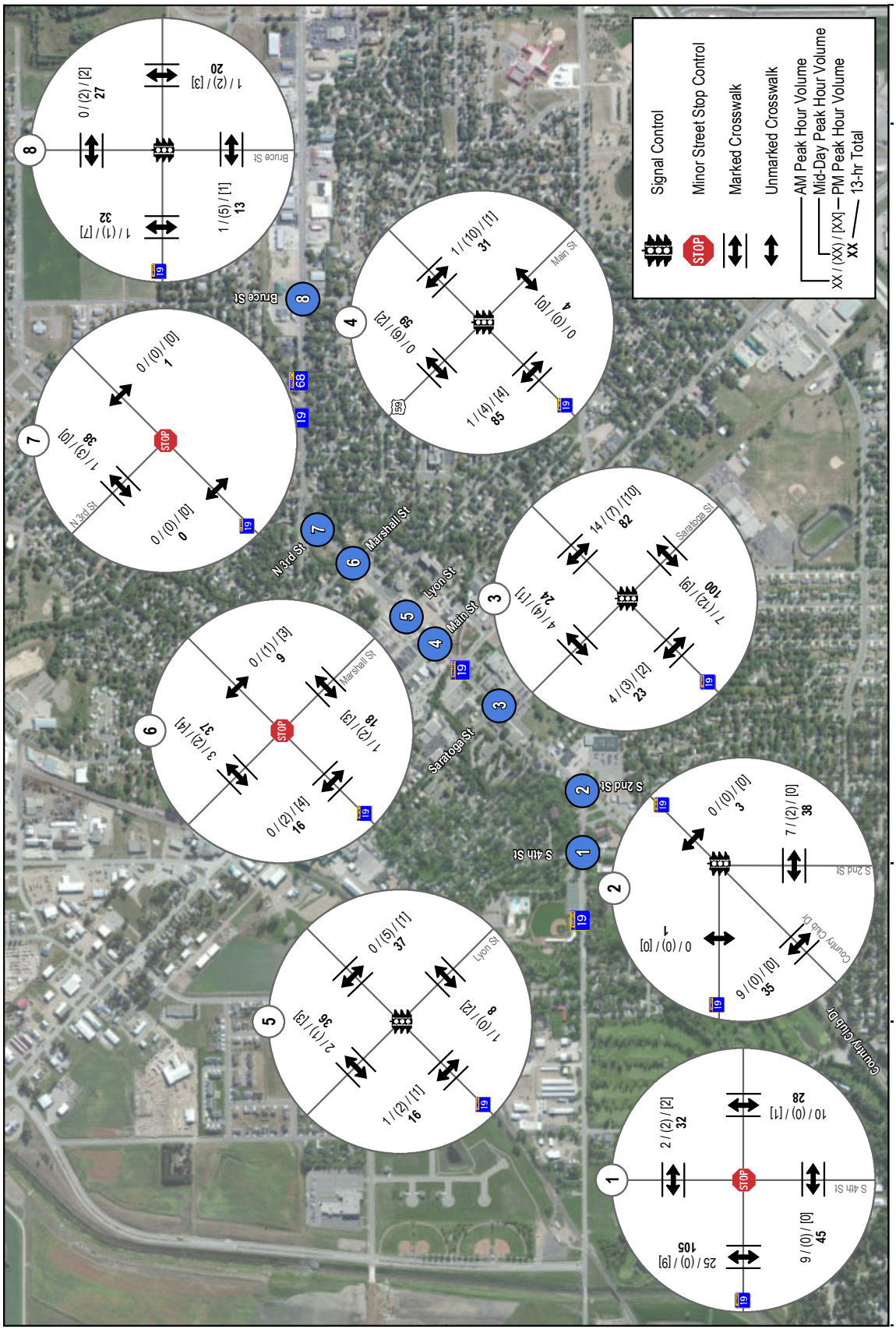


Figure 4 – Existing (2019) Pedestrian Volumes



The pedestrian and bicycle data shows there are three intersections with higher movements, between 180 and 230 total crossings, and five of the intersections having less than 100 total crossings in the 13-hour count data. Looking at the peak hour data, the majority of crossings during the AM, mid-day, and PM peak hours were below 15 crossings in each hour; the only exception is the west leg of S 4th Street during the AM peak hour which had a total of 25 crossings likely due to the adjacent elementary school. There were four intersection approaches that had over 80 crossings during the entire 13-hour count; these include the west leg of S 4th Street, the south and east legs of Saratoga Street, and the west leg of Main Street.

It should be noted that the elementary school near the S 4th Street intersection is planned to move to a new location by 2021. While there are no current plans, the redevelopment and surrounding land uses would continue to generate pedestrian activity.

In addition to the turning movement counts, three 48-hour roadway traffic volume counts were conducted along TH 19 (east of N 3rd St, east of Saratoga Street, and east of Country Club Drive). Because the counts were conducted in May, during summer break for Southwest University (located approximately ¾ miles northeast of the project area), the 48-hour roadway traffic volume counts were compared to MnDOT's traffic flow maps to ensure that traffic demands do not drastically change when Southwest University is in session.

It was found that the 2019 counts conducted as part of this study were very similar to the Average Annual Daily Traffic (AADT) counts obtained from MnDOT's traffic flow maps. Therefore, the existing traffic demands were not factored to account for additional traffic when Southwest University is in session.

The most current "official" AADT is from 2018; the AADT for the different roadways in the study are shown in **Table 3**. Mainline TH 19 AADT volumes within the study area range from 2,900 to 9,500 vehicle per day.

Table 3 – Existing Traffic Demands AADT

Roadway	Description	Year	AADT
TH 19	West of Country Club Dr	2016	2,900
	Country Club Dr to Main St	2016	8,300
	Main St to N 3rd St	2016	8,800
	N 3rd St to Bruce St	2018	9,500
	East of Bruce St	2018	9,300
S 4th St	North of TH 19	2018	2,500
	South of TH 19	2018	2,550
Country Club Drive	South of TH 19	2018	3,150
Saratoga Street	North of TH 19	2014	3,600
	South of TH 19	2014	3,600
Main Street (US 59)	North of TH 19	2014	9,300
	South of TH 19	2018	9,500
Marshall Street	North of TH 19	2018	2,050
N 3rd Street	North of TH 19	2018	1,750
Bruce Street	North of TH 19	2018	4,700
	South of TH 19	2018	4,450

3 Future Conditions

Historical AADT data along TH 19 and surrounding corridors were reviewed as well as historical population growth in the area. A linear regression analysis of TH 19 and the surrounding corridors results in very limited growth on many of the roadways, including some negative values. This indicates that traffic demands have been fairly steady in recent history.

MnDOT's Office of State Aid maintains current 20-year growth factors for all counties in Minnesota. The current growth factor for Lyon County is 1.3, which equates to a linear growth rate of 1.5% per year over a 20-year projection. However, it should be noted this is for the entire county area, which has extensive undeveloped land area outside of the City of Marshall.

Based on the previous 50 years of census data, Lyon County has had a relatively flat growth rate and the City of Marshall has had a growth rate of just over 0.6% per year.

Based on the linear regression analysis, historical population growth, and input from the Project Management Team (PMT), a linear growth rate of 0.5% per year was selected and utilized to develop the 2045 forecast traffic volumes. Due to the low expected growth, a year of opening forecast and analysis was not performed for this study.

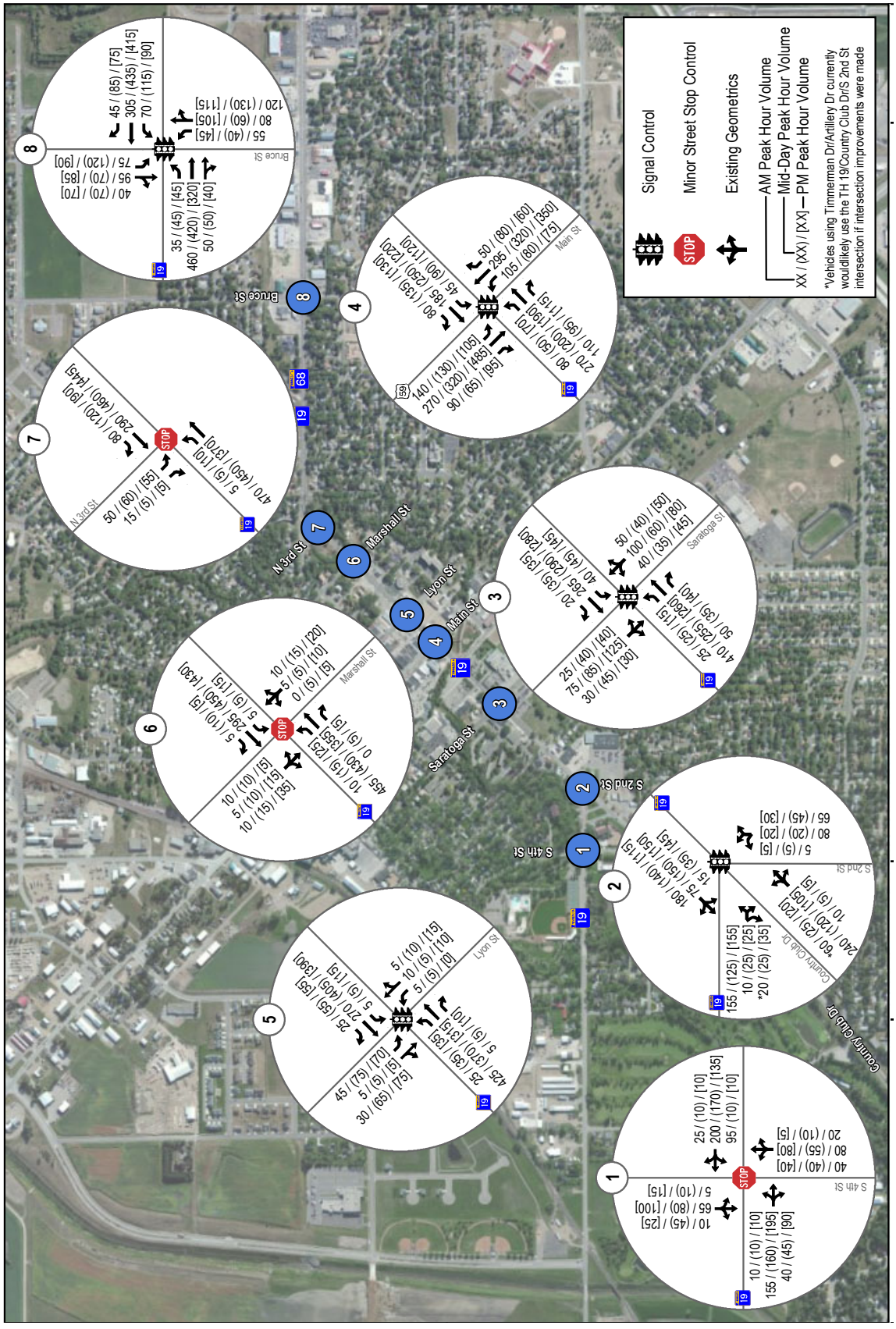
Table 4 shows the most recent AADT's, the 2045 projected AADTs and corresponding linear growth rate. The 2045 forecasted turning movement volumes can be found in **Figure 5**. Mainline TH 19 projected 2045 AADTs with the study area range from 3,500 to 10,550.

Table 4 – 2045 Forecasted Traffic Demands AADT

Roadway	Description	2018 Existing AADT*	2045 Forecast AADT	Linear Growth Rate
TH 19	West of Country Club Dr	3,150	3,600	0.5%
	Country Club Dr to Main St	8,200	9,300	0.5%
	Main St to N 3rd St	9,100	10,350	0.5%
	N 3rd St to Bruce St	9,500	10,800	0.5%
	East of Bruce St	9,300	10,550	0.5%
S 4th St	North of TH 19	2,500	2,850	0.5%
	South of TH 19	2,550	2,900	0.5%
Country Club Dr	South of TH 19	3,150	3,600	0.5%
Saratoga Street	North of TH 19	3,600	4,100	0.5%
	South of TH 19	3,200	3,650	0.5%
Main Street (US 59)	North of TH 19	9,800	11,100	0.5%
	South of TH 19	9,500	10,800	0.5%
Marshall Street	North of TH 19	2,050	2,350	0.5%
N 3rd Street	North of TH 19	1,750	2,000	0.5%
Bruce Street	North of TH 19	4,700	5,350	0.5%
	South of TH 19	4,450	5,050	0.5%

*AADTs from before 2018 were factored to 2018 AADTs using the previous 20-years of historical data

Figure 5 – 2045 Forecasted Traffic Volumes



4 Analysis of Alternatives

Intersection control evaluations rely on traffic control warrants to assess the different options available at any intersection. To determine the control options, warrants are evaluated to assess where control changes can be made based on volumes. The results are used to aid in the evaluation of traffic safety and traffic operations at the study intersections.

4.1 Warrant Analysis

The Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD) provides guidance on when it may be appropriate to use all-way stop or signal control at an intersection. This guidance is provided in the form of "warrants", or criteria, and engineering analysis of the intersection's design factors to determine when all-way stop or signal control may be justified. All-way stop or signal control should not be installed at an intersection unless a MnMUTCD warrant is met. Meeting a warrant at an intersection does not in itself require the installation of a particular control type. The particular control type also requires an engineering analysis of the intersection's design in order for it to be justified.

Under the MnDOT ICE process, roundabouts are considered to be warranted if traffic volumes meet the criteria for either all-way stop or traffic signal control.

4.1.1 Requirements for Installation of a Traffic Signal

For traffic signal installation, MnDOT typically requires volume thresholds for Warrant 1 to be satisfied, which requires 8-hours of combined major approach volumes and the highest minor street approach volume to meet MnMUTCD thresholds. These thresholds vary with the number of approach lanes on the major and minor street. Other warrants may be used as indicators of a need to consider traffic control change; an engineering study that considers factors, including warrants, should be performed to determine the optimum type of control at an intersection.

4.1.2 Requirements for Removal of an Existing Traffic Signal

The MnDOT Traffic Engineering Manual (TEM) provides guidance on volume requirements to remove an existing traffic signal. Based on Chapter 9, section 9-5.02.05 of the TEM, an intersection that meets 80 percent of the volume requirements of Warrant 1 should be considered justified and should not be removed. A signalized intersection that does not meet 60 percent of the volume requirements of Warrant 1, and meets no other Warrant, is an unjustified traffic signal and should be removed.

A signalized intersection that does not meet 80 percent of the volume requirements but does meet 60 percent of the volume requirements of Warrant 1 is in a "gray area" and may be considered for traffic signal removal. Additional studies, findings, engineering judgment and documentation beyond the volume requirements are needed to justify retaining the signal.

4.2 Warrant Analysis Assumptions

MnDOT guidelines suggest that for the purpose of warrant analysis, 100% of right turning traffic from the minor leg should be removed because right turning vehicles are typically able to enter the traffic stream with minimal delay or conflict; the right turning traffic would not require a traffic signal to reduce delay or improve safety. In certain circumstances (i.e. high right turn volume, minimum mainline gaps, etc.), MnDOT procedures allow for the inclusion of 50% of the minor

street right turning traffic in the analysis. The MnDOT guidance states "if right turning volume exceeds 70% of its potential capacity for any hour for each approach, 50% of the right turning volume for all hours should be added back in."

- Based upon MnDOT guidance, the analysis of the eight study intersections includes removal of 100% of the right turning traffic on the minor approaches.

MnDOT guidelines suggest that the warrant thresholds may also be reduced based on the roadway speeds and population of the city the intersection is within. If either major approach to the intersection has a posted speed, or 85th percentile speed, that exceeds 40 mph, then a reduction to 70% threshold volumes is allowed. If the population of the city is less than 10,000 people, a reduction to 70% threshold volumes is allowed.

- Based upon MnDOT guidance, the analysis of the eight study intersections does not include reductions based on speeds or population as all roadways are posted at 30 mph and the City of Marshall has a population above 10,000.

Traffic warrants were completed for the existing and forecasted 2045 traffic demands.

4.2.1 Warrant Results Summary

Based on the existing and 2045 traffic volumes, the following intersections do not meet the All-way Stop warrant or any Traffic Signal warrant and should retain their existing minor street stop intersection control (unless other factors dictate a need for an intersection control change):

- TH 19 at S 4th Street
- TH 19 at Marshall Street
- TH 19 at N 3rd Street

All-Way Stop Warrants

Based on the existing traffic volumes, the intersections of TH 19 at Main Street and TH 19 at Bruce Street meet the full warrant thresholds for the all-way stop warrants. The intersection of TH 19 at Saratoga Street meets all-way stop warrants with the future 2045 forecasted traffic demands.

The intersection of Lyon Street does not meet the all-way stop warrant for any hour of the day under both existing and future volumes.

Country Club Drive/S 2nd Street does not meet the full 8-hour all-way stop warrant, but does reach the threshold for 6 hours under both existing and future volumes. Based on input from the project team, a roundabout at the intersection of Country Club Drive/S 2nd Street will be considered, despite not fully meeting traffic control warrants as it has other benefits to the corridor such as traffic calming (speed reduction) and safety benefits (reduced conflict points).

Traffic Signal Warrants

Under the existing conditions, the intersection of TH 19 at Country Club Drive/S 2nd Street does not meet 60% of the traffic signal warrant volume thresholds. However, under 2045 conditions, this intersection meets 60% of the traffic signal warrant volume thresholds but not 80%, which puts this intersection in the gray area where removal of the signal could be considered. Based upon the forecasted traffic growth rate, this intersection is not expected to meet 60% of the warrant volume thresholds and enter the gray area until 18 years after the project is constructed (2043).

Under the existing conditions, the intersection of TH 19 at Saratoga Street does not meet 60% of the traffic signal warrant volume thresholds. However, under 2045 conditions, this intersection meets 60% of the traffic signal warrant volume thresholds but not 80%, which puts this intersection in the gray area where removal of the signal could be considered. Based upon the forecasted traffic growth rate, this intersection is expected to meet 60% of the warrant volume thresholds and enter the gray area within 6 years of the project being constructed (2028).

Under the existing conditions, the intersection of TH 19 at Main Street meets 80% of the traffic signal warrant volume thresholds; however, under 2045 conditions, this intersection meets the full signal warrant, which means the existing signal at this intersection is justified.

Under the existing and 2045 conditions, the intersection of TH 19 at Lyon Street does not meet 60% of the traffic signal warrant volume thresholds, potential removal of the traffic signal at this intersection is justified.

Under the existing conditions, the intersection of TH 19 at Bruce Street meets 60% of the traffic signal warrant volume thresholds but not 80%, this intersection is in the gray area where removal of the signal could be considered. Under 2045 conditions, this intersection meets 80% of the traffic signal warrant volume thresholds, which means the existing signal is justified. Based upon the forecasted traffic growth rate, this intersection is expected to meet 80% of the warrant volume thresholds and become justified within 8 years of the project being constructed (2027).

Table 5 provides the all-way stop and traffic signal warrant summary for the 2019 existing and 2045 future volume conditions. Complete all-way stop and traffic signal analyses can be found in **Appendix A**.

Table 5 – Warrant Analysis Results

Intersection	2019 Existing		2045 Future Demands	
TH 19 at:	All-way Stop Warrant	Signal Warrant 1 (8 Hour Volume)	All-way Stop Warrant	Signal Warrant 1 (8 Hour Volume)
S 4th Street (Minor Street Stop)	Not Met 3 of 8 hours	Not Met 0 of 8 hours	Not Met 4 of 8 hours	Not Met 0 of 8 hours
Country Club Drive (Traffic Signal)	Not Met 5 of 8 hours	Not Met[3] 0 of 8 hours	Not Met 6 of 8 hours	Not Met[2] 0 of 8 hours
Saratoga Street (Traffic Signal)	Not Met 7 of 8 hours	Not Met[3] 0 of 8 hours	**Met** **8 of 8 hours**	Not Met[2] 1 of 8 hours
Main Street (Traffic Signal)	**Met** **13 of 8 hours**	Not Met[1] 7 of 8 hours	**Met** **13 of 8 hours**	**Met** **10 of 8 hours**
Lyon Street (Traffic Signal)	Not Met 0 of 8 hours	Not Met[3] 0 of 8 hours	Not Met 0 of 8 hours	Not Met[3] 0 of 8 hours
Marshall Street (Minor Street Stop)	Not Met 0 of 8 hours	Not Met 0 of 8 hours	Not Met 0 of 8 hours	Not Met 0 of 8 hours
N 3rd Street (Minor Street Stop)	Not Met 0 of 8 hours	Not Met 0 of 8 hours	Not Met 0 of 8 hours	Not Met 0 of 8 hours
Bruce Street (Traffic Signal)	**Met** **12 of 8 hours**	Not Met[2] 2 of 8 hours	**Met** **12 of 8 hours**	Not Met[1] 5 of 8 hours

Notes:

1. Existing signal that does meet the 80 percent volume threshold for Warrant 1.
2. Existing signal that does meet the 60 percent volume threshold, but not the 80 percent threshold for Warrant 1.
3. Existing signal that does not meet the 60 percent volume threshold for Warrant 1.

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4.3 Safety Analysis

Future crash estimates were prepared by applying existing and MnDOT statewide average (10-year) crash rates to the 2045 projected traffic volumes for the study intersections.

The following crash rates were utilized in this analysis:

- No Build estimates are based on the existing crash rates described in Section 2.
- The MnDOT statewide average crash rate for urban minor street stop controlled intersections is 0.19 crashes per million vehicles entering the intersection.
- The MnDOT statewide average crash rate for all-way stop controlled intersections is 0.35 crashes per million vehicles entering the intersection.
- Signalized intersection rates are based on the MnDOT statewide average crash rates for low speed (<45 mph), low volume (<15,000 vpd on highest volume leg) signalized intersections; the average crash rate is 0.54 crashes per million vehicles entering the intersection.
- Roundabout crash estimation was done using MnDOT's *A Study of the Traffic Safety at Roundabouts in Minnesota*. This study concluded that single-lane roundabouts have a crash rate of 0.32 crashes per million vehicles entering the intersection.

  - Reduced speeds and reduced number of conflict points at roundabouts reduce the severity of crashes, including fatal crashes. A standard intersection has 32 vehicle conflict points, where a standard single-lane roundabout only has 8. For pedestrian crossings, a standard intersection can have 24 pedestrian conflict points, where a single-lane roundabout has only 8.

- For reduced conflict intersections like ¾ access or right-in/right-out (RI/RO) the MnDOT statewide average crash rate for "other" intersection types was used; the average crash rate is 0.15 crashes per million vehicles entering the intersection.
  - Although the estimates shown in **Table 5** are the same for ¾ access and RI/RO, it is expected that RI/RO would have slightly fewer crashes per year due to reduced conflicts with the elimination of the left turns from the major approaches.

Table 6 shows the projected number of total yearly crashes for each traffic control type analyzed for the projected 2045 traffic conditions. The "n/a" infer that a particular intersection control is not viable at an intersection based on warrant analysis, traffic volumes, or existing safety concerns. The bolded values are the annual crash estimates for the existing intersection control using the existing crash rates.

Table 6 – 2045 Annual Crash Frequency Estimates

TH 19 at:	Existing Intersection Control	Annual Crash Estimates by Control Type [1,2]				
		Thru-Stop	All-way Stop	Traffic Signal	Single-lane roundabout	¾ Access or RI/RO[3]
S 4th St	Thru-stop	**2.2**	n/a	n/a	0.7	0.3
Country Club Dr/S 2nd St	Traffic Signal	0.6*	n/a	**1.0**	1.0	n/a
Saratoga St	Traffic Signal	0.9	1.7	**2.6**	1.6	n/a
Main St	Traffic Signal	n/a	2.6	**7.1**	2.4	n/a
Lyon St	Traffic Signal	0.8	n/a	**1.5**	n/a	0.6
Marshall St	Thru-stop	**2.2**	n/a	n/a	1.3	0.6
N 3rd St	Thru-stop	**0.2**	n/a	n/a	n/a	0.6
Bruce St	Traffic Signal	1.1	2.0	**5.3**	1.9	n/a

1) Based on historical intersection crash rates (2009 to June 2019 Data) for the existing intersection control **BOLD**

2) Based on MnDOT Statewide average crash rates for control type (2006-2015 Data) for intersection control changes

3) Based on MnDOT Statewide average for "other" control type, does not distinguish between ¾ or RI/RO control.

"n/a" infer that a particular intersection control is not viable

*Due to the intersection skew, crashes at thru-stop intersection at Country Club Dr/S 2nd St would likely be higher than the statewide average

It should be noted that some of the intersections currently have crash rates that are above the MnDOT statewide average crash rates for their particular intersection control type, which

indicates a sustained crash problem at these locations. Bringing the intersection design up to current design standards should have a safety benefit to all intersections within the TH 19 corridor.

The existing intersection of TH 19 at Country Club Drive/S 2nd Street would likely have a crash rate higher than the statewide average under minor street stop control due to the existing intersection skew.

In the roadway design and traffic operations analysis, special attention should be given to the intersection of TH 19 at Main Street and TH 19 at Bruce Street as the observed crash rates are currently above the critical rate yet are unlikely to have traffic control changes.

4.4 Traffic Operation Analysis

Existing (2019) and forecast 2045 traffic operations analyses were conducted to determine the level of service (LOS), delay, and queueing information for the AM, mid-day, and PM peak hour conditions for each control type scenario.

LOS is a qualitative rating system used to describe the efficiency of traffic operations at an intersection. Six LOS levels are defined, designated by letters A through F. LOS A represents the best operating conditions (no congestion), and LOS F represents the worst operating conditions (severe congestion). For the eight study intersections, it was assumed that a LOS D or better represents acceptable operating conditions for all movements and approaches and LOS C or better represents acceptable operating conditions for all intersections.

LOS for intersections is determined by the average control delay per vehicle. The range of control delay for each LOS is different for signalized and unsignalized intersections (including roundabouts). The expectation is that a signalized intersection is designed to carry higher traffic volumes and will experience greater delays than an unsignalized intersection; driver tolerance for delay is greater at a signal than a stop sign. Therefore, LOS thresholds for each LOS category are lower for unsignalized intersections than for signalized intersections.

The traffic operations analyses for the two-way stop, all-way stop, and signalized intersections were performed using Synchro/SimTraffic (version 9) software package; an average of 10 simulation runs was used for each modeling result.

The traffic operations analyses for the roundabouts were performed using HCS 7 software. HCS 7 is intended to be a faithful implementation of the equations in the 2010 Highway Capacity Manual.

Appendix B includes all relevant operational tables and outputs for the existing and future 2045 scenarios that follow.

4.4.1 Validation of the Traffic Operations Model

The Project Management Team (PMT) voiced some concerns about queues from the TH 19 at Main Street intersection spilling back and effecting operations at some of the adjacent intersections, specifically at N 3rd Street (north of the intersection on US 59), Marvin Schwan Memorial Drive (west of the intersection on TH 19), and Lyon Street (east of the intersection on TH 19). In order to ensure that the operating conditions of the SimTraffic model closely match those at the intersections currently, a comparison of the maximum queues from the SimTraffic

model at the intersection of TH 19 at Main Street were compared to the video taken of the intersection in May 2019.

Using Synchro/SimTraffic's default saturation flow rate of 1,900 vehicle per hour per lane (vphpl), the SimTraffic maximum queue results were much lower than those observed in the video of the intersection. In order to more closely match the existing conditions, the saturation flow rate in Synchro/SimTraffic was lowered to 1,800 vphpl.

Table 7 shows the comparison between the observed existing maximum queues and the SimTraffic maximum queue results during the AM, mid-day, and PM peak hours.

Table 7 – Maximum Queue Length – Observed vs. SimTraffic Results

Peak Hour	Approach	Observed (ft)	SimTraffic Results (ft)	Difference (ft)
AM	EB	425	390	(35)
	WB	250	244	(6)
	NB	375	334	(41)
	SB	300	312	12
MD	EB	200	239	39
	WB	200	267	67
	NB	350	324	(26)
	SB	225	286	61
PM	EB	200	254	54
	WB	200	256	56
	NB	225	294	69
	SB	450	418	(32)

One of the main queueing concerns brought up by the PMT involved southbound queues spilling back through the N 3rd Street intersection. Both the observed and SimTraffic queues extended past N 3rd Street in the AM, mid-day, and PM peak hours. The Main Street at N 3rd Street intersection was not included as part of this project and the impact the long queues have on that intersection were not able to be analyzed further.

Another concerning approach was eastbound queues spilling back past Marvin Schwan Memorial Drive. Both the observed and SimTraffic maximum queues spill past Marvin Schwan Memorial Drive in the AM peak and into the intersection during the mid-day and PM peaks.

4.4.2 Existing Conditions

Current intersection operations are acceptable based on overall delays for all movements; all intersections and approaches overate at LOS C or better during the AM, mid-day, and PM peak hours.

There are some queues that spill beyond some short turn lane storage that is currently provided, however, these queues do not have a detrimental effect on overall operations and delays.

The intersection of TH 19 at Main Street has queues that spill past the nearby intersections in both the existing and all 2045 conditions, as was described in the previous section. These queueing issues may have some operational effect on nearby intersections; however, only the

effect on the Lyon Street intersection was studied because it is a study intersection. Therefore, the southbound, northbound, and eastbound queuing issues at the intersection of TH 19 at Main Street will not be directly evaluated in any of the 2045 analysis scenarios.

Due to the skew at the intersection of TH 19 at Country Club Drive/S 2nd Street, it is not immediately clear which approach is which in the operational analysis tables. Below is what each approach was designated at the Country Club Drive/S 2nd Street intersection. At all other intersections, the TH 19 approaches are the eastbound and westbound approaches.

- Country Club Drive – Northbound
- TH 19 to/from the northeast - Southbound
- TH 19 to/from the west – Eastbound
- S 2nd Street - Westbound

Table 8 represents the existing traffic operations for the AM, mid-day, and PM peak hours.

Table 8 – Existing 2019 Traffic Operations

TH 19 at:	Approach	AM Peak		MD Peak		PM Peak	
		Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)
S 4th St (Minor Stop)	EB	0.7 / A	3.5 / A	0.7 / A	2.9 / A	1.1 / A	3.6 / A
	WB	1.7 / A		0.5 / A		0.6 / A	
	NB	9 / A		7.4 / A		7.9 / A	
	SB	8.4 / A		6.9 / A		8.8 / A	
Country Club Dr/S 2nd St(1) (Signal)	EB	19.7 / B	13.7 / B	14.2 / B	9.6 / A	12.8 / B	9.5 / A
	WB	16 / B		10.0 / B		11.1 / B	
	NB	15.8 / B		10.0 / B		9.3 / A	
	SB	8 / A		7.6 / A		7.7 / A	
Saratoga St (Signal)	EB	9.5 / A	10.6 / B	7.3 / A	9.4 / A	7 / A	10.1 / B
	WB	8 / A		7.8 / A		8.1 / A	
	NB	15.7 / B		13.6 / B		13.4 / B	
	SB	14.8 / B		13.6 / B		16.5 / B	
Main St (Signal)	EB	20.8 / C	20.3 / C	20.2 / C	19.0 / B	23 / C	21.6 / C
	WB	18.1 / B		17.8 / B		20.6 / C	
	NB	21.8 / C		19.8 / B		20.5 / C	
	SB	19.7 / B		18.7 / B		22.3 / C	
Lyon St (Signal)	EB	5.0 / A	5.2 / A	5.6 / A	6.6 / A	5.3 / A	6.2 / A
	WB	3.3 / A		4.9 / A		4.8 / A	
	NB	17.8 / B		8.8 / A		9.3 / A	
	SB	12.8 / B		14.6 / B		12.1 / B	
Marshall St (Minor Stop)	EB	1.2 / A	1.3 / A	1.3 / A	1.4 / A	1.4 / A	1.6 / A
	WB	0.7 / A		0.8 / A		0.9 / A	
	NB	5.5 / A		6.3 / A		6.1 / A	
	SB	6.4 / A		8.2 / A		6.5 / A	
N 3rd St (Minor Stop)	EB	0.6 / A	1.1 / A	0.5 / A	1.2 / A	0.6 / A	1.2 / A
	NB	0.6 / A		0.8 / A		0.7 / A	
	SB	8.6 / A		10.4 / B		10.0 / B	
Bruce St (Signal)	EB	8.6 / A	10.7 / B	8.1 / A	10.3 / B	8.1 / A	10.6 / B
	WB	8.1 / A		8.1 / A		8.4 / A	
	NB	14.7 / B		13.3 / B		14.2 / B	
	SB	16.8 / B		17.1 / B		16.2 / B	

Notes: Minor street stop control intersection LOS is typically defined as the worst approach LOS; however the overall intersection delay is shown.
(1) WB is S 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19

4.4.3 Traffic Control Alternatives – 2045

Based on the warrant analysis, all existing minor street stop controlled intersections do not warrant a traffic control change as the minor street traffic demands do not meet the volume thresholds that merit change of traffic control in either the existing or forecast year. With existing traffic signal control not meeting warrants at some intersections, multiple control options were then evaluated for the study intersections.

Based on the warrant analysis for the intersection of TH 19 at S 4th Street, neither an all-way stop nor a traffic signal are warranted. However, the existing minor street stop control has safety issues, so alternative traffic control should be analyzed. Reduced access was not considered a viable option at S 4th Street due to the large number of northbound and southbound through trips at the intersection and the need to keep S 4th Street as a continuous route from downtown Marshall to TH 23. Therefore, the existing minor street stop and roundabout alternatives were analyzed at this intersection; all-way stop control was not considered as a safety improvement as TH 19 has 60% to 70% of the traffic which could lead to driver disregard of control.

Based on the warrant analysis for the intersection of TH 19 at Country Club Drive/S 2nd Street, the existing signal is not currently justified and could potentially be removed; it does not enter the "gray area" for signal removal until approximately 2043. However, the skew and geometry of the intersection would make minor street stop control difficult to achieve without major intersection reconstruction to square up some of the approaches. Therefore, the existing signal control was evaluated under the current alignment, but the minor street stop and roundabout control were analyzed with major roadway configuration changes. The roadway configurations would include access changes at both Timmerman Drive and Artillery Drive due to spacing. The reconfiguration would develop the west TH 19 approach and the 2nd Street approach as the minor approaches, with County Club Drive and the east TH 19 approaches being the major approaches.

Based on the warrant analysis for the intersection of TH 19 at Saratoga Street, an all-way stop is warranted under 2045 traffic demands and the existing signal will be in the "gray area" where removal of the signal is an option to be considered. Therefore, minor street stop, all-way stop, and roundabout control were analyzed at this intersection along with the existing signal control.

Based on the warrant analysis for the intersection of TH 19 at Main Street, both all-way stop and traffic signal warrants are met under existing and 2045 traffic demands. Therefore, all-way stop, traffic signal, and roundabout control were analyzed at this intersection.

Based on the warrant analysis for the intersection of TH 19 at Lyon Street, the existing signal is not justified and should potentially be removed. Therefore, this analysis only evaluated this intersection as a minor street stop controlled or reduced access intersection along with the existing signal control in the No Build condition.

Based on the warrant analysis for the intersection of TH 19 at Marshall Street, neither an all-way stop nor a traffic signal are warranted. However, the existing minor street stop control has safety issues so alternative traffic control should be analyzed. Therefore, the existing minor street stop, roundabout, and reduced access control was analyzed at this intersection.

Based on the warrant analysis for the intersection of TH 19 at S 3rd Street, neither an all-way stop nor a traffic signal are warranted. The existing minor street stop control does not have any safety issues so reduced access was not analyzed. Therefore, the existing minor street stop control was the only control analyzed at this intersection.

Based on the warrant analysis for the intersection of TH 19 at Bruce Street, the intersection will meet all-way stop warrants with 2045 traffic demands and the existing signal is currently in the "gray area" where removal of the signal is an option that should be considered. Therefore, minor street stop, all-way stop, and roundabout control were analyzed at this intersection along with the existing signal control.

This analysis will include the current No Build condition as well as multiple scenarios with different control options for each intersection. No major changes to the intersection geometry were analyzed under any of the 2045 alternatives. The following is a list of all 2045 scenarios evaluated:

- **No Build** conditions
  - Existing geometry and traffic control.
  - Consideration of Signal Coordination
- **Alternative 1** – Minor Street Stops (Signal Removal Intersections)
  - Minor street stop control at Country Club Drive/S 2nd Street and Lyon Street; do not meet 60% of signal warrant volume thresholds.
- **Alternative 2** – Minor Street Stops (Gray Area Signal Removal Intersections)
  - Minor street stop control at Country Club Drive/S 2nd Street and Lyon Street; do not meet 60% of signal warrant volume thresholds.
  - Minor street stop control at Saratoga Street and Bruce Street; are in the "gray area" where signal removal should be investigated.
- **Alternative 3** – All-way Stops
  - Minor street stop control at Country Club Drive/S 2nd Street and Lyon Street; do not meet 60% of signal warrant volume thresholds.
  - All-way stop control at Saratoga Street, Main Street, and Bruce Street.
- **Alternative 4** – Roundabout Control
  - Roundabout control at S 4th Street, Country Club Drive, Saratoga Street, Main Street, Marshall Street, and Bruce Street.
  - Minor Street stop control at Lyon Street
- **Alternative 5 –** Reduced Access
  - Alternative 2 with reduced access at various intersection along corridor.
  - Additional non-study intersections were included in analysis.
- **Alternative 6** – Potential Corridor Intersection Control
  - Corridor Alternative with potential intersection control at each intersection based on operations, safety, and other considerations.
  - Includes various minor street stop, roundabout, and traffic signal control as well as reduced access intersections; details listed in report section.
- **Alternative 7** – Potential Corridor Intersection Control
  - Corridor Alternative with potential intersection control at each intersection based on operations, safety, and other considerations.

- Includes various minor street stop, roundabout, and traffic signal control as well as reduced access intersections; details listed in report section.

4.4.3.1 No Build Conditions

With increased traffic demands, the existing traffic control at the study intersections is expected to operate acceptably based on the overall vehicle delay for all movements; all intersections and approaches are expected to operate at LOS C or better during the peak hours.

As with the existing conditions, some of the turn lanes at the intersections have maximum queues that spill out of the available storage or have storage lanes that are blocked by through queues. These queues do not have a detrimental effect on intersection operations, and are present in all of the potential build scenarios; therefore, these will not be covered in the analysis of the alternatives unless a major queuing issue is identified.

During all peak hours, the westbound approach to the Main Street intersection spills back to or through the Lyon Street intersection. As Lyon Street rests in green for mainline TH 19 the majority of time, this queue is easily dissipated and the intersection still operates acceptably. The eastbound, southbound, and northbound approaches all have maximum queues that spill through the adjacent intersection. The through queues on all four approaches of the Main Street intersection can spill back to block the left turn storage lanes.

Based on the No Build traffic operations, the existing traffic control at each study intersection is considered a viable option through the 2045 design year. **Table 9** represents the 2045 No Build traffic operations for the AM, mid-day, and PM peak hours.

Table 9 – 2045 No Build Operations

TH 19 at:	Approach	AM Peak		MD Peak		PM Peak	
		Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)
S 4th St (Minor Stop)	EB	0.9 / A	4.3 / A	0.8 / A	3.3 / A	1.2 / A	4.2 / A
	WB	2.2 / A		0.6 / A		0.7 / A	
	NB	11.0 / B		7.6 / A		9.1 / A	
	SB	9.1 / A		7.9 / A		9.9 / A	
Country Club Dr/S 2nd St(1) (Signal)	EB	21.7 / C	15.4 / B	16.8 / B	11.2 / B	14.7 / B	11.4 / B
	WB	16.8 / B		11.3 / B		13.7 / B	
	NB	17.2 / B		11.8 / B		11.6 / B	
	SB	9.1 / A		8.3 / A		8.9 / A	
Saratoga St (Signal)	EB	11.9 / B	12.3 / B	7.7 / A	10.3 / B	8.0 / A	11.1 / B
	WB	9.4 / A		8.7 / A		9.0 / A	
	NB	15.7 / B		14.2 / B		14.6 / B	
	SB	15.7 / B		15.5 / B		17.1 / B	
Main St (Signal)	EB	27.7 / C	25.5 / C	23.1 / C	22.4 / C	28.9 / C	27.9 / C
	WB	21.3 / C		20.7 / C		24.4 / C	
	NB	27.9 / C		23 / C		24.0 / C	
	SB	23.9 / C		22.9 / C		32.6 / C	
Lyon St (Signal)	EB	6.2 / A	6.4 / A	6.4 / A	7.4 / A	6.1 / A	6.9 / A
	WB	3.9 / A		5.6 / A		4.9 / A	
	NB	15.8 / B		14.0 / B		10.1 / B	
	SB	14.5 / B		15.1 / B		14.3 / B	
Marshall St (Minor Stop)	EB	1.4 / A	1.5 / A	1.4 / A	1.6 / A	1.6 / A	1.8 / A
	WB	0.8 / A		0.9 / A		1.0 / A	
	NB	7.1 / A		7.8 / A		7.0 / A	
	SB	8.5 / A		9.0 / A		7.2 / A	
N 3rd St (Minor Stop)	EB	0.7 / A	1.5 / A	0.6 / A	1.4 / A	0.7 / A	1.4 / A
	NB	0.7 / A		0.9 / A		0.8 / A	
	SB	11.4 / B		12.3 / B		11.1 / B	
Bruce St (Signal)	EB	9.5 / A	11.9 / B	9.2 / A	11.5 / B	8.9 / A	12.0 / B
	WB	8.9 / A		9.3 / A		9.8 / A	
	NB	16.3 / B		14.1 / B		16.0 / B	
	SB	18.7 / B		18.9 / B		17.8 / B	

Notes: Minor street stop control intersection LOS is typically defined as the worst approach LOS; however the overall intersection delay is shown.
(1) WB is S 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19

The existing signals along the TH 19 corridor are not coordinated, consideration of coordinating to provide better through traffic flow was considered. Based on the evaluation the following information was determined:

- Due to the split phase configuration at County Club Drive, as well as the turning traffic volumes, this intersection is not considered appropriate to include in a coordinated system.
- Saratoga Street is approximately 850 feet from Main Street.
  - Approximately 50-55% of all traffic at the intersection is eastbound/westbound through trips
- Main Street is the major intersection with the highest volume.
  - Approximately 20-25% of all traffic at the intersection is eastbound/westbound through trips
  - Approximately 55-60% of all traffic at the intersection is northbound/southbound from US 59/Main Street
- Lyon Street is approximately 350 feet from Main Street.
  - Approximately 70-80% of all traffic at the intersection is eastbound/westbound through trips
- Bruce Street is approximately 3,400 feet from Lyon Street, due to the spacing this intersection is not considered appropriate to include in a coordinated system.

Coordinating the existing signals of Saratoga Street, Main Street, and Lyon Street for east/west progression had minimal impacts to the intersection delays and queues.

- In the AM peak, there is improved delays and shortened queues along TH 19 with minimal impacts to Main Street traffic.
- In the mid-day and PM peaks, there was an overall increase in intersection delays at the three signalized intersections as well as increased queue lengths on Main Street.
- Signal coordination often decreases delay and queues on the major street, TH 19 in this case, while sometimes increasing delays and queues on the minor street approaches. This occurs as all signals would be coordinated to set cycle length to keep progression along the major route, which can extend the wait time on the minor approaches. In this study case, the major street improvements do not outweigh the minor street increased delays, resulting in an increase in overall intersection delay.

With minimal improvement or even slight degradation to each intersection, traffic signal coordination did not make a major impact. With the intersection volumes at Lyon Street not warranting a traffic signal, the likelihood of removal should be considered.

With a traffic signal at Saratoga Street and at Main Street being considered for coordination, the need for coordination may shift to the signalized intersections along Main Street. North of TH 19, Main Street has three additional traffic signals spaced approximately 400 feet apart; these include N 3rd Street, N 4th Street, and N 5th Street. Outside of this study, these intersection should be reviewed for coordination along the Main Street corridor. Depending on the recommendations of this study, the Saratoga Street signalized intersection could be reviewed to see the impact of coordinating with the Main Street system or leaving uncoordinated.

4.4.3.2 Country Club Drive/S 2nd Street Intersection Improvements

County Club Drive and S 2nd Street tie into TH 19 with skewed approaches.

To improve operations and safety, the intersection skew should be removed as part of any improvement. The intersection skew and geometry would require full reconstruction of the intersection in order to square up some of the intersection legs. If the existing intersection skew were to be maintained with minor street stop control, there may be a crash problem that presents itself due to difficult sightlines and approach angles. For those reasons, minor street stop control is not recommended at this intersection unless the intersection is to be fully reconstructed.

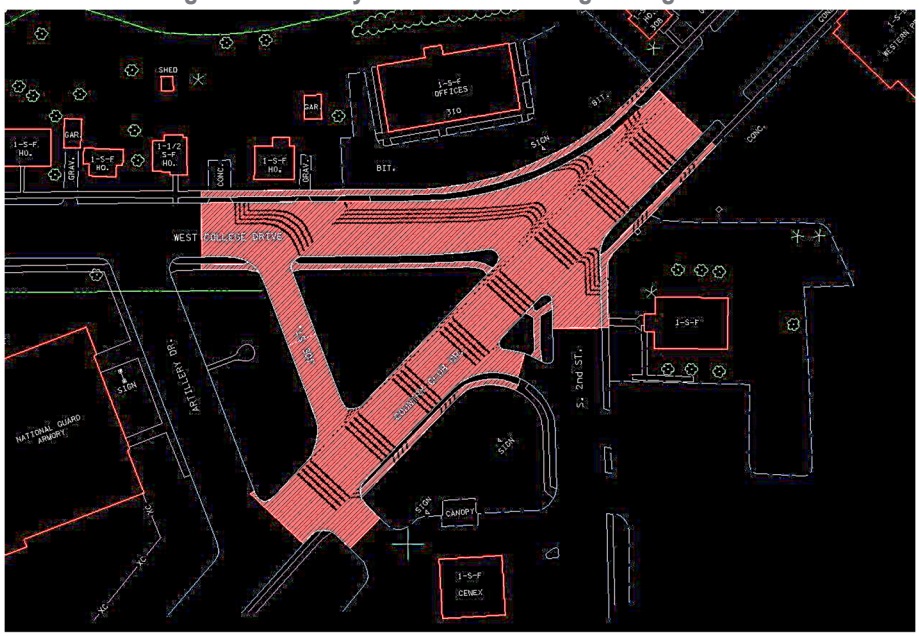
Improvements at this intersection would likely reduce crashes at S 4th Street. The crash problem at S 4th Street includes westbound vehicles in many of the right-angle crashes. This could be the result of the high speed southbound right turn movement at the Country Club Drive intersection. As the signal typically rests with a green phase for southbound TH 19, it allows vehicles to approach the S 4th Street intersection at a higher speed than expected.

For a minor street stop intersection design, the eastbound TH 19 approach and the northbound S 2nd Street approaches should be squared up as the minor legs. If traffic signal control is maintained at the intersection, reconstructing to this design would allow for the removal of the existing split phase and improve the overall operations of the intersection.

For comparative purposes a preliminary design of the existing intersection, with approach skew and traffic signal replacement, was also developed. The design limits for this option were similar to the construction end points for the two proposed options for a better comparison. This design option will not provide any potential safety improvement at S 4th Street.

The following **Figure 6** represents a preliminary design extents of the existing signal controlled intersection; a preliminary cost estimate was completed for $1.40M.

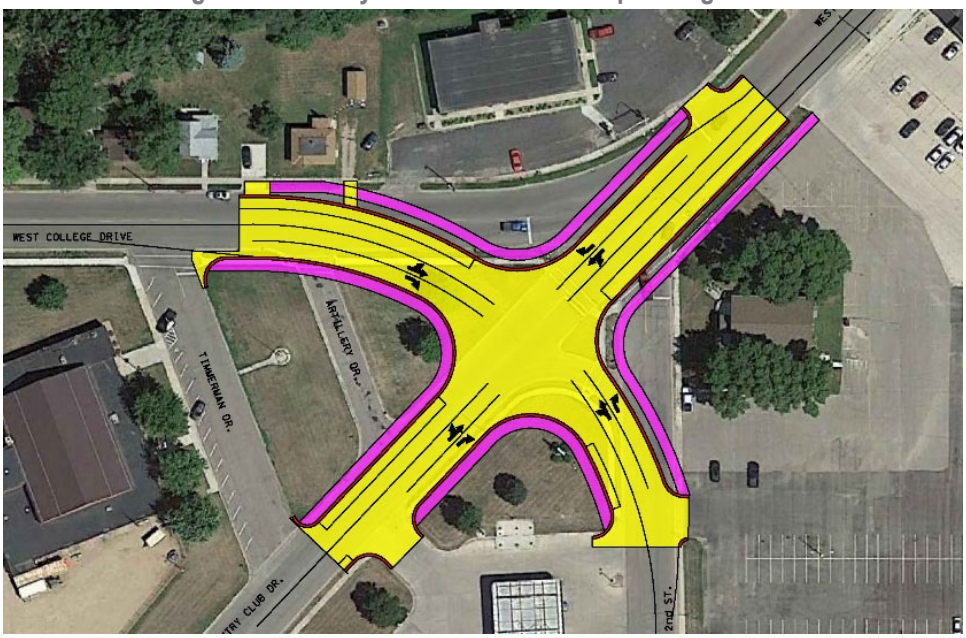
Figure 6 – County Club Drive Existing Configuration



These two design options below will be carried forward in all of the build alternative evaluations. Preliminary intersection layout drawings and cost estimates are attached in **Appendix C**.

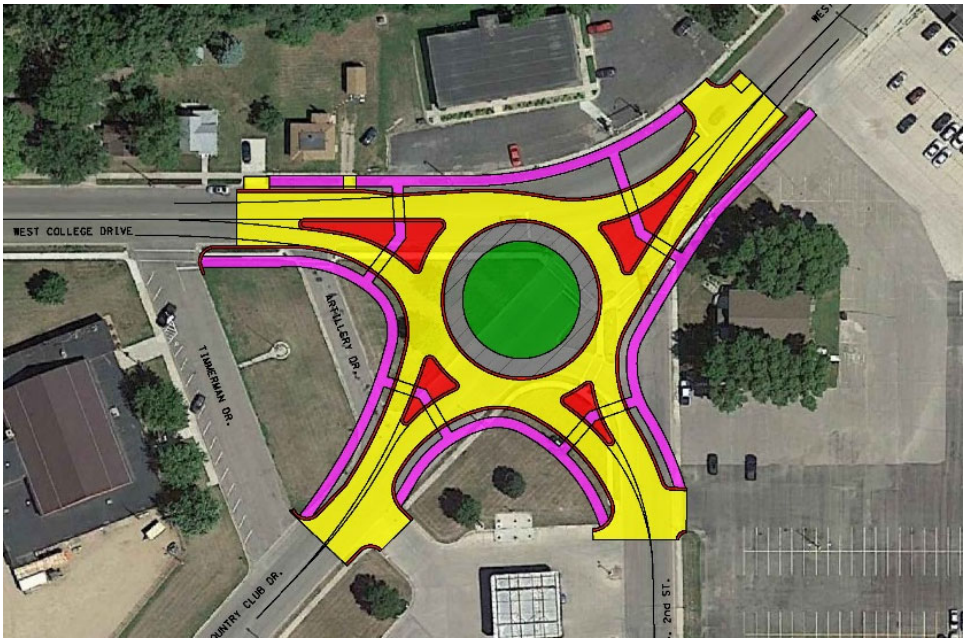
The following **Figure 7** represents a preliminary design of a minor stop controlled intersection; a preliminary cost estimate was completed for $1.17M.

Figure 7 – County Club Drive Minor Stop Configuration



A roundabout controlled intersection could be designed in a similar fashion. The following **Figure 8** represents a preliminary design of a roundabout controlled intersection; a preliminary cost estimate was completed for $1.53M

Figure 8 – County Club Drive Roundabout Configuration



4.4.3.3 Alternative 1 – Minor Street Stop Control (Signal Removal Intersections)

Under Alternative 1, the existing signals that do not meet 60% of the signal warrant volume thresholds under 2045 traffic demands were removed and replaced with minor street stop controlled intersections. The changes from the No Build condition include:

- Country Club Drive/S 2nd Street changed to minor street stop control and roadways realigned to remove the existing skew.
  - The west leg of TH 19 and S 2nd Street are the minor stopped approaches
- Lyon Street changed to minor street stop control.

Under Alternative 1 traffic control, all intersections are expected to operate acceptably based on the overall vehicle delay for all movements; all intersections and approaches are expected to operate at LOS C or better during the AM, mid-day, and PM peak hours; except the eastbound approach to the Main Street intersection, which operates at LOS D.

The intersection of TH 19 at Country Club Drive/S 2nd Street operates acceptably with minor street stop control. Therefore, removal of the existing traffic signal at this intersection is a viable option with the intersection reconfiguration to remove the existing skew.

The intersection of TH 19 at Lyon Street operates acceptably with minor street stop control. Therefore, removal of the existing traffic signal at this intersection is a viable option and is included in all of the remaining alternatives.

Table 10 represents the 2045 Build traffic operations under Alternative 1 traffic control for the AM, mid-day, and PM peak hours.

Table 10 – 2045 Build Operations – Alternative 1

TH 19 at:	Approach	AM Peak		MD Peak		PM Peak	
		Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)
S 4th St (Minor Stop)	EB	0.8 / A	3.9 / A	0.8 / A	3.4 / A	1.3 / A	4.2 / A
	WB	1.8 / A		0.6 / A		0.7 / A	
	NB	10.3 / B		8.0 / A		8.8 / A	
	SB	9.0 / A		8.0 / A		10.3 / B	
Country Club Dr/S 2nd St(1)(2) (Minor Stop)	EB	15.3 / C	7.8 / A	9.2 / A	3.9 / A	10.3 / B	4.6 / A
	WB	21.1 / C		6.4 / A		6.8 / A	
	NB	0.8 / A		0.5 / A		0.5 / A	
	SB	2.3 / A		2.2 / A		2.3 / A	
Saratoga St (Signal)	EB	8.9 / A	10.8 / B	6.9 / A	9.9 / A	7.2 / A	10.8 / B
	WB	8.5 / A		8.8 / A		8.9 / A	
	NB	15.9 / B		14.3 / B		15.0 / B	
	SB	16.0 / B		14.4 / B		16.1 / B	
Main St (Signal)	EB	26.5 / C	24.6 / C	22.8 / C	22.0 / C	27.6 / C	29.2 / C
	WB	20.7 / C		20.0 / C		24.2 / C	
	NB	26.7 / C		22.7 / C		24.7 / C	
	SB	23.3 / C		22.7 / C		36.8 / D	
Lyon St (Minor Stop)	EB	2.0 / A	2.6 / A	2.2 / A	3.3 / A	2.0 / A	3.2 / A
	WB	1.2 / A		1.7 / A		1.6 / A	
	NB	10.3 / B		10.3 / B		8.1 / A	
	SB	9.5 / A		10.8 / B		10.3 / B	
Marshall St (Minor Stop)	EB	0.8 / A	1.1 / A	0.9 / A	1.3 / A	1.0 / A	1.6 / A
	WB	0.6 / A		0.8 / A		1.0 / A	
	NB	7.2 / A		6.6 / A		7.4 / A	
	SB	8.1 / A		8.5 / A		7.7 / A	
N 3rd St (Minor Stop)	EB	0.6 / A	1.4 / A	0.6 / A	1.5 / A	0.6 / A	1.4 / A
	NB	0.6 / A		0.9 / A		0.9 / A	
	SB	11.4 / B		13.0 / B		11.7 / B	
Bruce St (Signal)	EB	9.8 / A	11.8 / B	9.6 / A	11.5 / B	9.0 / A	12.1 / B
	WB	8.8 / A		9.2 / A		9.9 / A	
	NB	15.4 / B		14.3 / B		16.4 / B	
	SB	18.8 / B		18.1 / B		17.9 / B	

Notes: Minor street stop control intersection LOS is typically defined as the worst approach LOS; however the overall intersection delay is shown.
(1) WB is S 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19
(2) With roadway realignment to remove existing skew
Green Shaded Intersection names indicate a change in traffic control from the Existing Conditions.

4.4.3.4 Alternative 2 – Minor Street Stop Control (Gray Area Signal Removal Intersections)

Under Alternative 2, the existing signals that do not meet 80% of the signal warrant volume thresholds under 2045 traffic demands were removed and replaced with minor street stop controlled intersections. The changes from the No Build condition include:

- Country Club Drive/S 2nd Street changed to minor street stop control and roadways realigned to remove the existing skew.
  - The west leg of TH 19 and S 2nd Street are the minor stopped approaches
- Saratoga Street changed to minor street stop control.
- Lyon Street changed to minor street stop control.
- Bruce Street changed to minor street stop control.

Under Alternative 2 traffic control, all intersections except Saratoga Street are expected to operate acceptably based on the overall vehicle delay for all movements; all intersections and approaches are expected to operate at LOS C or better during the AM, mid-day, and PM peak hours; except the eastbound approach to the Main Street intersection, which operates at LOS D.

Under minor street stop control, the intersection of TH 19 at Saratoga Street does not operate acceptably as the northbound approach operates at LOS F during the AM peak hour. For that reason, minor street stop control is not recommended at this intersection.

Under minor street stop control, the intersection of TH 19 at Bruce Street operates well. Nevertheless, the fact that both the east and west legs of the intersection are 5-lane sections and the north and south approaches each have 2 lanes results in the intersection being fairly large to operate as a minor street stop controlled intersection. While a minor street stop control at this intersection is a viable option, it is not recommended due to intersection size and potential safety issues.

Table 11 represents the 2045 Build traffic operations under Alternative 2 traffic control for the AM, mid-day, and PM peak hours.

Table 11 – 2045 Build Operations – Alternative 2

TH 19 at:	Approach	AM Peak		MD Peak		PM Peak	
		Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)
S 4th St (Minor Stop)	EB	0.9 / A	4.1 / A	0.9 / A	3.3 / A	1.2 / A	4.0 / A
	WB	1.8 / A		0.6 / A		0.6 / A	
	NB	10.9 / B		7.8 / A		8.4 / A	
	SB	9.2 / A		7.6 / A		9.7 / A	
Country Club Dr/S 2nd St(1)(2) (Minor Stop)	EB	15.6 / C	6.8 / A	9.7 / A	3.7 / A	9.7 / A	4.0 / A
	WB	16.4 / C		6.2 / A		7.4 / A	
	NB	0.8 / A		0.5 / A		0.5 / A	
	SB	1.5 / A		1.6 / A		1.4 / A	
Saratoga St (Minor Stop)	EB	1.6 / A	15.6 / C	1.4 / A	5.3 / A	1.3 / A	6.0 / A
	WB	2.6 / A		2.8 / A		2.6 / A	
	NB	**67.2 / F**		11.0 / B		12.0 / B	
	SB	25.3 / D		13.2 / B		14.5 / B	
Main St (Signal)	EB	22.8 / C	23.8 / C	22.3 / C	22.2 / C	27.5 / C	30.0 / C
	WB	20.9 / C		20.0 / C		23.1 / C	
	NB	26.6 / C		23.8 / C		24.5 / C	
	SB	24 / C		22.5 / C		40.0 / D	
Lyon St (Minor Stop)	EB	2.1 / A	2.6 / A	2.2 / A	3.4 / A	2.0 / A	2.9 / A
	WB	1.0 / A		1.6 / A		1.4 / A	
	NB	11.0 / B		9.9 / A		8.6 / A	
	SB	9.5 / A		11.5 / B		8.9 / A	
Marshall St (Minor Stop)	EB	0.8 / A	1.0 / A	0.9 / A	1.3 / A	1.0 / A	1.6 / A
	WB	0.5 / A		0.8 / A		0.9 / A	
	NB	6.4 / A		6.7 / A		7.1 / A	
	SB	8.1 / A		8.4 / A		7.4 / A	
N 3rd St (Minor Stop)	EB	0.6 / A	1.3 / A	0.7 / A	1.5 / A	0.6 / A	1.3 / A
	NB	0.5 / A		0.7 / A		0.7 / A	
	SB	11.0 / B		13.4 / B		10.7 / B	
Bruce St (Minor Stop)	EB	1.2 / A	12.2 / B	1.2 / A	7.3 / A	1.2 / A	8.8 / A
	WB	1.8 / A		1.9 / A		1.7 / A	
	NB	**39.4 / E**		19.5 / C		25.9 / D	
	SB	28.7 / D		21.7 / C		19.6 / C	

Notes: Minor street stop control intersection LOS is typically defined as the worst approach LOS; however the overall intersection delay is shown.
(1) WB is S 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19
(2) With roadway realignment to remove existing skew
Green Shaded Intersection names indicate a change in traffic control from the Existing Conditions.

4.4.3.5 Alternative 3 – All-way Stop Control

Under Alternative 3, the existing intersections that meet all-way stop control warrants were analyzed as all-way stop controlled intersections, while continuing to operate the intersections that do not warrant signals as minor street stop control. The changes from the No Build condition include:

- Country Club Drive/S 2nd Street changed to minor street stop control and roadways realigned to remove the existing skew.
  - The west leg of TH 19 and S 2nd Street are the minor stopped approaches
- Saratoga Street changed to all-way stop control.
- Main Street changed to all-way stop control.
- Lyon Street changed to minor street stop control.
- Bruce Street changed to all-way stop control.

Under Alternative 3 traffic control, all intersections except Main Street are expected to operate acceptably based on the overall vehicle delay for all movements; all intersections and approaches are expected to operate at LOS C or better during the AM, mid-day, and PM peak hours; except the eastbound approach to the Saratoga Street intersection, which operates at LOS D.

Under all-way stop control, the intersection of TH 19 at Main Street operates under failing conditions with a LOS E during the AM and mid-day peak hours, and LOS F during the PM peak hour. For that reason, all-way stop control is not recommended at this intersection.

The intersection of TH 19 at Bruce Street would operate well as an all-way stop. Nevertheless, the size of the intersection and number of approach lanes make this control problematic. Vehicles would arrive in different lanes at different times on the same approaches and vehicles would have a tough time determining who has the right of way. Therefore, this control is not recommended due to intersection size and potential safety concerns.

The intersection of TH 19 at Saratoga Street would operate well as an all-way stop. Nevertheless, the number of approach lanes could make this control problematic. Vehicles would arrive in different lanes at different times on the same approaches and vehicles would have a tough time determining who has the right of way. In the AM peak hour, the eastbound maximum queue from the all-way stop would reach 550 feet and begin to impact Greeley Street. Therefore, if this control is to be carried forward, a reduction in the number of approach lanes should be considered.

It should be noted that all-way stop control would require all vehicles on TH 19 to stop at the intersection and would disrupt traffic flow for the large number of vehicle traveling through the project area on TH 19, including commercial freight traffic.

Table 12 represents the 2045 Build traffic operations under Alternative 3 traffic control for the AM, mid-day, and PM peak hours.

Table 12 – 2045 Build Operations – Alternative 3

TH 19 at:	Approach	AM Peak		MD Peak		PM Peak	
		Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)
S 4th St (Minor Stop)	EB	0.8 / A	4 / A	0.8 / A	3.3 / A	1.2 / A	4.1 / A
	WB	1.7 / A		0.5 / A		0.6 / A	
	NB	11.2 / B		7.6 / A		8.7 / A	
	SB	8.8 / A		7.8 / A		10 / B	
Country Club Dr/S 2nd St(1)(2) (Minor Stop)	EB	15.4 / C	8.7 / A	9.6 / A	4.3 / A	9.9 / A	4.6 / A
	WB	24.6 / C		6.5 / A		6.6 / A	
	NB	0.9 / A		0.6 / A		0.5 / A	
	SB	2.9 / A		2.7 / A		2.7 / A	
Saratoga St (All-way Stop)	EB	32.2 / D	19.4 / C	8.7 / A	8.3 / A	8.9 / A	8.5 / A
	WB	10.0 / B		8.9 / A		8.9 / A	
	NB	10.3 / B		6.7 / A		7.3 / A	
	SB	8.5 / A		7.3 / A		8.1 / A	
Main St (All-way Stop)	EB	**38.2 / E**	**47.0 / E**	18.2 / C	**42.7 / E**	17.8 / C	**92.5 / F**
	WB	15.2 / C		18.8 / C		14.5 / B	
	NB	**62.1 / F**		**54.6 / F**		**46.1 / E**	
	SB	**61.1 / F**		**70.2 / F**		**219.7 / F**	
Lyon St (Minor Stop)	EB	2.4 / A	2.7 / A	2.4 / A	3.5 / A	2.4 / A	3.0 / A
	WB	0.9 / A		2.0 / A		1.3 / A	
	NB	10.6 / B		9.3 / A		8.2 / A	
	SB	8.9 / A		10.9 / B		8.6 / A	
Marshall St (Minor Stop)	EB	0.4 / A	0.8 / A	0.6 / A	1.1 / A	0.7 / A	1.3 / A
	WB	0.6 / A		0.7 / A		0.8 / A	
	NB	6.6 / A		6.8 / A		6.9 / A	
	SB	7.9 / A		7.9 / A		6.8 / A	
N 3rd St (Minor Stop)	EB	0.4 / A	1.2 / A	0.4 / A	1.2 / A	0.4 / A	1.1 / A
	NB	0.4 / A		0.6 / A		0.6 / A	
	SB	12.1 / B		12.9 / B		10.5 / B	
Bruce St (All-way Stop)	EB	9.9 / A	10.4 / B	9.0 / A	10.6 / B	7.9 / A	10.5 / B
	WB	12.3 / B		13.8 / B		14.5 / B	
	NB	9.7 / A		8.3 / A		8.2 / A	
	SB	8.7 / A		8.2 / A		7.8 / A	

Notes: Minor street stop control intersection LOS is typically defined as the worst approach LOS; however the overall intersection delay is shown.
(1) WB is S 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19
(2) With roadway realignment to remove existing skew
Green Shaded Intersection names indicate a change in traffic control from the Existing Conditions.

4.4.3.6 Alternative 4 – Roundabout Control

Under Alternative 4, the intersections that meet either all-way stop or signal warrants or have existing safety issues were analyzed as single-lane roundabouts. If a single-lane roundabout did not operate acceptably, a multi-lane roundabout was analyzed. The changes from the No Build condition include:

- S 4th Street changed to single-lane roundabout control.
- Country Club Drive/S 2nd Street changed to single-lane roundabout control.
- Saratoga Street changed to single-lane roundabout control.
- Main Street changed to single-lane roundabout control.
  - The single lane failed and a multi-lane roundabout was evaluated.
- Lyon Street changed to minor street stop control.
- Marshall Street changed to single-lane roundabout control.
- Bruce Street changed to single-lane roundabout control.

For intersections where a single-lane roundabout would operate acceptably, but would have construction and right of way impacts, a mini-roundabout was considered. Mini-roundabouts have an inscribed circle diameter ranging from 50 to 95 feet. Accommodation of large vehicles through a mini-roundabout is feasible and MnDOT has constructed or is constructing several mini-roundabouts throughout the State on similar roadways.

Currently, there is not a standard traffic operations analysis tool to evaluate a mini-roundabout; there are only guidelines for the expected operational capacity of the intersection. It should be noted that a mini-roundabout would have less capacity than single-lane roundabout examined in this section. Current FHWA guidance suggests a total entering demand for a mini-roundabout to be less than 1,600 vehicles per hour on all approaches.

Under roundabout control, all intersection except Main Street are expected to operate acceptably based on the overall vehicle delay for all movements as single-lane roundabouts; all intersections and approaches are expected to operate at LOS C or better during the AM, mid-day, and PM peak hours.

The intersection of TH 19 at S 4th Street is expected to operate acceptably under single-lane roundabout control. The intersection currently has a safety issue and a change in control in order to reduce the safety concerns at the intersection should be considered. Due to the size of the intersection and the lower volumes, a mini-roundabout would be feasible at this intersection. The S 4th Street intersection has the potential to accommodate a mini-roundabout with an inscribed circle of 60 feet in diameter. The 2045 projections are less than 750 vehicles per hour entering the intersection, which is substantially less than the FHWA guidance capacity of 1,600 vehicles per hour.

The intersection of TH 19 at Country Club Drive is expected to operate acceptably under single-lane roundabout control. This intersection does not currently meet 60% of the volume thresholds for the signal warrant and the existing signal should be considered for removal. However, the intersection skew and geometry would require full reconstruction of the intersection in order to square up some of the intersection legs and convert the intersection to minor street stop control. A single-lane roundabout at this intersection would require reconstruction, but have minimal right of way impacts and would operate acceptably and should be considered at this intersection.

The intersection of TH 19 at Saratoga Street is expected to operate acceptably under single-lane roundabout control. Constructing a single-lane roundabout would have right of way impacts; therefore, a mini roundabout could be considered at this intersection. The Saratoga Street intersection has the potential to accommodate a mini-roundabout with an inscribed circle of 70 feet in diameter. The 2045 projections are less than 1,150 vehicles per hour entering the intersection, which is less than the FHWA guidance capacity of 1,600 vehicles per hour.

The intersection of TH 19 at Main Street does not operate well under single-lane roundabout control, the eastbound and northbound approaches operate at LOS E during the AM peak hour and the southbound approach operates at LOS D during the PM peak hour. Therefore, a multi-lane roundabout was analyzed to provide acceptably results.

For the multi-lane roundabout, a 2 by 1 roundabout was analyzed with two northbound and southbound lanes and a single lane eastbound and westbound. A multi-lane roundabout is expected to operate acceptably at the intersection of TH 19 at Main Street; the eastbound approach will operate at LOS D but all other approaches and the intersection will operate at LOS B or better during the AM, mid-day, and PM peak hours. However, due to the close proximity of buildings to the intersection, a multi-lane roundabout would have a large diameter circle and would not fit within the available space. Therefore, a roundabout is not recommended at the intersection of TH 19 and Main Street.

The intersection of TH 19 at Marshall Street is expected to operate acceptably under single-lane roundabout control. Constructing a single-lane roundabout would have right of way impacts, though a mini roundabout would be feasible at this intersection. The Marshall Street intersection has the potential to accommodate a mini-roundabout with an inscribed circle of 70 feet in diameter. The 2045 projections are less than 980 vehicles per hour entering the intersection, which is significantly less than the FHWA guidance capacity of 1,600 vehicles per hour.

The intersection of TH 19 at Bruce Street is expected to operate acceptably under single-lane roundabout control. However, the fact that both the east and west legs of the intersection are 5-lane sections would make it difficult to configure a single-lane roundabout at this location and a multi-lane roundabout would be more costly and have higher safety impacts.

Table 13 represents the 2045 Build traffic operations under Alternative 4 traffic control for the AM, mid-day, and PM peak hours.

Table 13 – 2045 Build Operations – Alternative 4

TH 19 at:	Approach	AM Peak		MD Peak		PM Peak	
		Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)
S 4th St (Single Lane)	EB	7.2 / A	7.2 / A	5.0 / A	4.9 / A	6.6 / A	5.7 / A
	WB	8.1 / A		4.8 / A		5.1 / A	
	NB	5.6 / A		4.4 / A		5.1 / A	
	SB	6.5 / A		5.0 / A		5.1 / A	
Country Club Dr/S 2nd St(1) (Single Lane)	EB	5.5 / A	7.6 / A	5.2 / A	5.2 / A	6.1 / A	5.6 / A
	WB	9.3 / A		4.4 / A		5.1 / A	
	NB	8.4 / A		4.7 / A		5.2 / A	
	SB	7.1 / A		5.5 / A		5.6 / A	
Saratoga St (Single Lane)	EB	12.6 / B	10.5 / B	6.3 / A	6.2 / A	6.6 / A	6.4 / A
	WB	8.4 / A		6.4 / A		6.4 / A	
	NB	10.9 / B		5.3 / A		5.7 / A	
	SB	7.2 / A		6.2 / A		6.5 / A	
Main St (Single Lane)	EB	**45.1 / E**	**35.5 / E**	13.0 / B	15.2 / C	19.8 / C	20.2 / C
	WB	18.2 / C		15.8 / B		16.7 / C	
	NB	**46.3 / E**		14.7 / B		12.6 / B	
	SB	24.2 / C		16.6 / C		28.3 / D	
Main St (Multi-Lane)	EB	25.6 / D	14.6 / B	10.4 / B	9.3 / A	14.0 / B	10.0 / A
	WB	13.4 / B		12.3 / B		12.7 / B	
	NB	10.7 / B		7.2 / A		6.6 / A	
	SB	8.7 / A		7.5 / A		8.5 / A	
Lyon St (Minor Stop)	EB	2.8 / A	2.8 / A	2.5 / A	3.5 / A	2.4 / A	3.6 / A
	WB	0.7 / A		1.7 / A		1.6 / A	
	NB	9.4 / A		8.4 / A		7.7 / A	
	SB	9.0 / A		11.5 / B		12.2 / B	
Marshall St (Single Lane)	EB	7.3 / A	6.5 / A	6.1 / A	6.1 / A	5.4 / A	5.7 / A
	WB	5.5 / A		6.3 / A		6.2 / A	
	NB	5.6 / A		4.6 / A		4.3 / A	
	SB	5.0 / A		5.0 / A		5.1 / A	
N 3rd St (Minor Stop)	EB	0.3 / A	1.2 / A	0.3 / A	1.3 / A	0.4 / A	1.2 / A
	WB	0.5 / A		0.7 / A		0.6 / A	
	SB	12.4 / B		14.4 / B		11.3 / B	
Bruce St (Single Lane)	EB	18.7 / C	14.5 / B	11.1 / B	10.3 / B	8.5 / A	9.7 / A
	WB	9.9 / A		10.1 / B		11.0 / B	
	NB	16.7 / C		9.0 / A		8.7 / A	
	SB	10.0 / B		10.2 / B		9.7 / A	

Notes: Minor street stop control intersection LOS is typically defined as the worst approach LOS; however the overall intersection delay is shown.
(1) WB is S 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19
Green/Blue Shaded Intersection names indicate a change in traffic control from the Existing Conditions.

4.4.3.7 Alternative 5 – Reduced Access

For Alternative 5, the possibility of reduced access was investigated at intersections where traffic control changes were not warranted and the minor street volumes could accommodate the reduction in movements without significantly impacting the surrounding intersections; of the study intersections, both Lyon Street and Marshall Street are good candidates for potential access reduction.

It should be noted that other, non-study intersections along TH 19 could also be considered for reduced access to either RI/RO or ¾ access. As part of an expanded scope, additional intersection counts were taken in November 2019 at the intersections of TH 19 at Greeley Street, Marvin Schwan Memorial Drive, and Redwood Street. These intersection have a potential to be considered for reduced access; due to lower volumes, these intersections were not evaluated for control warrants.

Greeley Street is not a continuous route on either side of TH 19, in fact both legs of Greeley Street turn towards the east and connect to Saratoga Street. On the north side, Greeley Street connects to Hamden Street to serve the adjacent commercial and residential properties. On the south side, Greeley Street provides connections to the residential neighborhoods. A reduction to a ¾ access was considered to allow traffic to access Greeley Street from TH 19, the minor street through and left turn movements would shift to Saratoga Street. The reduction in access would shift approximately 5 southbound vehicles and 20 or less northbound vehicles in each peak hour.

Marvin Schwan Memorial Drive (MSMD) is not a continuous route, it provides a connection between TH 19 and S A Street, for a total of 2 blocks and primarily serves the commercial site and parking lot adjacent to the roadway. West of Main Street, MSMD is a T-intersection located less than 300 feet from Main Street; the eastbound queues from the Main Street signal frequently spill into and through this intersection. If this intersection was reduced to a RI/RO only, there would be benefits to TH 19 without major rerouting of traffic; a ¾ access would not provide significant benefits to TH 19 and was not considered.

- The TH 19 eastbound approach to Main Street could extend the left turn storage and reduce the through lane from blocking access to the turn lane.
- On TH 19, only the westbound lefts would be routed to both Main Street and Saratoga Street to access the parking and commercial areas; a maximum of 50 vehicles in a peak hour make this maneuver.
- Traffic approaching TH 19 would reroute only northbound left turns, there is no through movement. The lefts would have the option of using Main Street or Saratoga Street; a maximum of 10 vehicles in a peak hour make this maneuver.

At Lyon Street, due to the proximity to Main Street, the Lyon Street access to TH 19 was analyzed as a right-in/right-out access. This would allow for the westbound left turn lane on TH 19 at Main Street to be extended approximately 100 feet. Vehicles that would normally make a northbound/southbound left or through movement or eastbound/westbound left turn movements would reroute to the Main Street intersection. A ¾ access would not provide significant benefits to TH 19 and was not considered at this intersection.

Redwood Street is not a continuous route on either side of TH 19, the road only extends 2 blocks north of TH 19 and a single block to the south. The connection serves primarily residential uses to the north and commercial uses to the south. With Lyon Street and Marshall Street being considered for access reductions, this intersection could be evaluated as a RI/RO or ¾ access

intersection; the minor street left turns would be routed to the next adjacent access depending on the access reduction. The reduction in access would shift approximately 10 or less southbound vehicles and 20 or less northbound vehicles in each peak hour

Marshall Street is a continuous route through the city north of TH 19, however south of TH 19 the roadway ends with a single block. As the intersection is far from Main Street, it doesn't impact the signal operations and a ¾ access was considered at this intersection. After some design considerations for this intersection, it was determined a ¾ access design would not be feasible due to the historic bridge structure and narrow bridge width; therefore, only a RI/RO was considered at this location. Minor street left or through movements would reroute to N 3rd Street, Redwood Street, or Lyon Street depending on available access connections; the left turns from TH 19 would reroute to Redwood Street or N 3rd Street.

The following **Table 14** represents the estimated daily traffic volumes on the minor street legs at the intersections with potential access reductions. The daily estimates are developed based on the 13-hour intersection count data expanded to a 24-hour daily estimated based on MnDOT's hourly distribution information which suggests 81% of the daily traffic volumes occur in the 13-hours (6 am to 7 pm) collected at each intersection.

Table 14 – Estimated Daily Volumes at Unsignalized Intersections

Roadway	Estimated Daily Traffic		13-Hr Pedestrian (Intersection Leg)			
	North Leg	South Leg	North	East	South	West
Greeley Street	300	950	12	6	30	11
Marvin Schwan Memorial Drive	n/a	1,000	n/a	56	41	2
Lyon Street	2,300	430	36	37	8	16
Redwood Street	550	630	13	12	8	12
Marshall Street	810	520	37	9	18	16
*Daily estimates are based on the intersection counts factored to 24-hours based on MnDOT's hourly distribution data with approximately 81% of the daily traffic occurring in the 13-hours collected.						

As a RI/RO access at both Lyon Street and Marshall Street are the only potentially viable reduced access intersections, the Redwood Street intersection will only be evaluated as a ¾ access to allow TH 19 traffic to access the local street network.

For this scenario, the following changes from the No Build condition include:

- Greeley Street changed to ¾ access.
- Marvin Schwan Memorial Drive changed to RI/RO.
- Lyon Street changed to RI/RO access.
- Redwood Street remains full access
  - In this scenario Redwood Street will remain full access to accommodate the changes in circulation with the reduction in access at both Lyon Street and Marshall Street.
- Marshall Street changed to RI/RO access.

With reduced access and vehicles rerouted to the appropriate intersections, all intersections are expected to operate acceptably based on the overall vehicle delay for all movements; all

intersections and approaches are expected to operate at LOS C or better during the AM, mid-day, and PM peak hours.

Greeley Street and MSMD would both operate acceptably with reduced access and the rerouted traffic does not create a negative impact at Saratoga Street or Main Street. The additional minor street volumes at the Saratoga Street intersection would move up the forecast year the intersection would fall into the gray area for traffic signal warrants, from 2028 up to 2024.

The intersection of Main Street currently has queuing issues that would only be intensified by the introduction of more vehicles having to reroute to the intersection if Lyon Street were converted to a right-in/right-out access. The rerouting of trips from Lyon Street to Main Street would add up to 85 vehicles to the Main Street intersection during the mid-day peak. While this is not expected to cause the intersection to operate poorly based on delays, it does increase the southbound approach queue by up to 150’ during the mid-day peak and would create more spillback through the Main Street at N 3rd Street signal.

Redwood Street would operate acceptably remaining full access with reduced access on either side of the intersection, the additional trips from Lyon Street and Marshall Street have negligible impacts on the intersection.

TH 19 at Marshall Street operates acceptably as a RI/RO access and the vehicles that would have to reroute would have several rerouting options to access TH 19/Marshall Street through the downtown grid system. A RI/RO access would also eliminate most of the existing safety concerns caused by minor street vehicles either crossing or turning left onto TH 19.

Table 15 represents the 2045 Build traffic operations under Alternative 5 traffic control for the AM, mid-day, and PM peak hours.

Table 15 – 2045 Build Operations – Alternative 5

TH 19 at:	Approach	AM Peak		MD Peak		PM Peak	
		Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)
S 4th St (Minor Stop)	EB	1.0 / A	4.7 / A	0.8 / A	3.3 / A	1.2 / A	3.9 / A
	WB	2.3 / A		0.6 / A		0.6 / A	
	NB	12.4 / B		7.8 / A		8.4 / A	
	SB	10.1 / B		7.6 / A		9.3 / A	
Country Club Dr/S 2nd St(1) (Signal)	EB	21.3 / C	14.8 / B	16.7 / B	11.3 / B	14.9 / B	11.0 / B
	WB	18.2 / B		11.7 / B		13.9 / B	
	NB	16.7 / B		11.2 / B		9.3 / A	
	SB	7.1 / A		8.7 / A		8.9 / A	
Greeley St (3/4 Access)	EB	2.2 / A	2.1 / A	1.3 / A	1.8 / A	1.4 / A	2.0 / A
	WB	1.7 / A		2.1 / A		2.2 / A	
	NB	5.4 / A		3.7 / A		3.5 / A	
	SB	4.1 / A		3.9 / A		4.0 / A	
Saratoga St (Signal)	EB	11.1 / B	13 / B	7.1 / A	10.3 / B	7.1 / A	11.4 / B
	WB	11.4 / B		8.9 / A		9.5 / A	
	NB	17.8 / B		15.2 / B		17.0 / B	
	SB	15.7 / B		14.8 / B		16.1 / B	
Marvin Schwan Memorial Dr (RI/RO)	EB	5.4 / A	3.6 / A	1.7 / A	1.6 / A	1.6 / A	1.6 / A
	WB	1.2 / A		1.3 / A		1.3 / A	
	NB	7.1 / A		4.7 / A		4.4 / A	
Main St (Signal)	EB	23.6 / C	26 / C	22.7 / C	26.2 / C	26.2 / C	30.8 / C
	WB	21.9 / C		22.8 / C		24.4 / C	
	NB	29.6 / C		27.2 / C		25.6 / C	
	SB	27.4 / C		30.1 / C		40.6 / D	
Lyon St (RI/RO)	EB	2.0 / A	2.2 / A	1.8 / A	2.5 / A	1.7 / A	2.6 / A
	WB	2.5 / A		2.7 / A		2.8 / A	
	NB	4.5 / A		4.7 / A		3.9 / A	
	SB	3.2 / A		5.0 / A		5.7 / A	
Redwood St (Minor Stop)	EB	9.4 / A	8.7 / A	8.6 / A	8.7 / A	7.6 / A	8.6 / A
	WB	8.0 / A		9.5 / A		9.9 / A	
	NB	5.8 / A		4.8 / A		5.7 / A	
	SB	5.3 / A		5.3 / A		5.1 / A	
Marshall St (RI/RO)	EB	2.4 / A	1.8 / A	2.4 / A	1.7 / A	2.3 / A	1.7 / A
	WB	0.7 / A		0.9 / A		0.9 / A	
	NB	6.3 / A		3.9 / A		4.1 / A	
	SB	4.1 / A		4.1 / A		5.2 / A	
N 3rd St (Minor Stop)	EB	0.3 / A	1.6 / A	0.3 / A	1.6 / A	0.3 / A	1.4 / A
	NB	0.7 / A		0.9 / A		0.8 / A	
	SB	14.4 / B		14.9 / B		12.4 / B	
Bruce St (Signal)	EB	9.4 / A	11.8 / B	9.3 / A	11.3 / B	8.7 / A	12.0 / B
	WB	9.1 / A		8.9 / A		9.5 / A	
	NB	15.6 / B		14.1 / B		16.6 / B	
	SB	18.9 / B		18.9 / B		18.1 / B	

Notes: Minor street stop control intersection LOS is typically defined as the worst approach LOS; however the overall intersection delay is shown.
(1) WB is S 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19
Green Shaded Intersection names indicate a change in traffic control from the Existing Conditions.

4.5 Comparison of Intersection Control Options

Based upon the warrant, safety, and operations analysis for each intersection, below is comparison of the control options for each individual study intersection. Intersection control options were chosen for further analysis, based on input from the PMT or the traffic analysis, and each intersection gives reasoning for why each control type was kept or removed from further consideration. The control types considered viable in this comparison will be carried forward into a corridor alternative evaluated for further consideration with all control types working together.

The ensuing text describes each control option for all of the study (and non-study) intersections, the following **Figure 9** summarizes the eight study intersections:

Figure 9 – Comparison of Intersection Control Options

4th Street	Country Club Drive	Saratoga Street	Main Street	Lyon Street	Marshall Street	3rd Street	Bruce Street
Not Warranted	Not Warranted; consider due to intersection skew	Meets 60% Volume Threshold	Meets Warrant	Not Warranted	Not Warranted	Not Warranted	Meets 60% Volume Threshold
Not Warranted	Not Warranted	Meets Warrant; LOS C	Meets Warrant; LOS F	Not Warranted	Not Warranted	Not Warranted	Not practical due to 5-lane section.
Operates at LOS A/B	LOS A/B (reconstructed intersection)	LOS F for NB in AM	LOS F	Operates at LOS A/B	Operates at LOS A/B	Operates at LOS A/B	Not practical due to 5-lane section.
Consider due to safety issues Operates at LOS A	Consider due to intersection skew Operates at LOS A	Right of Way Impacts	Operates at LOS D	Does not meet warrants or have an existing safety issues	Right of Way/Bridge Impacts	Does not meet warrants or have an existing safety issues	Not practical due to 5-lane section.
No reduced access considered	No reduced access considered	No reduced access considered	No reduced access considered	Reduced access impacts Main Street.	RI/RO Access	No reduced access considered	No reduced access considered

- **TH 19 at S 4th Street:**
  - The existing minor street stop control has a safety issue at this intersection, therefore, intersection improvements should be considered.
    - Pedestrian bump outs could potentially control TH 19 speeds and improve gap acceptance which could improve the overall safety of the intersection.
    - A control change at Country Club Drive could also improve safety at this intersection as the existing high speed right turn from TH 19 could account for the existing westbound crashes.
  - Reduced access is not viable due to the need to keep S 4th Street as a through route at the intersection; high volume of through and left turns from minor street.
  - All-way stop control is not viable as warrants are not met at this intersection.
  - Traffic Signal control is not viable as warrants are not met at this intersection.
  - A single-lane roundabout would operate well and help to reduce crashes at the intersection. A mini-roundabout is more feasible and has a traffic demand well below the FHWA guidance capacity.
  - **The existing minor street stop control and a mini-roundabout alternative should be analyzed further.**

- **TH 19 at Country Club Drive/S 2nd Street:**
  - The existing traffic signal does not meet 60% of the volume thresholds for signal warrants and the existing signal should be considered for removal.
    - The signal operates acceptably, see Alternative 5 results, and would be acceptable if the intersection skew was improved.
  - Minor street stop control is not viable at the existing intersection due to the intersection skew and geometry. If minor street stop control were installed with the existing intersection skew, there may be a crash problem that presents itself due to difficult sightlines and approach angles.
  - Minor street stop control would operate acceptably with full reconstruction of the intersection to address skew issue.
  - All-way stop control is not viable as warrants are not met at this intersection.
  - A single-lane roundabout would operate acceptably at the intersection and could be constructed with minimal right of way impacts. A roundabout would also eliminate the intersection skew issue and control vehicle speeds. The PMT previously provided support for roundabout control.
  - **Single-lane roundabout control and a reconstructed minor street stop controlled intersection should be analyzed further.**
    - Either improvement may provide a safety benefit at the S 4th Street intersection. The roundabout would control speeds approaching and departing the intersection.
    - A traffic signal could also be an acceptable control at this intersection only if the intersection skew was improved and the existing southbound free right turn movement is removed.

- **TH 19 at W Greeley Street:**
  - The existing minor street stop control operates acceptably with no existing safety issues.
  - All-way stop or traffic signal control warrants are not met at this intersection.
  - A ¾ access would operate acceptably with minimal impacts to traffic patterns.
  - **The existing minor street stop control and ¾ access should be analyzed further.**
- **TH 19 at Saratoga Street:**
  - The existing traffic signal is in the gray area for removal with 2045 forecasted traffic demands. Therefore, removal of the signal was analyzed but the existing signal is still a viable control option.
  - Minor street stop control would fail during the AM peak hour.
  - All-way stop control is a viable control option at this intersection but would require all vehicles to stop on TH 19 and may require approach lane changes.
  - A single-lane roundabout is a viable control option at this intersection but constructing the intersection would have right of way impacts.
  - **The existing traffic signal and all-way stop control should be analyzed further.**
- **TH 19 at Marvin Schwan Memorial Drive:**
  - The existing minor street stop control operates acceptably with no existing safety issues.
  - All-way stop or traffic signal control warrants are not met at this intersection.
  - A RI/RO access would operate acceptably with minimal impacts to traffic patterns.
  - **The existing minor street stop control and RI/RO access should be analyzed further.**
- **TH 19 at Main Street:**
  - The existing traffic signal is a viable option and is expected to operate acceptably through 2045.
    - To improve the southbound queues, an option of converted the existing southbound right turn lane into a shared through-right will be considered.
  - Minor stop control wasn't evaluated due to high traffic volumes on all approaches.
  - All-way stop control would have failing operations.
  - A single-lane roundabout would not provide acceptable operations and a multi-lane roundabout would have significant right of way impacts.
  - **The existing traffic signal is the only control that should be analyzed further. However, the southbound lane conversion will also be analyzed.**
- **TH 19 at Lyon Street:**
  - The existing traffic signal does not meet 60% of the volume thresholds for signal warrants and the existing signal should be considered for removal.
  - All-way stop control is not viable as warrants are not met at this intersection.
  - Reduced access would operate acceptably but would require many vehicles to reroute to the intersection of TH 19 at Main Street. This would increase the queues

along Main Street and create more congestion along the corridor. Therefore, reducing access is not recommended at this intersection.

- **Minor street stop control is a viable option and is expected to operate acceptably through 2045, it is the only control that will be analyzed further.**

- **TH 19 at Redwood Street:**
  - The existing minor street stop control operates acceptably with no existing safety issues.
  - All-way stop or traffic signal control warrants are not met at this intersection.
  - A ¾ access would operate acceptably with minimal impacts to traffic patterns.
  - **The existing minor street stop control and ¾ access should be analyzed further.**

- **TH 19 at Marshall Street:**
  - The existing minor street stop control is not viable due to existing safety issues.
  - All-way stop control is not viable as warrants are not met at this intersection.
  - Traffic Signal control is not viable as warrants are not met at this intersection.
  - A ¾ access would operate acceptably; however the existing historic bridge width is too narrow to accommodate the appropriate medians and is not feasible.
  - **A RI/RO access would operate acceptably, without negatively impacting surrounding intersections, and reduce the safety issues by eliminating minor street vehicles from crossing or turning left onto TH 19; this is the only control that will be analyzed further.**

- **TH 19 at 3rd Street:**
  - This intersection does not have existing crash issues and operates acceptably.
  - All-way stop control is not viable as warrants are not met at this intersection.
  - Traffic Signal control is not viable as warrants are not met at this intersection.
  - **The existing minor street stop control operates acceptably and is the only control option that will be analyzed further at this intersection.**

- **TH 19 at Bruce Street:**
  - The existing traffic signal is in the gray area for removal with 2045 forecasted traffic demands. Therefore, removal of the signal was analyzed but the existing signal is still a viable control option.
  - Minor street stop control is a viable option because the intersection would operate acceptably. However, the large intersection makes minor stop control considered not practical at this intersection.
  - All-way stop control is a viable control option at this intersection. The intersection is large and has a high number of approach lanes, which is not desirable and could create safety impacts.
  - A single-lane roundabout is a viable control option at this intersection but 5-lane section on TH 19 near the intersection would make designing a single-lane roundabout challenging and not considered practical at this intersection.
  - **The existing traffic signal is the only alternative that will be analyzed further.**

4.5.1 TH 19 Corridor Alternatives Analysis

Based on the warrant, safety, and operations analysis, as well as input from the PMT, two different corridor alternatives were analyzed in order to analyze the different viable control types at each intersection and determine what effects different control types have on the adjacent intersections and the corridor as a whole.

The two corridor alternatives analyzed were:

- **Alternative 6 (Corridor Alternative 1):**
  - S 4th Street – Single-lane/Mini-roundabout
  - Country Club Drive/S 2nd Street – Single-lane roundabout
  - Greeley Street – Minor Street Stop
  - Saratoga Street – Existing Traffic Signal
    - EB/WB TH 19 reduced to two lanes, left and shared through-right.
  - Marvin Schwan Memorial Drive – Minor Street Stop
  - Main Street – Existing Traffic Signal
  - Lyon Street – Minor Street Stop
  - Redwood Street - Existing Minor Street Stop
  - Marshall Street – RI/RO Access
  - N 3rd Street – Minor Street Stop
  - Bruce Street – Existing Traffic Signal
- **Alternative 7 (Corridor Alternative 2)**:
  - S 4th Street – Minor Street Stop
  - Country Club Drive/S 2nd Street – Minor Street Stop
  - Greeley Street – ¾ Access
  - Saratoga Street – All-way stop
    - EB/WB TH 19 reduced to two lanes, left and shared through-right.
  - Marvin Schwan Memorial Drive – RI/RO Access
  - Main Street – Existing Traffic Signal with the southbound right turn lane converted to shared through-right
  - Lyon Street – Minor Street Stop
  - Redwood Street – ¾ Access
  - Marshall Street – RI/RO Access
  - N 3rd Street – Minor Street Stop
  - Bruce Street – Existing Traffic Signal

Comparing the following **Table 16** and **Table 17,** for Alternative 6 and Alternative 7 respectively, the majority of control options function with almost negligible differences.

The only noticeable difference between control types comes from the intersection of TH 19 at Saratoga Street. Under this alternatives all-way stop control, the all-way stop results in a LOS D in the AM peak hour. While this is an acceptable LOS, the delay is almost twice as much as the

traffic signal for the same peak period and the maximum eastbound queue is over 500 feet which would begin to impact operations and safety at Greeley Street.

4.5.1.1 Alternative 6 – Corridor Alternative 1

Under Alternative 6 traffic control for each intersection, each intersection is expected to operate acceptably based on the overall vehicle delay for all movements; all intersections and approaches are expected to operate at LOS C or better during the AM, mid-day, and PM peak hours.

Table 16 represents the 2045 Build traffic operations under Alternative 6 traffic control for the AM, mid-day, and PM peak hours.

4.5.1.2 Alternative 7 – Corridor Alternative 2

Under Alternative 7 traffic control for each intersection, the majority of intersections are expected to operate acceptably based on the overall vehicle delay for all movements; all intersections and approaches are expected to operate at LOS C or better during the AM, mid-day, and PM peak hours.

The exception is the intersection of TH 19 at Saratoga Street under all-way stop control. The eastbound approach in the AM peak period operates at a LOS E with a long eastbound queue; the maximum queue does spill through the Greeley Street by over 200 feet. The increase in volumes at this intersection between Alternative 3 and Alternative 7 is only an 8% increase in volumes from the access reductions at Greeley Street and Marvin Schwann Memorial Drive. This shows that an all-way stop controlled intersection does not have any excess capacity to serve the long term traffic volumes at the intersection.

Table 17 represents the 2045 Build traffic operations under Alternative 7 traffic control for the AM, mid-day, and PM peak hours.

Table 16 – 2045 Build Operations – Alternative 6

TH 19 at:	Approach	AM Peak		MD Peak		PM Peak	
		Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)
S 4th St (Single-lane roundabout)	EB	7.2 / A	7.2 / A	5.0 / A	4.9 / A	6.6 / A	5.7 / A
	WB	8.1 / A		4.8 / A		5.1 / A	
	NB	5.6 / A		4.4 / A		5.1 / A	
	SB	6.5 / A		5.0 / A		5.1 / A	
Country Club Dr/S 2nd St(1) (Single-lane roundabout)	EB	5.5 / A	7.6 / A	5.2 / A	5.2 / A	6.1 / A	5.6 / A
	WB	9.3 / A		4.4 / A		5.1 / A	
	NB	8.4 / A		4.7 / A		5.2 / A	
	SB	7.1 / A		5.5 / A		5.6 / A	
Greeley St (Minor Stop)	EB	1.2 / A	2.2 / A	0.6 / A	1.8 / A	0.7 / A	2.1 / A
	WB	1.7 / A		2.1 / A		2.3 / A	
	NB	11.2 / B		5.9 / A		6.0 / A	
	SB	8.7 / A		7.1 / A		7.2 / A	
Saratoga St (Signal)	EB	11.5 / B	12 / B	6.8 / A	9.6 / A	7 / A	10.8 / B
	WB	9.2 / A		8.0 / A		8.9 / A	
	NB	15.7 / B		13.5 / B		14.3 / B	
	SB	15.4 / B		15.2 / B		17.1 / B	
Marvin Schwan Memorial Dr (Minor Stop)	EB	7.3 / A	5.3 / A	2.0 / A	2.2 / A	1.9 / A	2.1 / A
	WB	2.5 / A		2.0 / A		1.7 / A	
	NB	8.6 / A		5.7 / A		5.9 / A	
Main St (Signal)	EB	23.8 / C	24.7 / C	23.1 / C	22.3 / C	27.1 / C	27.8 / C
	WB	20.4 / C		19.5 / B		23.6 / C	
	NB	27.4 / C		23.9 / C		24.0 / C	
	SB	25.7 / C		22.9 / C		33.8 / C	
Lyon St (Minor Stop)	EB	2.3 / A	3.7 / A	2.3 / A	4.7 / A	2.3 / A	4.5 / A
	WB	2.6 / A		2.8 / A		2.9 / A	
	NB	11.7 / B		11.7 / B		9.4 / A	
	SB	13.3 / B		16.8 / C		14.1 / B	
Redwood St (Minor Stop)	EB	9.1 / A	8.5 / A	8.2 / A	8.5 / A	8.1 / A	8.8 / A
	WB	8.1 / A		9.5 / A		10.0 / B	
	NB	5.3 / A		4.7 / A		5.7 / A	
	SB	5.6 / A		5.5 / A		5.2 / A	
Marshall St (RI/RO)	EB	2.5 / A	1.8 / A	2.4 / A	1.7 / A	2.3 / A	1.8 / A
	WB	0.7 / A		0.9 / A		1.0 / A	
	NB	4.7 / A		4.1 / A		3.7 / A	
	SB	4.1 / A		3.7 / A		5.4 / A	
N 3rd St (Minor Stop)	EB	0.3 / A	1.5 / A	0.4 / A	1.6 / A	0.3 / A	1.4 / A
	NB	0.6 / A		0.8 / A		0.9 / A	
	SB	13.3 / B		14.6 / B		12.3 / B	
Bruce St (Signal)	EB	9.8 / A	12.1 / B	9.0 / A	11.5 / B	8.9 / A	11.8 / B
	WB	9.1 / A		9.1 / A		9.6 / A	
	NB	16.8 / B		14.6 / B		16.1 / B	
	SB	18.5 / B		19.5 / B		17.4 / B	

Notes: Minor street stop control intersection LOS is typically defined as the worst approach LOS; however the overall intersection delay is shown.
(1) WB is S 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19
Green Shaded Intersection names indicate a change in traffic control from the Existing Conditions.

Table 17 – 2045 Build Operations – Alternative 7

TH 19 at:	Approach	AM Peak		MD Peak		PM Peak	
		Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)	Approach Delay (sec/veh / LOS)	Intersection Delay (sec/veh / LOS)
S 4th St (Minor Stop)	EB	1.8 / A	4.4 / A	0.9 / A	3.3 / A	1.2 / A	4.0 / A
	WB	1.8 / A		0.5 / A		0.6 / A	
	NB	11.4 / B		7.9 / A		8.7 / A	
	SB	9.1 / A		7.7 / A		9.3 / A	
Country Club Dr/S 2nd St(1)(2) (Minor Stop)	EB	17.8 / C	7.4 / A	9.5 / A	3.2 / A	9.1 / A	3.5 / A
	WB	18.9 / C		6.0 / A		6.4 / A	
	NB	0.9 / A		0.5 / A		0.5 / A	
	SB	0.7 / A		0.7 / A		0.8 / A	
Greeley St (3/4 Access)	EB	7.7 / A	5.9 / A	0.7 / A	1.9 / A	0.9 / A	1.9 / A
	WB	2.6 / A		2.7 / A		2.6 / A	
	NB	15.9 / C		3.3 / A		3.5 / A	
	SB	3.9 / A		4.1 / A		3.5 / A	
Saratoga St (All-way Stop)	EB	**44.8 / E**	25.1 / D	8.7 / A	8.9 / A	9.3 / A	9.2 / A
	WB	13.4 / B		10.2 / B		10.2 / B	
	NB	12.7 / B		7.5 / A		8.0 / A	
	SB	9.3 / A		7.4 / A		8.5 / A	
Marvin Schwan Memorial Dr (RI/RO)	EB	3.8 / A	2.7 / A	2.5 / A	1.9 / A	2.3 / A	1.9 / A
	WB	1.1 / A		1.2 / A		1.2 / A	
	NB	5.7 / A		4.1 / A		4.1 / A	
Main St (Signal)	EB	19.5 / B	22.7 / C	18.2 / B	20.0 / C	20.5 / C	21.2 / C
	WB	18.8 / B		17.8 / B		19.4 / B	
	NB	28.9 / C		23.3 / C		24.0 / C	
	SB	22.4 / C		20.3 / C		20.8 / C	
Lyon St (Minor Stop)	EB	2.3 / A	4.1 / A	2.3 / A	5.4 / A	2.4 / A	5.0 / A
	WB	2.6 / A		2.8 / A		2.8 / A	
	NB	14.5 / B		13.2 / B		13.2 / B	
	SB	13.2 / B		18.0 / C		13.2 / B	
Redwood St (3/4 Access)	EB	8.9 / A	8.4 / A	8.0 / A	8.3 / A	7.4 / A	8.1 / A
	WB	7.8 / A		9.0 / A		9.0 / A	
	NB	3.3 / A		3.3 / A		2.8 / A	
	SB	2.6 / A		3.1 / A		3.2 / A	
Marshall St (RI/RO)	EB	2.4 / A	1.7 / A	2.4 / A	1.7 / A	2.3 / A	1.7 / A
	WB	0.6 / A		0.9 / A		0.9 / A	
	NB	4.0 / A		4.4 / A		3.6 / A	
	SB	3.4 / A		4.8 / A		5.1 / A	
N 3rd St (Minor Stop)	EB	0.3 / A	1.4 / A	0.3 / A	1.6 / A	0.3 / A	1.3 / A
	NB	0.6 / A		0.9 / A		0.8 / A	
	SB	12.1 / B		14.1 / B		11.5 / B	
Bruce St (Signal)	EB	9.9 / A	12.3 / B	9.4 / A	11.6 / B	8.7 / A	11.9 / B
	WB	9.1 / A		9.1 / A		9.6 / A	
	NB	16.8 / B		14.9 / B		16.1 / B	
	SB	19.8 / B		19.3 / B		18.2 / B	

Notes: Minor street stop control intersection LOS is typically defined as the worst approach LOS; however the overall intersection delay is shown.
(1) WB is S 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19
(2) With roadway realignment to remove existing skew
Green Shaded Intersection names indicate a change in traffic control from the Existing Conditions.

5 Other Considerations

5.1 TH 19 at Country Club Drive/S 2nd Street – Cost Comparison

As was discussed in Section 4.5, a single-lane roundabout or a reconstructed minor street stop controlled intersection are the most viable traffic control options at the intersection of TH 19 at Country Club Drive/S 2nd Street. A 20-year lifetime cost analysis was done to compare the single-lane roundabout and reconstructed minor street stop as part of the consideration for making a recommendation at this intersection. The 20-year lifetime cost analysis included vehicle delay costs, crash costs, construction costs, and remaining capital value of the infrastructure.

A true benefit costs analysis, comparing the build options to a No Build scenario, was not considered in this evaluation for two reasons. First, the No Build conditions is not a viable alternative as the intersection is skewed and the existing traffic signal is not warranted. Second, reconstructing the existing signalized intersection has the highest overall user cost calculations and higher construction costs than the minor street stop control, resulting in a negative cost value. Therefore, only the costs for the two viable build options were compared.

The 20-year lifetime cost analysis (2025-2045) for the two intersection control alternatives at the intersection of TH 19 at Country Club Drive/S 2nd Street were completed using the MnDOT Office of Transportation Management's methodology for benefit-cost analyses and used their recommended values for all relevant cost calculations. The costs were calculated based on their present worth (2019 dollars); therefore, the construction costs in this comparison do not directly match those discussed in Section 4.4.3.2 and attached in **Appendix C**, which were inflated to 2021 dollars. More detailed results of the 20-year lifetime cost analysis can be found in **Appendix E**.

Vehicle miles traveled (VMT) was not considered as part of this evaluation as the difference between the intersection control options would be negligible.

Vehicle Delay Costs

20-year lifetime vehicle delay costs for the reconstructed minor street stop control and single-lane roundabout were calculated using the intersection delay from SimTraffic for 2019 and 2045. The single-lane roundabout delays reported previously in this report utilized HCS, which provides a conservative approach to roundabout capacity. To obtain a better comparison of the delays between the two control options, the roundabout intersection alternative was developed in SimTraffic, these results were used for the vehicle delay costs in order to have a more direct evaluation between the two intersection control alternatives. The most significant change for the roundabout was a reduction in the AM peak hour delays to under 5 seconds per vehicle.

Hourly volume scenarios were developed for both intersection control alternatives; this included the AM, Mid-Day and PM peak hours. The results were spread across the 24-hour daily distribution based on hourly percentages of the existing daily traffic demands for the intersection. The resulting 2019 and 2045 total daily vehicle delay values were then used to forecast the total daily vehicle delay for each year between 2025 and 2045. The 2019 and 2045 SimTraffic Operations results tables can be found in **Appendix E**.

Based on vehicle delay costs, the single-lane roundabout would cost an estimated $830,000 less in vehicle delay costs when compared to the minor street stop control.

Crash Costs

Crash costs for the reconstructed minor street stop control and single-lane roundabout were calculated using MnDOT's statewide average crash rates for urban minor street stop control and single-lane roundabout controlled intersections along with forecasted intersection volumes.

The reconstructed single-lane roundabout is estimated to have more overall crashes; the estimated crash rates are 0.32 crashes per million entering vehicles for single-lane roundabouts and 0.19 crashes per million entering vehicles for minor street stop controlled intersections. The roundabout would have less severe crashes due to the lower vehicle speeds and reduced conflict points. Over the 20-year analysis period, the single-lane roundabout is estimated to have approximately $200,000 more in crash costs than the minor street stop controlled intersection.

Construction Costs

The construction costs for each alternative can be found in **Appendix C**; however, they were converted from 2021 to 2019 dollars for this analysis and therefore do not directly match those in **Appendix C**. The cost estimates indicate that the single-lane roundabout would cost approximately $320,000 more than the reconstructed minor street stop control.

Remaining Capital Value

The remaining capital value of each intersection control alternative was calculated based on the MnDOT Office of Transportation Management's methodology. The single-lane roundabout is expected to have approximately $23,000 more remaining capital value compared to the reconstructed minor street stop control.

Table 18 summarizes the total 20-year costs of the reconstructed minor street stop control and the single-lane roundabout intersection alternatives.

The single-lane roundabout is expected to have approximately $630,000 less operating costs (vehicle delay and crash costs), but would cost approximately $300,000 more to construct when the remaining capital value is considered.

Table 18 – 20-Year Costs

Item	Reconstructed Minor Street Stop Control	Single-lane Roundabout
Vehicle Delay Cost	$ 2,507,128	$ 1,675,122
Crash Cost	$ 903,995	$ 1,106,802
Total Operating Costs (2019 Dollars)	**$ 3,411,124**	**$ 2,781,924**
Total Construction Cost (2019 Dollars)	**$ 1,049, 763**	**$ 1,369, 938**
Project Remaining Capital Value (RCV)	$ (161,677)	$ (184,637)
Total Construction Cost Minus RCV (2019 Dollars)	**$ 888,086**	**$ 1,185,301**
Total Lifetime Cost (2019 Dollars)	**$4,299,210**	**$3,967,225**

Note: All costs were converted to 2019 dollars based on MnDOT's benefit-cost methodology; therefore, the construction costs do not match those in Section 4.4.3.2 or attached in Appendix C, which are in 2021 dollars.

5.2 Pedestrian Facilities

A desired outcome of this study is to identify appropriate treatments for pedestrian crossing.

At all eight study intersections, there are pedestrian curb ramps and marked crossings on the majority of intersection legs. As part of the reconstruction project, all existing curb ramps will be upgraded with ADA compliant curb ramps and landings.

At all of the traffic signal controlled intersections, marked crosswalks should be provided on all legs of each intersection. ADA compliant pedestrian push buttons and countdown pedestrian signals should also be provided.

MnDOT Technical Memorandum No. 15-01-T-0, Pedestrian Crossing Facilitation, provides guidance on when to mark crosswalks or provide additional treatments at unsignalized intersections. The guidance identifies a demand of 20 pedestrians per hour as one of the criteria for consideration of crosswalk treatments. Other criteria include: presence of regular pedestrian generators, school crossing or elderly facilities.

Based on the existing pedestrian counts collected in May 2019, only the intersection of TH 19 at S 4th Street has over 20 pedestrians per hour; there are marked crosswalks at this intersection and it is within a school zone. The school crossing is controlled by an adult crossing guard during school arrival and dismissal times.

Throughout the downtown area, the pedestrian count data does identify that a regular crossing demand does exist all existing crosswalk locations. Therefore, marked pedestrian crossings are supported at any unsignalized location where an existing pedestrian sidewalk corridor or connection exists. Further, wherever possible, it is prudent to shorten the crossing distance to reduce pedestrian exposure by providing curb extensions (bump-outs) at crosswalks.

Pedestrian crossings at unsignalized downtown intersections should be identified with pavement markings and equipped with crosswalk warning signs serving all north and south crosswalks. East/west crossing should also be provided with pavement markings; Crosswalks should be marked across minor street stop sign controlled approaches; however, no warning sign would be appropriate due to the presence of a stop sign.

Additional marked crossings of TH 19 should be considered where there are continuous pedestrian facilities (east-west sidewalk corridors) on both sides of TH 19 including these:

- TH 19 at Marvin Schwan Memorial Drive, west intersection leg
- TH 19 at Marshall Street; east intersection leg
- TH 19 at N 3rd Street; east and/or west intersection leg

At intersections where RI/RO or ¾ access are considered, center medians should be considered to serve as pedestrian refuges to allow two stage crossings.

6 Findings and Conclusions

Based upon all information documented in this report, below are findings and conclusions for traffic control at each of the study intersections:

- **TH 19 at S 4th Street:**
  - Intersection geometric changes could be implemented to improve safety at the existing minor street stop control. This could include pedestrian bump outs to provide shorter crossing distances and reduce vehicle speeds; bump outs could be implemented on up to all four legs.
  - A single-lane or mini-roundabout would operate well and help to reduce crashes at the intersection, however this control is not warranted based on volumes.
  - In addition, changes could be made to the geometry of the TH 19 at Country Club Drive/S 2nd Street intersection to slow down the southbound right turning movement and, therefore, the speed of westbound vehicles at 4th Street. The reduced speed would likely reduce the frequency of right angle crashes involving westbound vehicles, which heavily contribute to the current safety concerns at the intersection.

- **TH 19 at Country Club Drive/S 2nd St:**
  - Replacing the existing signalized intersection in-kind would have a reconstruction cost of $1.40M. The intersection does not meet traffic warrants and due to the skews, signal control would be the only safe control for the in-kind alternative.
  - Any improvement at this intersection would require changes to Timmerman Drive and Artillery Drive connections between TH 19 and County Club Drive. Intersection reconstruction to remove the approach skews is recommended in all alternatives.
  - Minor street stop control would operate acceptably with full reconstruction of the intersection to address the intersection skew issue. The west leg of TH 19 and S 2nd Street would operate under stop control; this is estimated to cost approximately $1.17 million dollars to reconstruct.
  - A single-lane roundabout would operate acceptably at the intersection and could be constructed with minimal right of way impacts. A roundabout would also eliminate the intersection skew issue, reduce speeds, and reduce conflict points for vehicles and pedestrians. While this control is not warranted based on volumes, the PMT provided support for potential roundabout control at this intersection because single-lane roundabouts reduce serious injury and fatal crashes and have reduced confict points; this is estimated to cost approximately $1.53 million dollars to reconstruct.
  - Both the reconstructed minor street stop control and single-lane roundabout would help to reduce the speed at which vehicles take a southbound right turn at this intersection. These vehicles would then approach S 4th Street at a slower speed, which could help to improve safety at the S 4th Street intersection.
  - A 20-year cost analysis comparing the minor street stop control and roundabout was conducted. The results show the minor street stop would have slightly less total crash costs over the 20-year analysis period; however the delay reductions from the roundabout create a larger user cost savings than the additional cost to construct the roundabout.

- **TH 19 at Greeley Street:**
  - The existing minor street stop control operates acceptably and is a viable control.
  - A ¾ access intersection could be implemented with no negative impacts.
- **TH 19 at Saratoga Street:**
  - A single-lane roundabout is a viable control option at this intersection, but constructing the intersection would have right of way impacts.
  - All-way stop control is a viable control option at this intersection and would operate acceptably under existing lane configuration. The eastbound approach operates with a LOS D and a maximum queue of 550 feet during the AM peak, which is more than double the traffic signal queue.
    - If access reductions are to be considered at Greeley Street or Marvin Schwan Memorial Drive, the small increase in traffic at the all-way stop controlled intersection will begin to fail in the AM peak hour.
    - The number of lanes should be reduced under this control, as all existing approaches having 2 or more lanes, which may lead to driver confusion as to who has the right of way.
  - The existing traffic signal operates acceptably and does not have safety issues.
    - With access reductions at Greeley Street or Marvin Schwan Memorial Drive, the traffic signal warrants meet the gray area criteria in 2024.
- **TH 19 at Marvin Schwan Memorial Drive:**
  - The existing minor street stop control operates acceptably and is a viable control.
  - Access reduction to a RI/RO would provide positive impacts for the eastbound approach to Main Street without significant disruption to traffic patterns.
- **TH 19 at Main Street:**
  - The existing traffic signal is a viable option and is expected to operate acceptably through 2045.
  - To add capacity and reduce Main Street queues, the southbound right turn lane was converted to a shared through/right turn lane was analyzed. While intersection delays would improve minimally, the southbound maximum queue would be shortened by over 140 feet during the AM, mid-day and PM peak hours while the right turn movement would only degrade to a LOS B.
  - Improvements to adjacent intersections could improve safety at the signalized intersection. Flashing Yellow Arrow should be considered to improve visibility and driver attention for left turning traffic.
- **TH 19 at Lyon Street:**
  - The existing traffic signal does not meet 60% of the volume thresholds for signal warrants and the existing signal should be considered for removal.
  - Minor street stop control is a viable option and will operate acceptably through 2045.
  - Access reduction result in negative impacts to the surrounding TH 19 intersections.
- **TH 19 at Redwood Street:**
  - The existing minor street stop control operates acceptably and is a viable control.

- Access reductions, ¾ access, could be implemented with no negative impacts.

- **TH 19 at Marshall Street:**
  - The existing minor street stop control is not viable due to existing safety issues. The safety issues stem from sight line issues created by the adjacent bridge railing, which cannot be altered due to their historic nature.
  - A ¾ access controlled intersection is not feasible to construct due to bridge width.
  - A RI/RO access would improve the safety of the intersection without negative impacts to the surrounding intersections.

- **TH 19 at 3rd Street:**
  - The existing minor street stop control operates acceptably and is the optimal traffic control for this intersection.

- **TH 19 at Bruce Street:**
  - The existing traffic signal is a viable option and is expected to operate acceptably through 2045.
  - Improvements to the signal phasing could improve safety at the signalized intersection; northbound and southbound have no left turn phase. Flashing Yellow Arrow should be considered to improve visibility and driver attention for left turning traffic.

6.1 Recommendation

Based on the information provided in this report and input from the PMT, the following are the recommendations for each of the study intersections:

- TH 19 at S 4th Street (MSAS 124)…….Minor Stop Control (no change)
  - Bump outs could be constructed at this intersection in order to help reduce pedestrian crossing distances and reduce vehicle speeds.
  - Reconstruction of the Country Club Drive/S 2nd Street intersection should slow westbound traffic and improve safety at this intersection.
- TH 19 at Country Club Drive (MSAS 122)/S 2nd Street ….Roundabout Control
  - Roundabout will control speeds and simplify roadway connections in the area, resulting in operational and safety benefits. The cost difference between the reconstructed minor strop control ($1.17M) and the roundabout control ($1.53M) is $0.36M. In addition, a 20-year cost analysis showed an overall user cost savings for the roundabout control when comparing to the minor stop controlled.
- TH 19 at Greeley Street……..…Minor Stop Control (no change)
- TH 19 at Saratoga Street (MSAS 111) ……Traffic Signal (no change)
  - TH 19 approach lanes can be modified to a left and shared through-right lane (Alternative 6) with no change in operations.
- TH 19 at Marvin Schwan Memorial Drive ……RI/RO Access
  - Provides ability to extend eastbound turn lanes at Main Street for better efficiency at the signalized intersection.
  - Provides potential for a pedestrian refuge areas on east and south sides of the intersection.
- TH 19 at US 59 (Main Street) ……Traffic Signal (no change)
  - Add Flashing Yellow Arrow to improve safety and operations.
  - Modify southbound right turn lane to a shared through-right lane.
- TH 19 at Lyon Street ……..Minor Stop Control
- TH 19 at Redwood Street…… ……Minor Stop Control (no change)
- TH 19 at Marshall Street ……RI/RO Access
  - Reduced access should significantly improve safety.
  - Provides potential for a pedestrian refuge areas at the intersection.
- TH 19 at N 3rd Street (MSAS 112)…….Minor Stop Control (no change)
- TH 19 at Bruce Street (MSAS 115)……Traffic Signal (no change)
  - Add Flashing Yellow Arrow to improve safety and operations.

Appendix A

All-way Stop and Traffic Signal Warrants

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A1a

2019 Existing - TH19 at 4th St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at 4th St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019

OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH19 EB	1	1875
30	Major App3:	TH19 WB	1	1564
30	Minor App2:	4th St NB	1	1183
30	Minor App4:	4th St SB	1	937

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement	
300	**200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	64	75	114	14	139	128	NO / NO
7:00 - 8:00	150	271	113	62	421	175	YES / NO
8:00 - 9:00	118	94	95	60	212	155	NO / NO
9:00 - 10:00	108	72	65	48	180	113	NO / NO
10:00 - 11:00	110	73	58	54	183	112	NO / NO
11:00 - 12:00	176	99	67	68	275	135	NO / NO
12:00 - 13:00	189	164	93	115	353	208	**YES / YES**
13:00 - 14:00	139	120	88	74	259	162	NO / NO
14:00 - 15:00	127	96	90	72	223	162	NO / NO
15:00 - 16:00	151	157	129	100	308	229	**YES / YES**
16:00 - 17:00	218	124	102	97	342	199	YES / NO
17:00 - 18:00	232	134	102	106	366	208	**YES / YES**
18:00 - 19:00	93	85	67	67	178	134	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**1875**	**1564**	**1183**	**937**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	**3**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A1b

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at 4th St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at 4th St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	1	1875
30	Major App3:	TH19 WB	1	1564
30	Minor App2:	4th St NB	1	1075
30	Minor App4:	4th St SB	1	756

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	500	750	600
Minor Approach	150	75	120

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	64	75	113	9	139	113	NO / NO	NO / YES	NO / NO
7:00 - 8:00	150	271	99	54	421	99	NO / NO	NO / YES	NO / NO
8:00 - 9:00	118	94	88	51	212	88	NO / NO	NO / YES	NO / NO
9:00 - 10:00	108	72	56	36	180	56	NO / NO	NO / NO	NO / NO
10:00 - 11:00	110	73	52	41	183	52	NO / NO	NO / NO	NO / NO
11:00 - 12:00	176	99	60	50	275	60	NO / NO	NO / NO	NO / NO
12:00 - 13:00	189	164	84	77	353	84	NO / NO	NO / YES	NO / NO
13:00 - 14:00	139	120	81	61	259	81	NO / NO	NO / YES	NO / NO
14:00 - 15:00	127	96	84	63	223	84	NO / NO	NO / YES	NO / NO
15:00 - 16:00	151	157	102	83	308	102	NO / NO	NO / YES	NO / NO
16:00 - 17:00	218	124	94	82	342	94	NO / NO	NO / YES	NO / NO
17:00 - 18:00	232	134	99	89	366	99	NO / NO	NO / YES	NO / NO
18:00 - 19:00	93	85	63	60	178	63	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**1875**	**1564**	**1075**	**756**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	0	8	Not satisfied

COMMENTS:

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SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A1c

2019 Existing - TH19 at 4th St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at 4th St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019

OPERATOR: LJ

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	1	1875
30	Major App3:	TH19 WB	1	1564
30	Minor App2:	4th St NB	1	1075
30	Minor App4:	4th St SB	1	756

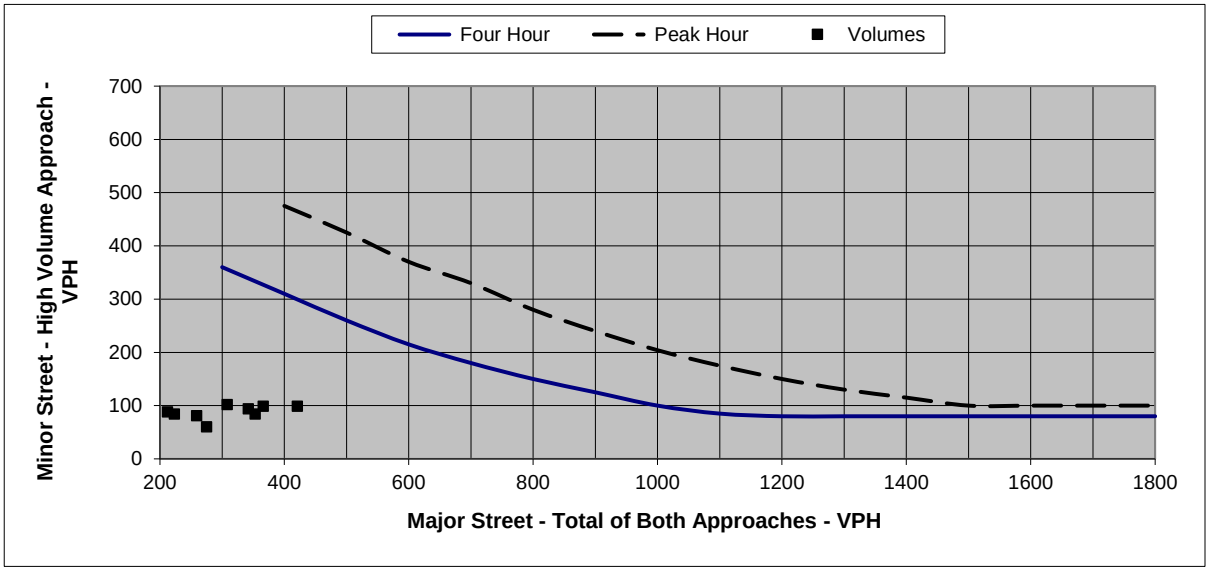

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	360	
400	310	475
500	260	425
600	215	370
700	180	330
800	150	280
900	125	240
1000	100	204
1100	85	175
1200	80	150
1300	80	130
1400	80	115
1500	80	100
1600	80	100
1700	80	100
1800	80	100

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	139	113	NO	NO
7:00 - 8:00	421	99	NO	NO
8:00 - 9:00	212	88	NO	NO
9:00 - 10:00	180	56	NO	NO
10:00 - 11:00	183	52	NO	NO
11:00 - 12:00	275	60	NO	NO
12:00 - 13:00	353	84	NO	NO
13:00 - 14:00	259	81	NO	NO
14:00 - 15:00	223	84	NO	NO
15:00 - 16:00	308	102	NO	NO
16:00 - 17:00	342	94	NO	NO
17:00 - 18:00	366	99	NO	NO
18:00 - 19:00	178	63	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

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SHORT ELLIOTT HENDRICKSON INC.

Exhibit A1d

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at 4th St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at 4th St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

85th% Speed	Approach Description	Lanes	Approach Total
30	Major App1: TH19 EB	1	2120
30	Major App3: TH19 WB	1	1768
30	Minor App2: 4th St NB	1	1339
30	Minor App4: 4th St SB	1	1057

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	72	84	130	16	156	146	NO / NO
7:00 - 8:00	170	306	128	69	476	197	YES / NO
8:00 - 9:00	133	106	107	67	239	174	NO / NO
9:00 - 10:00	122	81	73	54	203	127	NO / NO
10:00 - 11:00	124	82	65	60	206	125	NO / NO
11:00 - 12:00	199	112	76	78	311	154	YES / NO
12:00 - 13:00	214	185	105	130	399	235	**YES / YES**
13:00 - 14:00	157	136	100	83	293	183	NO / NO
14:00 - 15:00	144	109	102	82	253	184	NO / NO
15:00 - 16:00	171	178	146	112	349	258	**YES / YES**
16:00 - 17:00	247	140	116	110	387	226	**YES / YES**
17:00 - 18:00	262	152	116	120	414	236	**YES / YES**
18:00 - 19:00	105	97	75	76	202	151	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**2120**	**1768**	**1339**	**1057**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	**4**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A1e

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at 4th St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at 4th St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	TH19 EB	1	2120
30	Major App3:	TH19 WB	1	1768
30	Minor App2:	4th St NB	1	1215
30	Minor App4:	4th St SB	1	854

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	500	750	600
Minor Approach	150	75	120

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	72	84	128	9	156	128	NO / NO	NO / YES	NO / YES
7:00 - 8:00	170	306	113	61	476	113	NO / NO	NO / YES	NO / NO
8:00 - 9:00	133	106	99	57	239	99	NO / NO	NO / YES	NO / NO
9:00 - 10:00	122	81	63	41	203	63	NO / NO	NO / NO	NO / NO
10:00 - 11:00	124	82	58	47	206	58	NO / NO	NO / NO	NO / NO
11:00 - 12:00	199	112	68	56	311	68	NO / NO	NO / NO	NO / NO
12:00 - 13:00	214	185	94	88	399	94	NO / NO	NO / YES	NO / NO
13:00 - 14:00	157	136	92	69	293	92	NO / NO	NO / YES	NO / NO
14:00 - 15:00	144	109	95	71	253	95	NO / NO	NO / YES	NO / NO
15:00 - 16:00	171	178	115	95	349	115	NO / NO	NO / YES	NO / NO
16:00 - 17:00	247	140	106	93	387	106	NO / NO	NO / YES	NO / NO
17:00 - 18:00	262	152	113	100	414	113	NO / NO	NO / YES	NO / NO
18:00 - 19:00	105	97	71	67	202	71	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**2120**	**1768**	**1215**	**854**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	0	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A1f

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at 4th St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at 4th St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	TH19 EB	1	2120
30	Major App3:	TH19 WB	1	1768
30	Minor App2:	4th St NB	1	1215
30	Minor App4:	4th St SB	1	854

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

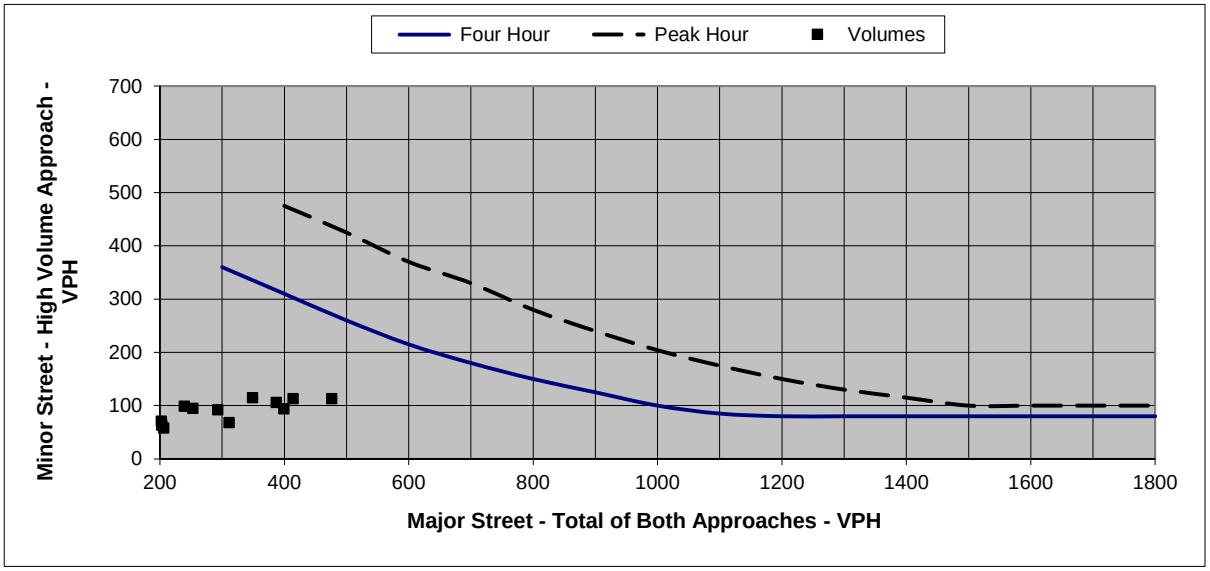

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	360	
400	310	475
500	260	425
600	215	370
700	180	330
800	150	280
900	125	240
1000	100	204
1100	85	175
1200	80	150
1300	80	130
1400	80	115
1500	80	100
1600	80	100
1700	80	100
1800	80	100

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	156	128	NO	NO
7:00 - 8:00	476	113	NO	NO
8:00 - 9:00	239	99	NO	NO
9:00 - 10:00	203	63	NO	NO
10:00 - 11:00	206	58	NO	NO
11:00 - 12:00	311	68	NO	NO
12:00 - 13:00	399	94	NO	NO
13:00 - 14:00	293	92	NO	NO
14:00 - 15:00	253	95	NO	NO
15:00 - 16:00	349	115	NO	NO
16:00 - 17:00	387	106	NO	NO
17:00 - 18:00	414	113	NO	NO
18:00 - 19:00	202	71	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

S:\KO\M\Mnt08\151024\8-planning\Traffic\Warrant Analysis\2045\[2045_TH19 at 4th St_Warrant analysis.xlsx]SignalWarrant

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2a

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Country Club Dr/S 2nd St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	Country Club Dr NB	1	1519
30	Major App3:	TH19 SB	1	2630
30	Minor App2:	TH19 EB	1	1584
30	Minor App4:	S 2nd St WB	1	656

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement	
300	**200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	73	81	50	42	154	92	NO / NO
7:00 - 8:00	255	231	129	117	486	246	**YES / YES**
8:00 - 9:00	120	145	115	47	265	162	NO / NO
9:00 - 10:00	79	125	100	37	204	137	NO / NO
10:00 - 11:00	86	159	98	31	245	129	NO / NO
11:00 - 12:00	82	186	147	46	268	193	NO / NO
12:00 - 13:00	131	289	159	59	420	218	**YES / YES**
13:00 - 14:00	103	187	111	40	290	151	NO / NO
14:00 - 15:00	114	182	109	39	296	148	NO / NO
15:00 - 16:00	147	316	151	63	463	214	**YES / YES**
16:00 - 17:00	103	273	165	43	376	208	**YES / YES**
17:00 - 18:00	117	265	170	46	382	216	**YES / YES**
18:00 - 19:00	109	191	80	46	300	126	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**1519**	**2630**	**1584**	**656**			

	Met (Hr)	**Required (Hr)**
Hours met for warrant:	**5**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2b

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1519
30	Major App3:	TH19 SB	1	2630
30	Minor App2:	TH19 EB	1	1358
30	Minor App4:	S 2nd St WB	1	235

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	500	750	600
Minor Approach	150	75	120

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	73	81	41	11	154	41	NO / NO	NO / NO	NO / NO
7:00 - 8:00	255	231	113	71	486	113	NO / NO	NO / YES	NO / NO
8:00 - 9:00	120	145	96	17	265	96	NO / NO	NO / YES	NO / NO
9:00 - 10:00	79	125	84	10	204	84	NO / NO	NO / YES	NO / NO
10:00 - 11:00	86	159	82	7	245	82	NO / NO	NO / YES	NO / NO
11:00 - 12:00	82	186	126	16	268	126	NO / NO	NO / YES	NO / YES
12:00 - 13:00	131	289	135	19	420	135	NO / NO	NO / YES	NO / YES
13:00 - 14:00	103	187	103	12	290	103	NO / NO	NO / YES	NO / NO
14:00 - 15:00	114	182	89	17	296	89	NO / NO	NO / YES	NO / NO
15:00 - 16:00	147	316	131	20	463	131	NO / NO	NO / YES	NO / YES
16:00 - 17:00	103	273	141	8	376	141	NO / NO	NO / YES	NO / YES
17:00 - 18:00	117	265	147	20	382	147	NO / NO	NO / YES	NO / YES
18:00 - 19:00	109	191	70	7	300	70	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**1519**	**2630**	**1358**	**235**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	2	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2c

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1519
30	Major App3:	TH19 SB	1	2630
30	Minor App2:	TH19 EB	1	1358
30	Minor App4:	S 2nd St WB	1	235

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

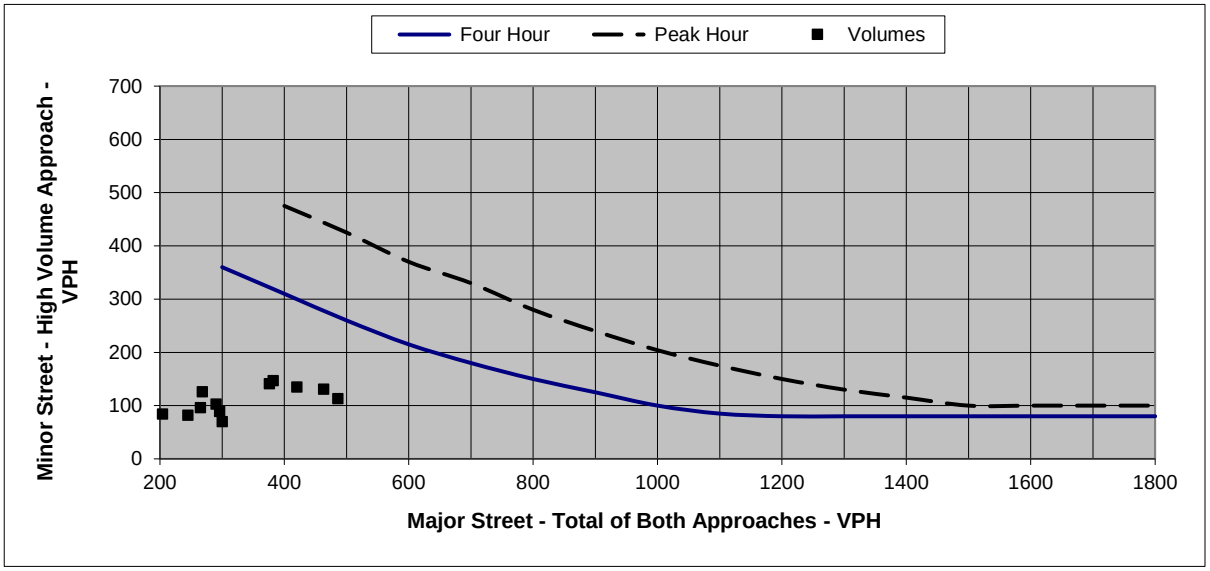

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	360	
400	310	475
500	260	425
600	215	370
700	180	330
800	150	280
900	125	240
1000	100	204
1100	85	175
1200	80	150
1300	80	130
1400	80	115
1500	80	100
1600	80	100
1700	80	100
1800	80	100

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	154	41	NO	NO
7:00 - 8:00	486	113	NO	NO
8:00 - 9:00	265	96	NO	NO
9:00 - 10:00	204	84	NO	NO
10:00 - 11:00	245	82	NO	NO
11:00 - 12:00	268	126	NO	NO
12:00 - 13:00	420	135	NO	NO
13:00 - 14:00	290	103	NO	NO
14:00 - 15:00	296	89	NO	NO
15:00 - 16:00	463	131	NO	NO
16:00 - 17:00	376	141	NO	NO
17:00 - 18:00	382	147	NO	NO
18:00 - 19:00	300	70	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2d

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1519
30	Major App3:	TH19 SB	1	2630
30	Minor App2:	TH19 EB	1	1358
30	Minor App4:	S 2nd St WB	1	235

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

80%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	400	600	480
Minor Approach	120	60	96

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	73	81	41	11	154	41	NO / NO	NO / NO	NO / NO
7:00 - 8:00	255	231	113	71	486	113	YES / NO	NO / YES	**YES / YES**
8:00 - 9:00	120	145	96	17	265	96	NO / NO	NO / YES	NO / YES
9:00 - 10:00	79	125	84	10	204	84	NO / NO	NO / YES	NO / NO
10:00 - 11:00	86	159	82	7	245	82	NO / NO	NO / YES	NO / NO
11:00 - 12:00	82	186	126	16	268	126	NO / YES	NO / YES	NO / YES
12:00 - 13:00	131	289	135	19	420	135	**YES / YES**	NO / YES	NO / YES
13:00 - 14:00	103	187	103	12	290	103	NO / NO	NO / YES	NO / YES
14:00 - 15:00	114	182	89	17	296	89	NO / NO	NO / YES	NO / NO
15:00 - 16:00	147	316	131	20	463	131	**YES / YES**	NO / YES	NO / YES
16:00 - 17:00	103	273	141	8	376	141	NO / YES	NO / YES	NO / YES
17:00 - 18:00	117	265	147	20	382	147	NO / YES	NO / YES	NO / YES
18:00 - 19:00	109	191	70	7	300	70	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**1519**	**2630**	**1358**	**235**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	2	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	2	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	1	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2e

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 60% of Full Volume Warrant Thresholds

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1519
30	Major App3:	TH19 SB	1	2630
30	Minor App2:	TH19 EB	1	1358
30	Minor App4:	S 2nd St WB	1	235

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

60%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	300	450	360
Minor Approach	90	45	72

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	73	81	41	11	154	41	NO / NO	NO / NO	NO / NO
7:00 - 8:00	255	231	113	71	486	113	**YES / YES**	**YES / YES**	**YES / YES**
8:00 - 9:00	120	145	96	17	265	96	NO / YES	NO / YES	NO / YES
9:00 - 10:00	79	125	84	10	204	84	NO / NO	NO / YES	NO / YES
10:00 - 11:00	86	159	82	7	245	82	NO / NO	NO / YES	NO / YES
11:00 - 12:00	82	186	126	16	268	126	NO / YES	NO / YES	NO / YES
12:00 - 13:00	131	289	135	19	420	135	**YES / YES**	NO / YES	**YES / YES**
13:00 - 14:00	103	187	103	12	290	103	NO / YES	NO / YES	NO / YES
14:00 - 15:00	114	182	89	17	296	89	NO / NO	NO / YES	NO / YES
15:00 - 16:00	147	316	131	20	463	131	**YES / YES**	**YES / YES**	**YES / YES**
16:00 - 17:00	103	273	141	8	376	141	**YES / YES**	NO / YES	**YES / YES**
17:00 - 18:00	117	265	147	20	382	147	**YES / YES**	NO / YES	**YES / YES**
18:00 - 19:00	109	191	70	7	300	70	YES / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**1519**	**2630**	**1358**	**235**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	5	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	5	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	2	8	Not satisfied
1A & 1B	Combination of Warrants	5	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2f

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Country Club Dr/S 2nd St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	Country Club Dr NB	1	1718
30	Major App3:	TH19 SB	1	2972
30	Minor App2:	TH19 EB	1	1791
30	Minor App4:	S 2nd St WB	1	740

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement	
300	**200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	82	91	56	47	173	103	NO / NO
7:00 - 8:00	288	260	146	132	548	278	**YES / YES**
8:00 - 9:00	136	165	131	53	301	184	YES / NO
9:00 - 10:00	89	141	113	41	230	154	NO / NO
10:00 - 11:00	97	180	110	35	277	145	NO / NO
11:00 - 12:00	93	210	166	52	303	218	**YES / YES**
12:00 - 13:00	148	326	180	67	474	247	**YES / YES**
13:00 - 14:00	117	211	126	45	328	171	YES / NO
14:00 - 15:00	128	206	123	44	334	167	YES / NO
15:00 - 16:00	167	358	171	71	525	242	**YES / YES**
16:00 - 17:00	116	309	187	49	425	236	**YES / YES**
17:00 - 18:00	133	299	193	52	432	245	**YES / YES**
18:00 - 19:00	124	216	89	52	340	141	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**1718**	**2972**	**1791**	**740**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	**6**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2g

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1718
30	Major App3:	TH19 SB	1	2972
30	Minor App2:	TH19 EB	1	1533
30	Minor App4:	S 2nd St WB	1	262

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	500	750	600
Minor Approach	150	75	120

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	82	91	46	12	173	46	NO / NO	NO / NO	NO / NO
7:00 - 8:00	288	260	127	80	548	127	YES / NO	NO / YES	NO / YES
8:00 - 9:00	136	165	108	19	301	108	NO / NO	NO / YES	NO / NO
9:00 - 10:00	89	141	95	11	230	95	NO / NO	NO / YES	NO / NO
10:00 - 11:00	97	180	92	7	277	92	NO / NO	NO / YES	NO / NO
11:00 - 12:00	93	210	143	19	303	143	NO / NO	NO / YES	NO / YES
12:00 - 13:00	148	326	153	21	474	153	NO / YES	NO / YES	NO / YES
13:00 - 14:00	117	211	118	13	328	118	NO / NO	NO / YES	NO / NO
14:00 - 15:00	128	206	100	19	334	100	NO / NO	NO / YES	NO / NO
15:00 - 16:00	167	358	147	22	525	147	YES / NO	NO / YES	NO / YES
16:00 - 17:00	116	309	159	9	425	159	NO / YES	NO / YES	NO / YES
17:00 - 18:00	133	299	166	23	432	166	NO / YES	NO / YES	NO / YES
18:00 - 19:00	124	216	79	7	340	79	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**1718**	**2972**	**1533**	**262**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	5	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2h

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1718
30	Major App3:	TH19 SB	1	2972
30	Minor App2:	TH19 EB	1	1533
30	Minor App4:	S 2nd St WB	1	262

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

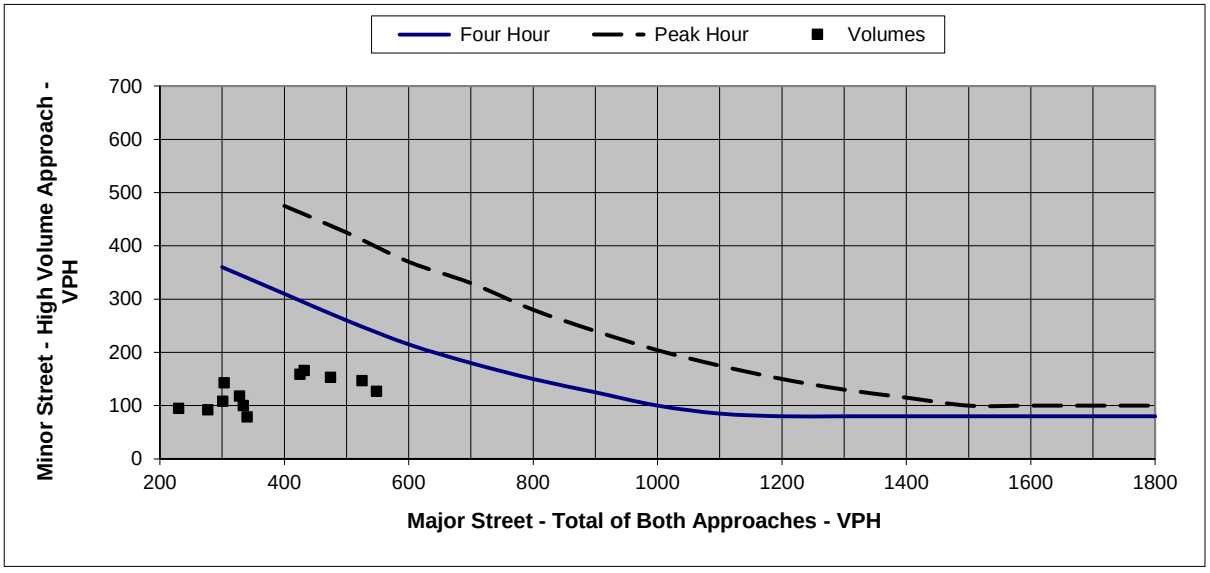

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major Approach	Minor App. Four Hour	Minor App. Peak Hour
200		
300	360	
400	310	475
500	260	425
600	215	370
700	180	330
800	150	280
900	125	240
1000	100	204
1100	85	175
1200	80	150
1300	80	130
1400	80	115
1500	80	100
1600	80	100
1700	80	100
1800	80	100

Actual Hourly Count			Warrants Met: Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	173	46	NO	NO
7:00 - 8:00	548	127	NO	NO
8:00 - 9:00	301	108	NO	NO
9:00 - 10:00	230	95	NO	NO
10:00 - 11:00	277	92	NO	NO
11:00 - 12:00	303	143	NO	NO
12:00 - 13:00	474	153	NO	NO
13:00 - 14:00	328	118	NO	NO
14:00 - 15:00	334	100	NO	NO
15:00 - 16:00	525	147	NO	NO
16:00 - 17:00	425	159	NO	NO
17:00 - 18:00	432	166	NO	NO
18:00 - 19:00	340	79	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2i

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1718
30	Major App3:	TH19 SB	1	2972
30	Minor App2:	TH19 EB	1	1533
30	Minor App4:	S 2nd St WB	1	262

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

80%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	400	600	480
Minor Approach	120	60	96

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	82	91	46	12	173	46	NO / NO	NO / NO	NO / NO
7:00 - 8:00	288	260	127	80	548	127	**YES / YES**	NO / YES	**YES / YES**
8:00 - 9:00	136	165	108	19	301	108	NO / NO	NO / YES	NO / YES
9:00 - 10:00	89	141	95	11	230	95	NO / NO	NO / YES	NO / NO
10:00 - 11:00	97	180	92	7	277	92	NO / NO	NO / YES	NO / NO
11:00 - 12:00	93	210	143	19	303	143	NO / YES	NO / YES	NO / YES
12:00 - 13:00	148	326	153	21	474	153	**YES / YES**	NO / YES	NO / YES
13:00 - 14:00	117	211	118	13	328	118	NO / NO	NO / YES	NO / YES
14:00 - 15:00	128	206	100	19	334	100	NO / NO	NO / YES	NO / YES
15:00 - 16:00	167	358	147	22	525	147	**YES / YES**	NO / YES	**YES / YES**
16:00 - 17:00	116	309	159	9	425	159	**YES / YES**	NO / YES	NO / YES
17:00 - 18:00	133	299	166	23	432	166	**YES / YES**	NO / YES	NO / YES
18:00 - 19:00	124	216	79	7	340	79	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**1718**	**2972**	**1533**	**262**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	5	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	5	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	2	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2j

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 60% of Full Volume Warrant Thresholds

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1718
30	Major App3:	TH19 SB	1	2972
30	Minor App2:	TH19 EB	1	1533
30	Minor App4:	S 2nd St WB	1	262

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

60%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	300	450	360
Minor Approach	90	45	72

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	82	91	46	12	173	46	NO / NO	NO / YES	NO / NO
7:00 - 8:00	288	260	127	80	548	127	**YES / YES**	**YES / YES**	**YES / YES**
8:00 - 9:00	136	165	108	19	301	108	**YES / YES**	NO / YES	NO / YES
9:00 - 10:00	89	141	95	11	230	95	NO / YES	NO / YES	NO / YES
10:00 - 11:00	97	180	92	7	277	92	NO / YES	NO / YES	NO / YES
11:00 - 12:00	93	210	143	19	303	143	**YES / YES**	NO / YES	NO / YES
12:00 - 13:00	148	326	153	21	474	153	**YES / YES**	**YES / YES**	**YES / YES**
13:00 - 14:00	117	211	118	13	328	118	**YES / YES**	NO / YES	NO / YES
14:00 - 15:00	128	206	100	19	334	100	**YES / YES**	NO / YES	NO / YES
15:00 - 16:00	167	358	147	22	525	147	**YES / YES**	**YES / YES**	**YES / YES**
16:00 - 17:00	116	309	159	9	425	159	**YES / YES**	NO / YES	**YES / YES**
17:00 - 18:00	133	299	166	23	432	166	**YES / YES**	NO / YES	**YES / YES**
18:00 - 19:00	124	216	79	7	340	79	YES / NO	NO / YES	NO / YES
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**1718**	**2972**	**1533**	**262**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	9	8	Satisfied
Warrant 1A	Minimum Vehicular Volume	9	8	Satisfied
Warrant 1B	Interruption of Continuous Flow	3	8	Not satisfied
1A & 1B	Combination of Warrants	5	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A2k

2043 Future - TH19 at Country Club Dr/S 2nd St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	Country Club Dr NB	1	1698
30	Major App3:	TH19 SB	1	2949
30	Minor App2:	TH19 EB	1	1773
30	Minor App4:	S 2nd St WB	1	736

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement	
300	**200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	82	91	55	47	173	102	NO / NO
7:00 - 8:00	286	259	145	131	545	276	**YES / YES**
8:00 - 9:00	133	162	129	53	295	182	NO / NO
9:00 - 10:00	88	140	112	41	228	153	NO / NO
10:00 - 11:00	96	179	110	35	275	145	NO / NO
11:00 - 12:00	92	209	165	52	301	217	**YES / YES**
12:00 - 13:00	146	324	178	67	470	245	**YES / YES**
13:00 - 14:00	115	210	124	45	325	169	YES / NO
14:00 - 15:00	128	204	122	44	332	166	YES / NO
15:00 - 16:00	164	354	170	70	518	240	**YES / YES**
16:00 - 17:00	116	306	185	49	422	234	**YES / YES**
17:00 - 18:00	131	297	189	51	428	240	**YES / YES**
18:00 - 19:00	121	214	89	51	335	140	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**1698**	**2949**	**1773**	**736**			

	Met (Hr)	**Required (Hr)**
Hours met for warrant:	**6**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2l

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2043 Future - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1698
30	Major App3:	TH19 SB	1	2949
30	Minor App2:	TH19 EB	1	1523
30	Minor App4:	S 2nd St WB	1	257

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	500	750	600
Minor Approach	150	75	120

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	82	91	46	12	173	46	NO / NO	NO / NO	NO / NO
7:00 - 8:00	286	259	126	80	545	126	YES / NO	NO / YES	NO / YES
8:00 - 9:00	133	162	108	19	295	108	NO / NO	NO / YES	NO / NO
9:00 - 10:00	88	140	95	10	228	95	NO / NO	NO / YES	NO / NO
10:00 - 11:00	96	179	92	7	275	92	NO / NO	NO / YES	NO / NO
11:00 - 12:00	92	209	141	18	301	141	NO / NO	NO / YES	NO / YES
12:00 - 13:00	146	324	152	21	470	152	NO / YES	NO / YES	NO / YES
13:00 - 14:00	115	210	114	13	325	114	NO / NO	NO / YES	NO / NO
14:00 - 15:00	128	204	100	18	332	100	NO / NO	NO / YES	NO / NO
15:00 - 16:00	164	354	147	22	518	147	YES / NO	NO / YES	NO / YES
16:00 - 17:00	116	306	158	8	422	158	NO / YES	NO / YES	NO / YES
17:00 - 18:00	131	297	165	22	428	165	NO / YES	NO / YES	NO / YES
18:00 - 19:00	121	214	79	7	335	79	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**1698**	**2949**	**1523**	**257**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	5	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2m

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2043 Future - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1698
30	Major App3:	TH19 SB	1	2949
30	Minor App2:	TH19 EB	1	1523
30	Minor App4:	S 2nd St WB	1	257

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

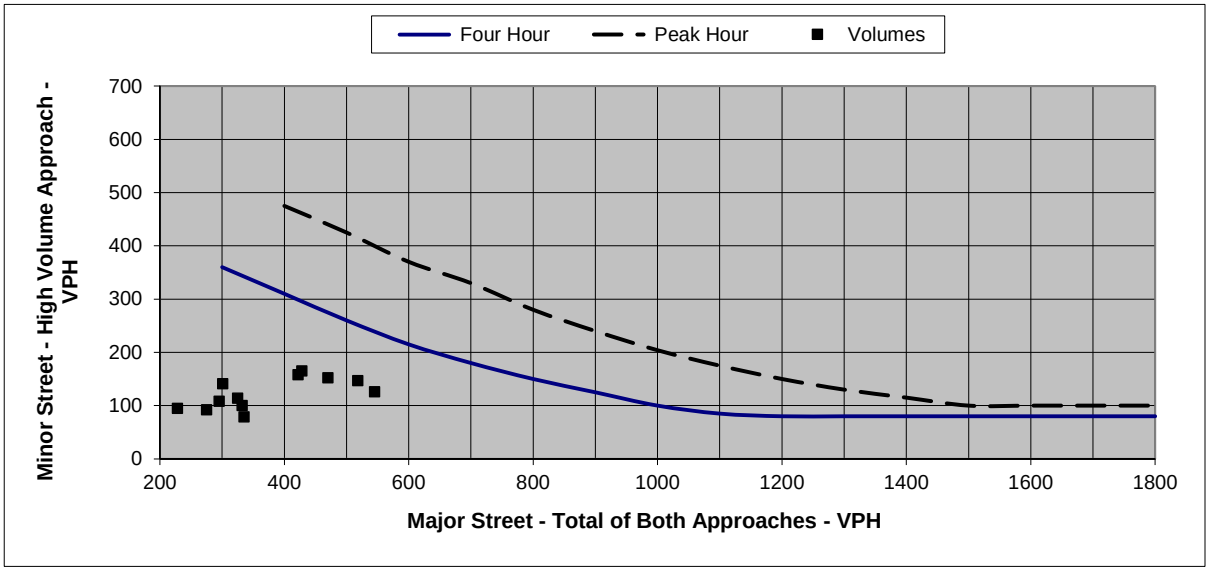

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	360	
400	310	475
500	260	425
600	215	370
700	180	330
800	150	280
900	125	240
1000	100	204
1100	85	175
1200	80	150
1300	80	130
1400	80	115
1500	80	100
1600	80	100
1700	80	100
1800	80	100

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	173	46	NO	NO
7:00 - 8:00	545	126	NO	NO
8:00 - 9:00	295	108	NO	NO
9:00 - 10:00	228	95	NO	NO
10:00 - 11:00	275	92	NO	NO
11:00 - 12:00	301	141	NO	NO
12:00 - 13:00	470	152	NO	NO
13:00 - 14:00	325	114	NO	NO
14:00 - 15:00	332	100	NO	NO
15:00 - 16:00	518	147	NO	NO
16:00 - 17:00	422	158	NO	NO
17:00 - 18:00	428	165	NO	NO
18:00 - 19:00	335	79	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2n

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2043 Future - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1698
30	Major App3:	TH19 SB	1	2949
30	Minor App2:	TH19 EB	1	1523
30	Minor App4:	S 2nd St WB	1	257

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

80%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	400	600	480
Minor Approach	120	60	96

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	82	91	46	12	173	46	NO / NO	NO / NO	NO / NO
7:00 - 8:00	286	259	126	80	545	126	**YES / YES**	NO / YES	**YES / YES**
8:00 - 9:00	133	162	108	19	295	108	NO / NO	NO / YES	NO / YES
9:00 - 10:00	88	140	95	10	228	95	NO / NO	NO / YES	NO / NO
10:00 - 11:00	96	179	92	7	275	92	NO / NO	NO / YES	NO / NO
11:00 - 12:00	92	209	141	18	301	141	NO / YES	NO / YES	NO / YES
12:00 - 13:00	146	324	152	21	470	152	**YES / YES**	NO / YES	NO / YES
13:00 - 14:00	115	210	114	13	325	114	NO / NO	NO / YES	NO / YES
14:00 - 15:00	128	204	100	18	332	100	NO / NO	NO / YES	NO / YES
15:00 - 16:00	164	354	147	22	518	147	**YES / YES**	NO / YES	**YES / YES**
16:00 - 17:00	116	306	158	8	422	158	**YES / YES**	NO / YES	NO / YES
17:00 - 18:00	131	297	165	22	428	165	**YES / YES**	NO / YES	NO / YES
18:00 - 19:00	121	214	79	7	335	79	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**1698**	**2949**	**1523**	**257**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	5	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	5	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	2	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A2o

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2043 Future - TH19 at Country Club Dr/S 2nd St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 60% of Full Volume Warrant Thresholds

LOCATION: TH19 at Country Club Dr/S 2nd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Country Club Dr NB	1	1698
30	Major App3:	TH19 SB	1	2949
30	Minor App2:	TH19 EB	1	1523
30	Minor App4:	S 2nd St WB	1	257

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

60%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	300	450	360
Minor Approach	90	45	72

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	82	91	46	12	173	46	NO / NO	NO / YES	NO / NO
7:00 - 8:00	286	259	126	80	545	126	**YES / YES**	**YES / YES**	**YES / YES**
8:00 - 9:00	133	162	108	19	295	108	NO / YES	NO / YES	NO / YES
9:00 - 10:00	88	140	95	10	228	95	NO / YES	NO / YES	NO / YES
10:00 - 11:00	96	179	92	7	275	92	NO / YES	NO / YES	NO / YES
11:00 - 12:00	92	209	141	18	301	141	**YES / YES**	NO / YES	NO / YES
12:00 - 13:00	146	324	152	21	470	152	**YES / YES**	**YES / YES**	**YES / YES**
13:00 - 14:00	115	210	114	13	325	114	**YES / YES**	NO / YES	NO / YES
14:00 - 15:00	128	204	100	18	332	100	**YES / YES**	NO / YES	NO / YES
15:00 - 16:00	164	354	147	22	518	147	**YES / YES**	**YES / YES**	**YES / YES**
16:00 - 17:00	116	306	158	8	422	158	**YES / YES**	NO / YES	**YES / YES**
17:00 - 18:00	131	297	165	22	428	165	**YES / YES**	NO / YES	**YES / YES**
18:00 - 19:00	121	214	79	7	335	79	YES / NO	NO / YES	NO / YES
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**1698**	**2949**	**1523**	**257**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	**8**	8	**Satisfied**
Warrant 1A	Minimum Vehicular Volume	**8**	8	**Satisfied**
Warrant 1B	Interruption of Continuous Flow	3	8	Not satisfied
1A & 1B	Combination of Warrants	5	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A3a

2019 Existing - TH19 at Saratoga St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH19 EB	3	3143
30	Major App3:	TH19 WB	3	2945
30	Minor App2:	Saratoga St NB	1	1356
30	Minor App4:	Saratoga St SB	1	1302

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement	
300	**200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	135	85	60	24	220	84	NO / NO
7:00 - 8:00	379	266	156	108	645	264	**YES / YES**
8:00 - 9:00	234	172	71	68	406	139	YES / NO
9:00 - 10:00	187	153	65	54	340	119	YES / NO
10:00 - 11:00	200	165	75	77	365	152	YES / NO
11:00 - 12:00	223	217	104	90	440	194	YES / NO
12:00 - 13:00	279	327	124	150	606	274	**YES / YES**
13:00 - 14:00	235	227	108	101	462	209	**YES / YES**
14:00 - 15:00	220	209	71	86	429	157	YES / NO
15:00 - 16:00	311	298	142	143	609	285	**YES / YES**
16:00 - 17:00	269	298	149	144	567	293	**YES / YES**
17:00 - 18:00	269	317	127	157	586	284	**YES / YES**
18:00 - 19:00	202	211	104	100	413	204	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**3143**	**2945**	**1356**	**1302**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	**7**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3b

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3143
30	Major App3:	TH19 WB	3	2945
30	Minor App2:	Saratoga St NB	1	1000
30	Minor App4:	Saratoga St SB	1	1014

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	150	75	120

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	135	85	46	22	220	46	NO / NO	NO / NO	NO / NO
7:00 - 8:00	379	266	113	87	645	113	YES / NO	NO / YES	NO / NO
8:00 - 9:00	234	172	54	48	406	54	NO / NO	NO / NO	NO / NO
9:00 - 10:00	187	153	51	41	340	51	NO / NO	NO / NO	NO / NO
10:00 - 11:00	200	165	53	61	365	61	NO / NO	NO / NO	NO / NO
11:00 - 12:00	223	217	76	69	440	76	NO / NO	NO / YES	NO / NO
12:00 - 13:00	279	327	88	108	606	108	YES / NO	NO / YES	NO / NO
13:00 - 14:00	235	227	84	79	462	84	NO / NO	NO / YES	NO / NO
14:00 - 15:00	220	209	48	67	429	67	NO / NO	NO / NO	NO / NO
15:00 - 16:00	311	298	113	103	609	113	YES / NO	NO / YES	NO / NO
16:00 - 17:00	269	298	98	117	567	117	NO / NO	NO / YES	NO / NO
17:00 - 18:00	269	317	96	135	586	135	NO / NO	NO / YES	NO / YES
18:00 - 19:00	202	211	80	77	413	80	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3143**	**2945**	**1000**	**1014**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	1	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3c

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3143
30	Major App3:	TH19 WB	3	2945
30	Minor App2:	Saratoga St NB	1	1000
30	Minor App4:	Saratoga St SB	1	1014

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

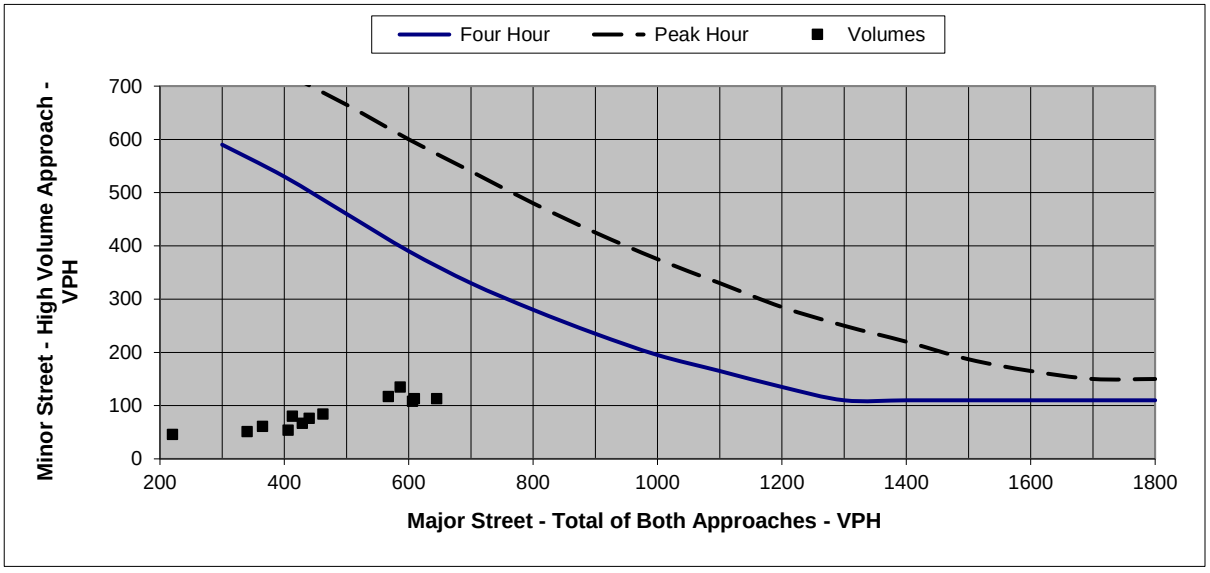

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	220	46	NO	NO
7:00 - 8:00	645	113	NO	NO
8:00 - 9:00	406	54	NO	NO
9:00 - 10:00	340	51	NO	NO
10:00 - 11:00	365	61	NO	NO
11:00 - 12:00	440	76	NO	NO
12:00 - 13:00	606	108	NO	NO
13:00 - 14:00	462	84	NO	NO
14:00 - 15:00	429	67	NO	NO
15:00 - 16:00	609	113	NO	NO
16:00 - 17:00	567	117	NO	NO
17:00 - 18:00	586	135	NO	NO
18:00 - 19:00	413	80	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3d

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3143
30	Major App3:	TH19 WB	3	2945
30	Minor App2:	Saratoga St NB	1	1000
30	Minor App4:	Saratoga St SB	1	1014

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

80%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	480	720	576
Minor Approach	120	60	96

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	135	85	46	22	220	46	NO / NO	NO / NO	NO / NO
7:00 - 8:00	379	266	113	87	645	113	YES / NO	NO / YES	**YES / YES**
8:00 - 9:00	234	172	54	48	406	54	NO / NO	NO / NO	NO / NO
9:00 - 10:00	187	153	51	41	340	51	NO / NO	NO / NO	NO / NO
10:00 - 11:00	200	165	53	61	365	61	NO / NO	NO / YES	NO / NO
11:00 - 12:00	223	217	76	69	440	76	NO / NO	NO / YES	NO / NO
12:00 - 13:00	279	327	88	108	606	108	YES / NO	NO / YES	**YES / YES**
13:00 - 14:00	235	227	84	79	462	84	NO / NO	NO / YES	NO / NO
14:00 - 15:00	220	209	48	67	429	67	NO / NO	NO / YES	NO / NO
15:00 - 16:00	311	298	113	103	609	113	YES / NO	NO / YES	**YES / YES**
16:00 - 17:00	269	298	98	117	567	117	YES / NO	NO / YES	NO / YES
17:00 - 18:00	269	317	96	135	586	135	**YES / YES**	NO / YES	**YES / YES**
18:00 - 19:00	202	211	80	77	413	80	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3143**	**2945**	**1000**	**1014**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	4	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	1	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	4	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3e

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 60% of Full Volume Warrant Thresholds

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	TH19 EB	3	3143
30	Major App3:	TH19 WB	3	2945
30	Minor App2:	Saratoga St NB	1	1000
30	Minor App4:	Saratoga St SB	1	1014

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

60%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	360	540	432
Minor Approach	90	45	72

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	135	85	46	22	220	46	NO / NO	NO / YES	NO / NO
7:00 - 8:00	379	266	113	87	645	113	**YES / YES**	**YES / YES**	**YES / YES**
8:00 - 9:00	234	172	54	48	406	54	YES / NO	NO / YES	NO / NO
9:00 - 10:00	187	153	51	41	340	51	NO / NO	NO / YES	NO / NO
10:00 - 11:00	200	165	53	61	365	61	YES / NO	NO / YES	NO / NO
11:00 - 12:00	223	217	76	69	440	76	YES / NO	NO / YES	**YES / YES**
12:00 - 13:00	279	327	88	108	606	108	**YES / YES**	**YES / YES**	**YES / YES**
13:00 - 14:00	235	227	84	79	462	84	YES / NO	NO / YES	**YES / YES**
14:00 - 15:00	220	209	48	67	429	67	YES / NO	NO / YES	NO / NO
15:00 - 16:00	311	298	113	103	609	113	**YES / YES**	**YES / YES**	**YES / YES**
16:00 - 17:00	269	298	98	117	567	117	**YES / YES**	**YES / YES**	**YES / YES**
17:00 - 18:00	269	317	96	135	586	135	**YES / YES**	**YES / YES**	**YES / YES**
18:00 - 19:00	202	211	80	77	413	80	YES / NO	NO / YES	NO / YES
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3143**	**2945**	**1000**	**1014**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	7	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	5	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	5	8	Not satisfied
1A & 1B	Combination of Warrants	7	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A3f

2045 Future - TH19 at Saratoga St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH19 EB	3	3550
30	Major App3:	TH19 WB	3	3327
30	Minor App2:	Saratoga St NB	1	1536
30	Minor App4:	Saratoga St SB	1	1472

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	152	96	68	27	248	95	NO / NO
7:00 - 8:00	428	300	176	122	728	298	**YES / YES**
8:00 - 9:00	265	195	81	76	460	157	YES / NO
9:00 - 10:00	211	173	73	62	384	135	YES / NO
10:00 - 11:00	225	186	85	87	411	172	YES / NO
11:00 - 12:00	252	245	118	102	497	220	**YES / YES**
12:00 - 13:00	316	369	141	169	685	310	**YES / YES**
13:00 - 14:00	265	257	122	114	522	236	**YES / YES**
14:00 - 15:00	248	236	80	97	484	177	YES / NO
15:00 - 16:00	351	337	162	161	688	323	**YES / YES**
16:00 - 17:00	305	337	168	164	642	332	**YES / YES**
17:00 - 18:00	304	358	144	178	662	322	**YES / YES**
18:00 - 19:00	228	238	118	113	466	231	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**3550**	**3327**	**1536**	**1472**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	8	8

All-way Stop Warrant: **Satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3g

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	TH19 EB	3	3550
30	Major App3:	TH19 WB	3	3327
30	Minor App2:	Saratoga St NB	1	1128
30	Minor App4:	Saratoga St SB	1	1148

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	150	75	120

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	152	96	52	25	248	52	NO / NO	NO / NO	NO / NO
7:00 - 8:00	428	300	128	98	728	128	YES / NO	NO / YES	**YES / YES**
8:00 - 9:00	265	195	61	55	460	61	NO / NO	NO / NO	NO / NO
9:00 - 10:00	211	173	57	47	384	57	NO / NO	NO / NO	NO / NO
10:00 - 11:00	225	186	59	69	411	69	NO / NO	NO / NO	NO / NO
11:00 - 12:00	252	245	86	78	497	86	NO / NO	NO / YES	NO / NO
12:00 - 13:00	316	369	100	122	685	122	YES / NO	NO / YES	NO / YES
13:00 - 14:00	265	257	94	89	522	94	NO / NO	NO / YES	NO / NO
14:00 - 15:00	248	236	54	75	484	75	NO / NO	NO / YES	NO / NO
15:00 - 16:00	351	337	128	117	688	128	YES / NO	NO / YES	NO / YES
16:00 - 17:00	305	337	110	133	642	133	YES / NO	NO / YES	NO / YES
17:00 - 18:00	304	358	109	153	662	153	**YES / YES**	NO / YES	NO / YES
18:00 - 19:00	228	238	90	87	466	90	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3550**	**3327**	**1128**	**1148**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	1	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	1	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	1	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	5	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3h

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3550
30	Major App3:	TH19 WB	3	3327
30	Minor App2:	Saratoga St NB	1	1128
30	Minor App4:	Saratoga St SB	1	1148

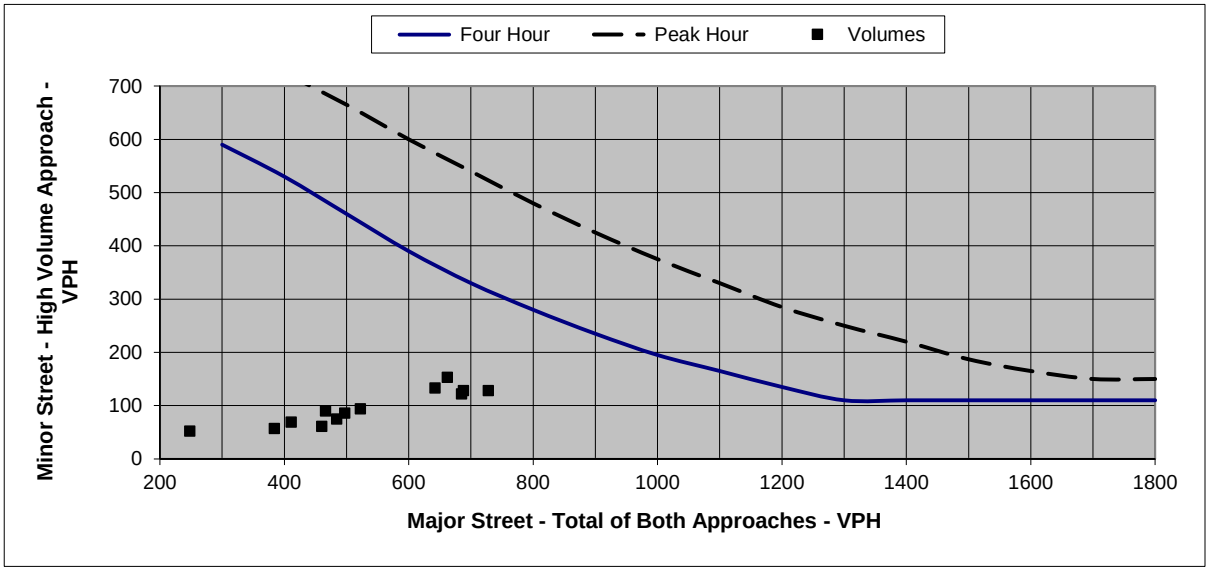

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	248	52	NO	NO
7:00 - 8:00	728	128	NO	NO
8:00 - 9:00	460	61	NO	NO
9:00 - 10:00	384	57	NO	NO
10:00 - 11:00	411	69	NO	NO
11:00 - 12:00	497	86	NO	NO
12:00 - 13:00	685	122	NO	NO
13:00 - 14:00	522	94	NO	NO
14:00 - 15:00	484	75	NO	NO
15:00 - 16:00	688	128	NO	NO
16:00 - 17:00	642	133	NO	NO
17:00 - 18:00	662	153	NO	NO
18:00 - 19:00	466	90	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3i

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3550
30	Major App3:	TH19 WB	3	3327
30	Minor App2:	Saratoga St NB	1	1128
30	Minor App4:	Saratoga St SB	1	1148

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

80%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	480	720	576
Minor Approach	120	60	96

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	152	96	52	25	248	52	NO / NO	NO / NO	NO / NO
7:00 - 8:00	428	300	128	98	728	128	**YES / YES**	**YES / YES**	**YES / YES**
8:00 - 9:00	265	195	61	55	460	61	NO / NO	NO / YES	NO / NO
9:00 - 10:00	211	173	57	47	384	57	NO / NO	NO / NO	NO / NO
10:00 - 11:00	225	186	59	69	411	69	NO / NO	NO / YES	NO / NO
11:00 - 12:00	252	245	86	78	497	86	YES / NO	NO / YES	NO / NO
12:00 - 13:00	316	369	100	122	685	122	**YES / YES**	NO / YES	**YES / YES**
13:00 - 14:00	265	257	94	89	522	94	YES / NO	NO / YES	NO / NO
14:00 - 15:00	248	236	54	75	484	75	YES / NO	NO / YES	NO / NO
15:00 - 16:00	351	337	128	117	688	128	**YES / YES**	NO / YES	**YES / YES**
16:00 - 17:00	305	337	110	133	642	133	**YES / YES**	NO / YES	**YES / YES**
17:00 - 18:00	304	358	109	153	662	153	**YES / YES**	NO / YES	**YES / YES**
18:00 - 19:00	228	238	90	87	466	90	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3550**	**3327**	**1128**	**1148**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	5	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	5	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	1	8	Not satisfied
1A & 1B	Combination of Warrants	5	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3j

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 60% of Full Volume Warrant Thresholds

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3550
30	Major App3:	TH19 WB	3	3327
30	Minor App2:	Saratoga St NB	1	1128
30	Minor App4:	Saratoga St SB	1	1148

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

60%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	360	540	432
Minor Approach	90	45	72

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	152	96	52	25	248	52	NO / NO	NO / YES	NO / NO
7:00 - 8:00	428	300	128	98	728	128	**YES / YES**	**YES / YES**	**YES / YES**
8:00 - 9:00	265	195	61	55	460	61	YES / NO	NO / YES	YES / NO
9:00 - 10:00	211	173	57	47	384	57	YES / NO	NO / YES	NO / NO
10:00 - 11:00	225	186	59	69	411	69	YES / NO	NO / YES	NO / NO
11:00 - 12:00	252	245	86	78	497	86	YES / NO	NO / YES	**YES / YES**
12:00 - 13:00	316	369	100	122	685	122	**YES / YES**	**YES / YES**	**YES / YES**
13:00 - 14:00	265	257	94	89	522	94	**YES / YES**	NO / YES	**YES / YES**
14:00 - 15:00	248	236	54	75	484	75	YES / NO	NO / YES	**YES / YES**
15:00 - 16:00	351	337	128	117	688	128	**YES / YES**	**YES / YES**	**YES / YES**
16:00 - 17:00	305	337	110	133	642	133	**YES / YES**	**YES / YES**	**YES / YES**
17:00 - 18:00	304	358	109	153	662	153	**YES / YES**	**YES / YES**	**YES / YES**
18:00 - 19:00	228	238	90	87	466	90	**YES / YES**	NO / YES	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3550**	**3327**	**1128**	**1148**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	**9**	8	**Satisfied**
Warrant 1A	Minimum Vehicular Volume	7	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	5	8	Not satisfied
1A & 1B	Combination of Warrants	**9**	8	**Satisfied**

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A3k

2028 Future - TH19 at Saratoga St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 10/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH19 EB	3	3280
30	Major App3:	TH19 WB	3	3078
30	Minor App2:	Saratoga St NB	1	1418
30	Minor App4:	Saratoga St SB	1	1359

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	141	89	62	25	230	87	NO / NO
7:00 - 8:00	396	279	164	112	675	276	**YES / YES**
8:00 - 9:00	244	181	75	71	425	146	YES / NO
9:00 - 10:00	195	160	68	58	355	126	YES / NO
10:00 - 11:00	208	172	79	81	380	160	YES / NO
11:00 - 12:00	233	226	109	94	459	203	**YES / YES**
12:00 - 13:00	291	342	129	156	633	285	**YES / YES**
13:00 - 14:00	245	236	113	105	481	218	**YES / YES**
14:00 - 15:00	229	218	75	90	447	165	YES / NO
15:00 - 16:00	325	312	148	149	637	297	**YES / YES**
16:00 - 17:00	281	311	155	150	592	305	**YES / YES**
17:00 - 18:00	281	331	132	163	612	295	**YES / YES**
18:00 - 19:00	211	221	109	105	432	214	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**3280**	**3078**	**1418**	**1359**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	8	8

All-way Stop Warrant: **Satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3l

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2028 Future - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 10/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3280
30	Major App3:	TH19 WB	3	3078
30	Minor App2:	Saratoga St NB	1	1044
30	Minor App4:	Saratoga St SB	1	1063

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	150	75	120

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	141	89	47	23	230	47	NO / NO	NO / NO	NO / NO
7:00 - 8:00	396	279	118	91	675	118	YES / NO	NO / YES	NO / NO
8:00 - 9:00	244	181	56	51	425	56	NO / NO	NO / NO	NO / NO
9:00 - 10:00	195	160	53	43	355	53	NO / NO	NO / NO	NO / NO
10:00 - 11:00	208	172	55	64	380	64	NO / NO	NO / NO	NO / NO
11:00 - 12:00	233	226	80	73	459	80	NO / NO	NO / YES	NO / NO
12:00 - 13:00	291	342	92	112	633	112	YES / NO	NO / YES	NO / NO
13:00 - 14:00	245	236	88	83	481	88	NO / NO	NO / YES	NO / NO
14:00 - 15:00	229	218	50	71	447	71	NO / NO	NO / NO	NO / NO
15:00 - 16:00	325	312	119	107	637	119	YES / NO	NO / YES	NO / NO
16:00 - 17:00	281	311	102	123	592	123	NO / NO	NO / YES	NO / YES
17:00 - 18:00	281	331	100	141	612	141	YES / NO	NO / YES	NO / YES
18:00 - 19:00	211	221	84	81	432	84	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3280**	**3078**	**1044**	**1063**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	2	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3m

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2028 Future - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 10/14/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3280
30	Major App3:	TH19 WB	3	3078
30	Minor App2:	Saratoga St NB	1	1044
30	Minor App4:	Saratoga St SB	1	1063

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

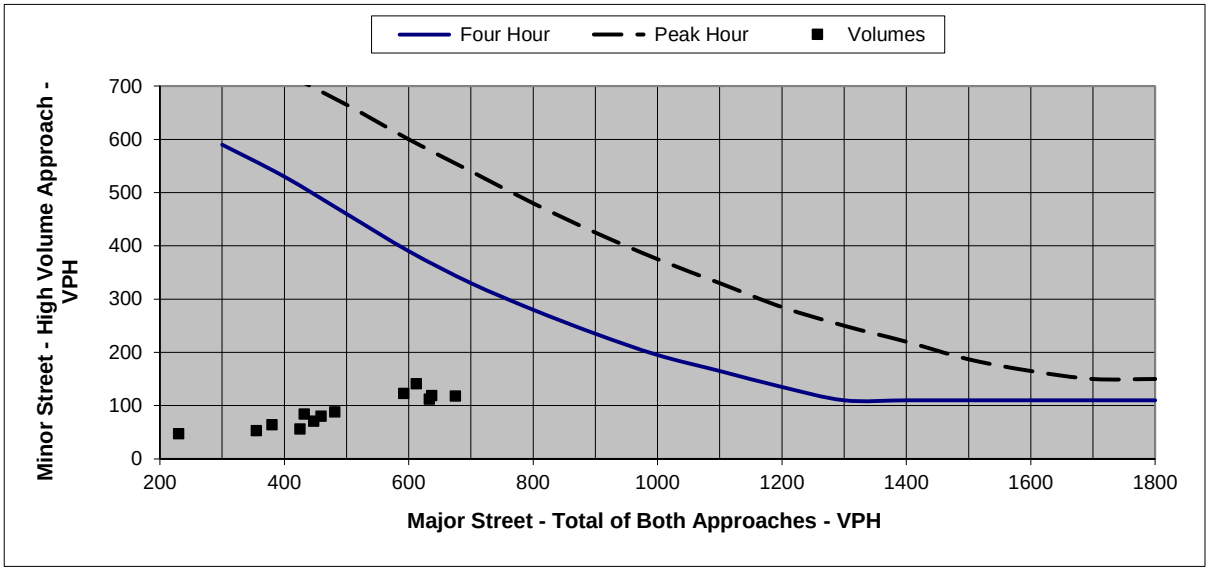

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	230	47	NO	NO
7:00 - 8:00	675	118	NO	NO
8:00 - 9:00	425	56	NO	NO
9:00 - 10:00	355	53	NO	NO
10:00 - 11:00	380	64	NO	NO
11:00 - 12:00	459	80	NO	NO
12:00 - 13:00	633	112	NO	NO
13:00 - 14:00	481	88	NO	NO
14:00 - 15:00	447	71	NO	NO
15:00 - 16:00	637	119	NO	NO
16:00 - 17:00	592	123	NO	NO
17:00 - 18:00	612	141	NO	NO
18:00 - 19:00	432	84	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3n

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2028 Future - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 10/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	TH19 EB	3	3280
30	Major App3:	TH19 WB	3	3078
30	Minor App2:	Saratoga St NB	1	1044
30	Minor App4:	Saratoga St SB	1	1063

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

80%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	480	720	576
Minor Approach	120	60	96

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	141	89	47	23	230	47	NO / NO	NO / NO	NO / NO
7:00 - 8:00	396	279	118	91	675	118	YES / NO	NO / YES	**YES / YES**
8:00 - 9:00	244	181	56	51	425	56	NO / NO	NO / NO	NO / NO
9:00 - 10:00	195	160	53	43	355	53	NO / NO	NO / NO	NO / NO
10:00 - 11:00	208	172	55	64	380	64	NO / NO	NO / YES	NO / NO
11:00 - 12:00	233	226	80	73	459	80	NO / NO	NO / YES	NO / NO
12:00 - 13:00	291	342	92	112	633	112	YES / NO	NO / YES	**YES / YES**
13:00 - 14:00	245	236	88	83	481	88	YES / NO	NO / YES	NO / NO
14:00 - 15:00	229	218	50	71	447	71	NO / NO	NO / YES	NO / NO
15:00 - 16:00	325	312	119	107	637	119	YES / NO	NO / YES	**YES / YES**
16:00 - 17:00	281	311	102	123	592	123	**YES / YES**	NO / YES	**YES / YES**
17:00 - 18:00	281	331	100	141	612	141	**YES / YES**	NO / YES	**YES / YES**
18:00 - 19:00	211	221	84	81	432	84	NO / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3280**	**3078**	**1044**	**1063**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	5	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	2	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	5	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A3o

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2028 Future - TH19 at Saratoga St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 60% of Full Volume Warrant Thresholds

LOCATION: TH19 at Saratoga St
COUNTY: Lyon
REF. POINT: 0
DATE: 10/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3280
30	Major App3:	TH19 WB	3	3078
30	Minor App2:	Saratoga St NB	1	1044
30	Minor App4:	Saratoga St SB	1	1063

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

60%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	360	540	432
Minor Approach	90	45	72

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	141	89	47	23	230	47	NO / NO	NO / YES	NO / NO
7:00 - 8:00	396	279	118	91	675	118	**YES / YES**	**YES / YES**	**YES / YES**
8:00 - 9:00	244	181	56	51	425	56	YES / NO	NO / YES	NO / NO
9:00 - 10:00	195	160	53	43	355	53	NO / NO	NO / YES	NO / NO
10:00 - 11:00	208	172	55	64	380	64	YES / NO	NO / YES	NO / NO
11:00 - 12:00	233	226	80	73	459	80	YES / NO	NO / YES	**YES / YES**
12:00 - 13:00	291	342	92	112	633	112	**YES / YES**	**YES / YES**	**YES / YES**
13:00 - 14:00	245	236	88	83	481	88	YES / NO	NO / YES	**YES / YES**
14:00 - 15:00	229	218	50	71	447	71	YES / NO	NO / YES	YES / NO
15:00 - 16:00	325	312	119	107	637	119	**YES / YES**	**YES / YES**	**YES / YES**
16:00 - 17:00	281	311	102	123	592	123	**YES / YES**	**YES / YES**	**YES / YES**
17:00 - 18:00	281	331	100	141	612	141	**YES / YES**	**YES / YES**	**YES / YES**
18:00 - 19:00	211	221	84	81	432	84	YES / NO	NO / YES	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3280**	**3078**	**1044**	**1063**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	**8**	8	**Satisfied**
Warrant 1A	Minimum Vehicular Volume	5	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	5	8	Not satisfied
1A & 1B	Combination of Warrants	**8**	8	**Satisfied**

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A4a

2019 Existing - TH19 at Main St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Main St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	Main St NB	3	4351
30	Major App3:	Main St SB	3	4896
30	Minor App2:	TH19 EB	3	3391
30	Minor App4:	TH19 WB	3	3665

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	174	153	129	113	327	242	**YES / YES**
7:00 - 8:00	364	404	362	246	768	608	**YES / YES**
8:00 - 9:00	259	333	241	214	592	455	**YES / YES**
9:00 - 10:00	244	296	209	210	540	419	**YES / YES**
10:00 - 11:00	305	342	215	221	647	436	**YES / YES**
11:00 - 12:00	319	395	262	281	714	543	**YES / YES**
12:00 - 13:00	423	454	307	415	877	722	**YES / YES**
13:00 - 14:00	347	381	270	307	728	577	**YES / YES**
14:00 - 15:00	327	370	229	271	697	500	**YES / YES**
15:00 - 16:00	435	457	320	340	892	660	**YES / YES**
16:00 - 17:00	417	519	333	412	936	745	**YES / YES**
17:00 - 18:00	395	515	292	393	910	685	**YES / YES**
18:00 - 19:00	342	277	222	242	619	464	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**4351**	**4896**	**3391**	**3665**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	13	**8**

All-way Stop Warrant: **Satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A4b

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Main St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Main St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	Main St NB	3	4351
30	Major App3:	Main St SB	3	4896
30	Minor App2:	TH19 EB	2	2488
30	Minor App4:	TH19 WB	2	2589

40 MPH OR FASTER? NO
POPULATION < 10,000? NO
VOLUME REQ. AT 70%? **NO**

CORRECTABLE CRASHES: 0
(12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	200	100	160

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL (APP.1 + APP. 3	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	174	153	105	68	327	105	NO / NO	NO / YES	NO / NO
7:00 - 8:00	364	404	272	185	768	272	**YES / YES**	NO / YES	**YES / YES**
8:00 - 9:00	259	333	186	141	592	186	NO / NO	NO / YES	NO / YES
9:00 - 10:00	244	296	151	143	540	151	NO / NO	NO / YES	NO / NO
10:00 - 11:00	305	342	163	142	647	163	YES / NO	NO / YES	NO / YES
11:00 - 12:00	319	395	180	204	714	204	**YES / YES**	NO / YES	NO / YES
12:00 - 13:00	423	454	221	297	877	297	**YES / YES**	NO / YES	**YES / YES**
13:00 - 14:00	347	381	206	198	728	206	**YES / YES**	NO / YES	**YES / YES**
14:00 - 15:00	327	370	168	190	697	190	YES / NO	NO / YES	NO / YES
15:00 - 16:00	435	457	235	239	892	239	**YES / YES**	NO / YES	**YES / YES**
16:00 - 17:00	417	519	240	306	936	306	**YES / YES**	**YES / YES**	**YES / YES**
17:00 - 18:00	395	515	206	291	910	291	**YES / YES**	**YES / YES**	**YES / YES**
18:00 - 19:00	342	277	155	185	619	185	YES / NO	NO / YES	NO / YES
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4351**	**4896**	**2488**	**2589**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	7	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	7	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	2	8	Not satisfied
1A & 1B	Combination of Warrants	6	8	Not satisfied
Warrant 2	**Four Hour Volumes**	**4**	4	**Satisfied**
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	**11**	8	Crashes Insufficient

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A4c

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Main St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Main St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019

OPERATOR: LJ

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Main St NB	3	4351
30	Major App3:	Main St SB	3	4896
30	Minor App2:	TH19 EB	2	2488
30	Minor App4:	TH19 WB	2	2589

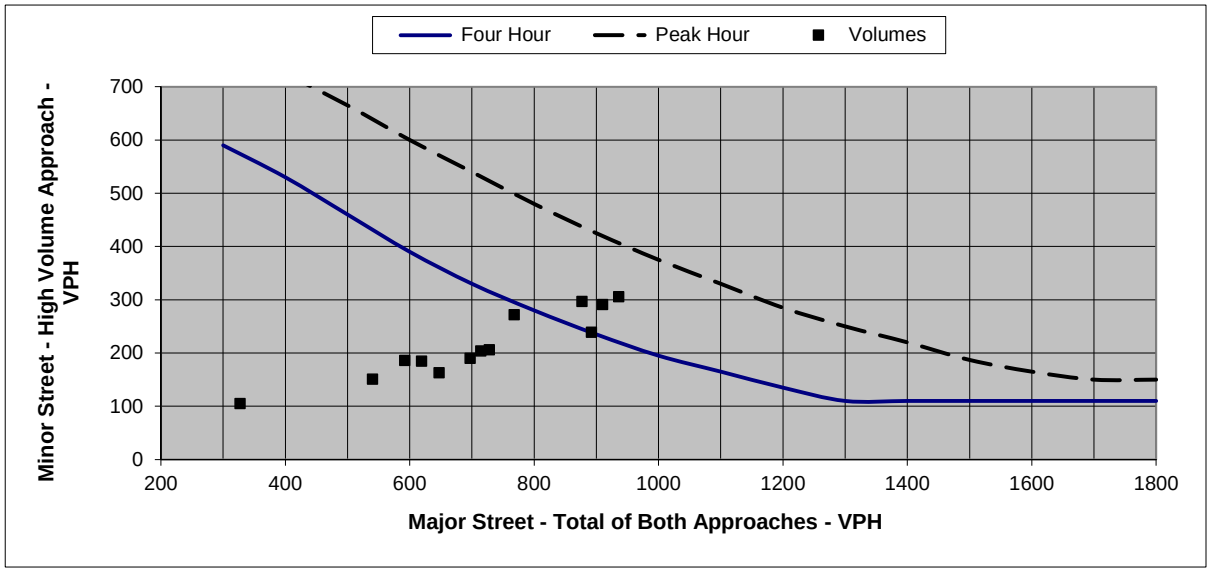

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major Approach	Minor App. Four Hour	Minor App. Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met: Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	327	105	NO	NO
7:00 - 8:00	768	272	NO	NO
8:00 - 9:00	592	186	NO	NO
9:00 - 10:00	540	151	NO	NO
10:00 - 11:00	647	163	NO	NO
11:00 - 12:00	714	204	NO	NO
12:00 - 13:00	877	297	**YES**	NO
13:00 - 14:00	728	206	NO	NO
14:00 - 15:00	697	190	NO	NO
15:00 - 16:00	892	239	**YES**	NO
16:00 - 17:00	936	306	**YES**	NO
17:00 - 18:00	910	291	**YES**	NO
18:00 - 19:00	619	185	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A4d

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Main St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH19 at Main St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Main St NB	3	4351
30	Major App3:	Main St SB	3	4896
30	Minor App2:	TH19 EB	2	2488
30	Minor App4:	TH19 WB	2	2589

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

CORRECTABLE CRASHES: 0
(12-month period)

80%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	480	720	576
Minor Approach	160	80	128

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL (APP.1 + APP. 3	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	174	153	105	68	327	105	NO / NO	NO / YES	NO / NO
7:00 - 8:00	364	404	272	185	768	272	**YES / YES**	**YES / YES**	**YES / YES**
8:00 - 9:00	259	333	186	141	592	186	**YES / YES**	NO / YES	**YES / YES**
9:00 - 10:00	244	296	151	143	540	151	YES / NO	NO / YES	NO / YES
10:00 - 11:00	305	342	163	142	647	163	**YES / YES**	NO / YES	**YES / YES**
11:00 - 12:00	319	395	180	204	714	204	**YES / YES**	NO / YES	**YES / YES**
12:00 - 13:00	423	454	221	297	877	297	**YES / YES**	**YES / YES**	**YES / YES**
13:00 - 14:00	347	381	206	198	728	206	**YES / YES**	**YES / YES**	**YES / YES**
14:00 - 15:00	327	370	168	190	697	190	**YES / YES**	NO / YES	**YES / YES**
15:00 - 16:00	435	457	235	239	892	239	**YES / YES**	**YES / YES**	**YES / YES**
16:00 - 17:00	417	519	240	306	936	306	**YES / YES**	**YES / YES**	**YES / YES**
17:00 - 18:00	395	515	206	291	910	291	**YES / YES**	**YES / YES**	**YES / YES**
18:00 - 19:00	342	277	155	185	619	185	**YES / YES**	NO / YES	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4351**	**4896**	**2488**	**2589**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	**11**	8	**Satisfied**
Warrant 1A	Minimum Vehicular Volume	**11**	8	**Satisfied**
Warrant 1B	Interruption of Continuous Flow	6	8	Not satisfied
1A & 1B	Combination of Warrants	**11**	8	**Satisfied**

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A4e

2045 Future - TH19 at Main St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Main St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description	Lanes	Approach Total
30	Major App1: Main St NB	3	4920
30	Major App3: Main St SB	3	5530
30	Minor App2: TH19 EB	3	3832
30	Minor App4: TH19 WB	3	4143

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	197	173	146	128	370	274	**YES / YES**
7:00 - 8:00	411	456	409	278	867	687	**YES / YES**
8:00 - 9:00	294	375	273	242	669	515	**YES / YES**
9:00 - 10:00	276	334	235	238	610	473	**YES / YES**
10:00 - 11:00	344	386	243	250	730	493	**YES / YES**
11:00 - 12:00	361	447	296	318	808	614	**YES / YES**
12:00 - 13:00	478	512	347	468	990	815	**YES / YES**
13:00 - 14:00	392	430	305	347	822	652	**YES / YES**
14:00 - 15:00	370	418	259	306	788	565	**YES / YES**
15:00 - 16:00	491	517	362	384	1008	746	**YES / YES**
16:00 - 17:00	472	587	376	466	1059	842	**YES / YES**
17:00 - 18:00	447	582	330	445	1029	775	**YES / YES**
18:00 - 19:00	387	313	251	273	700	524	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**4920**	**5530**	**3832**	**4143**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	13	8

All-way Stop Warrant: **Satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A4f

2045 Future - TH19 at Main St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Main St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Main St NB	3	4920
30	Major App3:	Main St SB	3	5530
30	Minor App2:	TH19 EB	2	2812
30	Minor App4:	TH19 WB	2	2928

40 MPH OR FASTER? NO
POPULATION < 10,000? NO
VOLUME REQ. AT 70%? **NO**

CORRECTABLE CRASHES: 0
(12-month period)

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	200	100	160

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL (APP.1 + APP. 3	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	197	173	118	77	370	118	NO / NO	NO / YES	NO / NO
7:00 - 8:00	411	456	307	208	867	307	**YES / YES**	NO / YES	**YES / YES**
8:00 - 9:00	294	375	211	160	669	211	**YES / YES**	NO / YES	NO / YES
9:00 - 10:00	276	334	170	162	610	170	YES / NO	NO / YES	NO / YES
10:00 - 11:00	344	386	184	161	730	184	YES / NO	NO / YES	**YES / YES**
11:00 - 12:00	361	447	204	232	808	232	**YES / YES**	NO / YES	**YES / YES**
12:00 - 13:00	478	512	251	336	990	336	**YES / YES**	**YES / YES**	**YES / YES**
13:00 - 14:00	392	430	233	224	822	233	**YES / YES**	NO / YES	**YES / YES**
14:00 - 15:00	370	418	190	215	788	215	**YES / YES**	NO / YES	**YES / YES**
15:00 - 16:00	491	517	265	269	1008	269	**YES / YES**	**YES / YES**	**YES / YES**
16:00 - 17:00	472	587	271	346	1059	346	**YES / YES**	**YES / YES**	**YES / YES**
17:00 - 18:00	447	582	233	329	1029	329	**YES / YES**	**YES / YES**	**YES / YES**
18:00 - 19:00	387	313	175	209	700	209	**YES / YES**	NO / YES	NO / YES
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4920**	**5530**	**2812**	**2928**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	**10**	8	**Satisfied**
Warrant 1A	Minimum Vehicular Volume	**10**	8	**Satisfied**
Warrant 1B	Interruption of Continuous Flow	4	8	Not satisfied
1A & 1B	Combination of Warrants	**9**	8	**Satisfied**
Warrant 2	**Four Hour Volumes**	**5**	4	**Satisfied**
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	**12**	8	Crashes Insufficient

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.
10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A4g

2045 Future - TH19 at Main St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Main St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	Main St NB	3	4920
30	Major App3:	Main St SB	3	5530
30	Minor App2:	TH19 EB	2	2812
30	Minor App4:	TH19 WB	2	2928

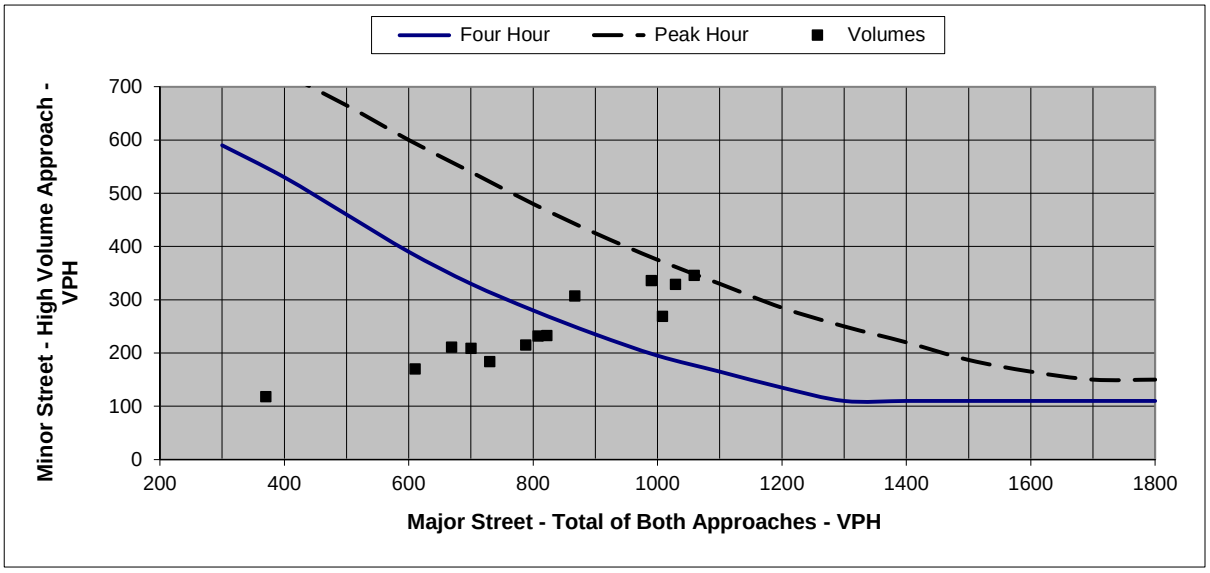

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major Approach	Minor App. Four Hour	Minor App. Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met: Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	370	118	NO	NO
7:00 - 8:00	867	307	**YES**	NO
8:00 - 9:00	669	211	NO	NO
9:00 - 10:00	610	170	NO	NO
10:00 - 11:00	730	184	NO	NO
11:00 - 12:00	808	232	NO	NO
12:00 - 13:00	990	336	**YES**	NO
13:00 - 14:00	822	233	NO	NO
14:00 - 15:00	788	215	NO	NO
15:00 - 16:00	1008	269	**YES**	NO
16:00 - 17:00	1059	346	**YES**	NO
17:00 - 18:00	1029	329	**YES**	NO
18:00 - 19:00	700	209	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A5a

2019 Existing - TH 19 at Lyon St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH 19 at Lyon St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH 19 EB	3	3584
30	Major App3:	TH 19 WB	3	3550
30	Minor App2:	Lyon St NB	2	184
30	Minor App4:	Lyon St SB	2	1103

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	136	110	3	16	246	19	NO / NO
7:00 - 8:00	359	245	11	68	604	79	YES / NO
8:00 - 9:00	268	213	8	36	481	44	YES / NO
9:00 - 10:00	216	194	12	60	410	72	YES / NO
10:00 - 11:00	231	218	12	86	449	98	YES / NO
11:00 - 12:00	307	282	18	102	589	120	YES / NO
12:00 - 13:00	359	411	18	130	770	148	YES / NO
13:00 - 14:00	273	280	14	100	553	114	YES / NO
14:00 - 15:00	245	257	18	89	502	107	YES / NO
15:00 - 16:00	328	350	17	82	678	99	YES / NO
16:00 - 17:00	340	392	16	127	732	143	YES / NO
17:00 - 18:00	282	361	21	126	643	147	YES / NO
18:00 - 19:00	240	237	16	81	477	97	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**3584**	**3550**	**184**	**1103**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	**0**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A5b

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH 19 at Lyon St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH 19 at Lyon St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH 19 EB	3	3584
30	Major App3:	TH 19 WB	3	3550
30	Minor App2:	Lyon St NB	2	116
30	Minor App4:	Lyon St SB	2	580

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	200	100	160

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	136	110	0	7	246	7	NO / NO	NO / NO	NO / NO
7:00 - 8:00	359	245	10	44	604	44	YES / NO	NO / NO	NO / NO
8:00 - 9:00	268	213	7	20	481	20	NO / NO	NO / NO	NO / NO
9:00 - 10:00	216	194	8	28	410	28	NO / NO	NO / NO	NO / NO
10:00 - 11:00	231	218	11	53	449	53	NO / NO	NO / NO	NO / NO
11:00 - 12:00	307	282	11	62	589	62	NO / NO	NO / NO	NO / NO
12:00 - 13:00	359	411	9	72	770	72	YES / NO	NO / NO	YES / NO
13:00 - 14:00	273	280	6	49	553	49	NO / NO	NO / NO	NO / NO
14:00 - 15:00	245	257	14	56	502	56	NO / NO	NO / NO	NO / NO
15:00 - 16:00	328	350	9	35	678	35	YES / NO	NO / NO	NO / NO
16:00 - 17:00	340	392	10	61	732	61	YES / NO	NO / NO	YES / NO
17:00 - 18:00	282	361	10	58	643	58	YES / NO	NO / NO	NO / NO
18:00 - 19:00	240	237	11	35	477	35	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3584**	**3550**	**116**	**580**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	0	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A5c

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH 19 at Lyon St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH 19 at Lyon St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH 19 EB	3	3584
30	Major App3:	TH 19 WB	3	3550
30	Minor App2:	Lyon St NB	2	116
30	Minor App4:	Lyon St SB	2	580

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

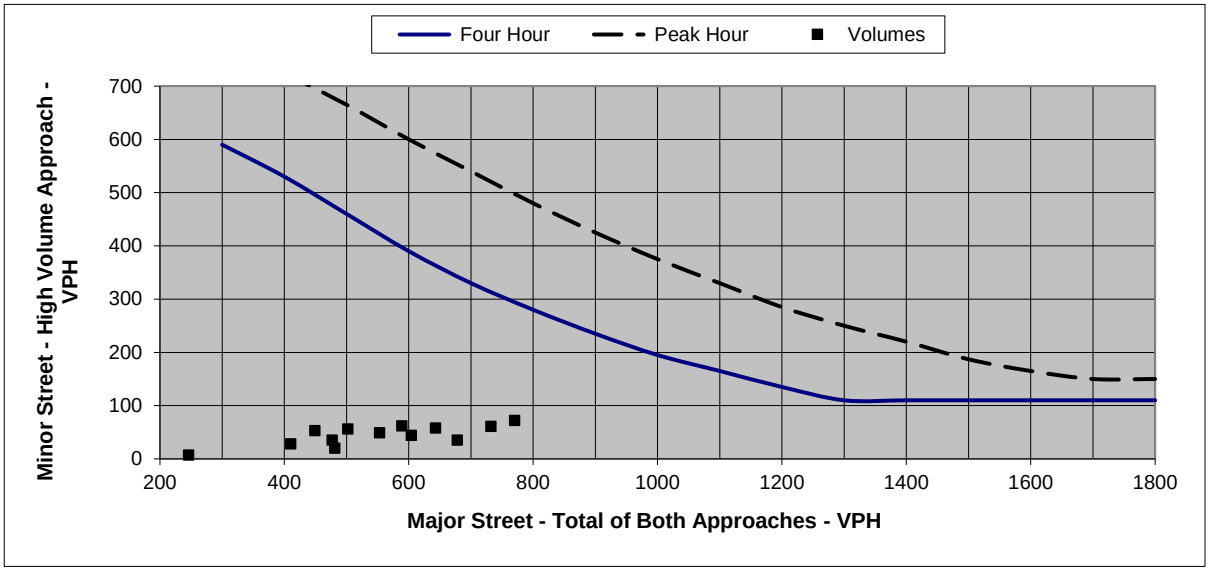

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	246	7	NO	NO
7:00 - 8:00	604	44	NO	NO
8:00 - 9:00	481	20	NO	NO
9:00 - 10:00	410	28	NO	NO
10:00 - 11:00	449	53	NO	NO
11:00 - 12:00	589	62	NO	NO
12:00 - 13:00	770	72	NO	NO
13:00 - 14:00	553	49	NO	NO
14:00 - 15:00	502	56	NO	NO
15:00 - 16:00	678	35	NO	NO
16:00 - 17:00	732	61	NO	NO
17:00 - 18:00	643	58	NO	NO
18:00 - 19:00	477	35	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A5d

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH 19 at Lyon St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH 19 at Lyon St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH 19 EB	3	3584
30	Major App3:	TH 19 WB	3	3550
30	Minor App2:	Lyon St NB	2	116
30	Minor App4:	Lyon St SB	2	580

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

80%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	480	720	576
Minor Approach	160	80	128

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	136	110	0	7	246	7	NO / NO	NO / NO	NO / NO
7:00 - 8:00	359	245	10	44	604	44	YES / NO	NO / NO	YES / NO
8:00 - 9:00	268	213	7	20	481	20	YES / NO	NO / NO	NO / NO
9:00 - 10:00	216	194	8	28	410	28	NO / NO	NO / NO	NO / NO
10:00 - 11:00	231	218	11	53	449	53	NO / NO	NO / NO	NO / NO
11:00 - 12:00	307	282	11	62	589	62	YES / NO	NO / NO	YES / NO
12:00 - 13:00	359	411	9	72	770	72	YES / NO	YES / NO	YES / NO
13:00 - 14:00	273	280	6	49	553	49	YES / NO	NO / NO	NO / NO
14:00 - 15:00	245	257	14	56	502	56	YES / NO	NO / NO	NO / NO
15:00 - 16:00	328	350	9	35	678	35	YES / NO	NO / NO	YES / NO
16:00 - 17:00	340	392	10	61	732	61	YES / NO	YES / NO	YES / NO
17:00 - 18:00	282	361	10	58	643	58	YES / NO	NO / NO	YES / NO
18:00 - 19:00	240	237	11	35	477	35	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3584**	**3550**	**116**	**580**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A5e

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH 19 at Lyon St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 60% of Full Volume Warrant Thresholds

LOCATION: TH 19 at Lyon St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH 19 EB	3	3584
30	Major App3:	TH 19 WB	3	3550
30	Minor App2:	Lyon St NB	2	116
30	Minor App4:	Lyon St SB	2	580

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

60%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	360	540	432
Minor Approach	120	60	96

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	136	110	0	7	246	7	NO / NO	NO / NO	NO / NO
7:00 - 8:00	359	245	10	44	604	44	YES / NO	YES / NO	YES / NO
8:00 - 9:00	268	213	7	20	481	20	YES / NO	NO / NO	YES / NO
9:00 - 10:00	216	194	8	28	410	28	YES / NO	NO / NO	NO / NO
10:00 - 11:00	231	218	11	53	449	53	YES / NO	NO / NO	YES / NO
11:00 - 12:00	307	282	11	62	589	62	YES / NO	**YES / YES**	YES / NO
12:00 - 13:00	359	411	9	72	770	72	YES / NO	**YES / YES**	YES / NO
13:00 - 14:00	273	280	6	49	553	49	YES / NO	YES / NO	YES / NO
14:00 - 15:00	245	257	14	56	502	56	YES / NO	NO / NO	YES / NO
15:00 - 16:00	328	350	9	35	678	35	YES / NO	YES / NO	YES / NO
16:00 - 17:00	340	392	10	61	732	61	YES / NO	**YES / YES**	YES / NO
17:00 - 18:00	282	361	10	58	643	58	YES / NO	YES / NO	YES / NO
18:00 - 19:00	240	237	11	35	477	35	YES / NO	NO / NO	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3584**	**3550**	**116**	**580**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	3	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	3	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A5f

2045 Future - TH 19 at Lyon St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH 19 at Lyon St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description	Lanes	Approach Total
30	Major App1: TH 19 EB	3	4053
30	Major App3: TH 19 WB	3	4014
30	Minor App2: Lyon St NB	2	208
30	Minor App4: Lyon St SB	2	1248

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	154	124	3	18	278	21	NO / NO
7:00 - 8:00	406	276	13	77	682	90	YES / NO
8:00 - 9:00	303	241	8	42	544	50	YES / NO
9:00 - 10:00	244	220	14	69	464	83	YES / NO
10:00 - 11:00	261	247	13	98	508	111	YES / NO
11:00 - 12:00	347	319	20	116	666	136	YES / NO
12:00 - 13:00	406	465	21	147	871	168	YES / NO
13:00 - 14:00	309	316	16	113	625	129	YES / NO
14:00 - 15:00	277	291	21	100	568	121	YES / NO
15:00 - 16:00	371	396	19	92	767	111	YES / NO
16:00 - 17:00	384	443	18	143	827	161	YES / NO
17:00 - 18:00	319	408	24	142	727	166	YES / NO
18:00 - 19:00	272	268	18	91	540	109	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**4053**	**4014**	**208**	**1248**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	**0**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A5g

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH 19 at Lyon St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH 19 at Lyon St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	TH 19 EB	3	4053
30	Major App3:	TH 19 WB	3	4014
30	Minor App2:	Lyon St NB	2	128
30	Minor App4:	Lyon St SB	2	653

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	200	100	160

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	154	124	0	7	278	7	NO / NO	NO / NO	NO / NO
7:00 - 8:00	406	276	11	50	682	50	YES / NO	NO / NO	NO / NO
8:00 - 9:00	303	241	7	23	544	23	NO / NO	NO / NO	NO / NO
9:00 - 10:00	244	220	9	32	464	32	NO / NO	NO / NO	NO / NO
10:00 - 11:00	261	247	12	59	508	59	NO / NO	NO / NO	NO / NO
11:00 - 12:00	347	319	13	71	666	71	YES / NO	NO / NO	NO / NO
12:00 - 13:00	406	465	9	81	871	81	YES / NO	NO / NO	YES / NO
13:00 - 14:00	309	316	6	55	625	55	YES / NO	NO / NO	NO / NO
14:00 - 15:00	277	291	16	63	568	63	NO / NO	NO / NO	NO / NO
15:00 - 16:00	371	396	10	39	767	39	YES / NO	NO / NO	YES / NO
16:00 - 17:00	384	443	11	69	827	69	YES / NO	NO / NO	YES / NO
17:00 - 18:00	319	408	11	65	727	65	YES / NO	NO / NO	YES / NO
18:00 - 19:00	272	268	13	39	540	39	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4053**	**4014**	**128**	**653**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	1	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.
10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A5g

2045 Future - TH 19 at Lyon St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH 19 at Lyon St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	TH 19 EB	3	4053
30	Major App3:	TH 19 WB	3	4014
30	Minor App2:	Lyon St NB	2	128
30	Minor App4:	Lyon St SB	2	653

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

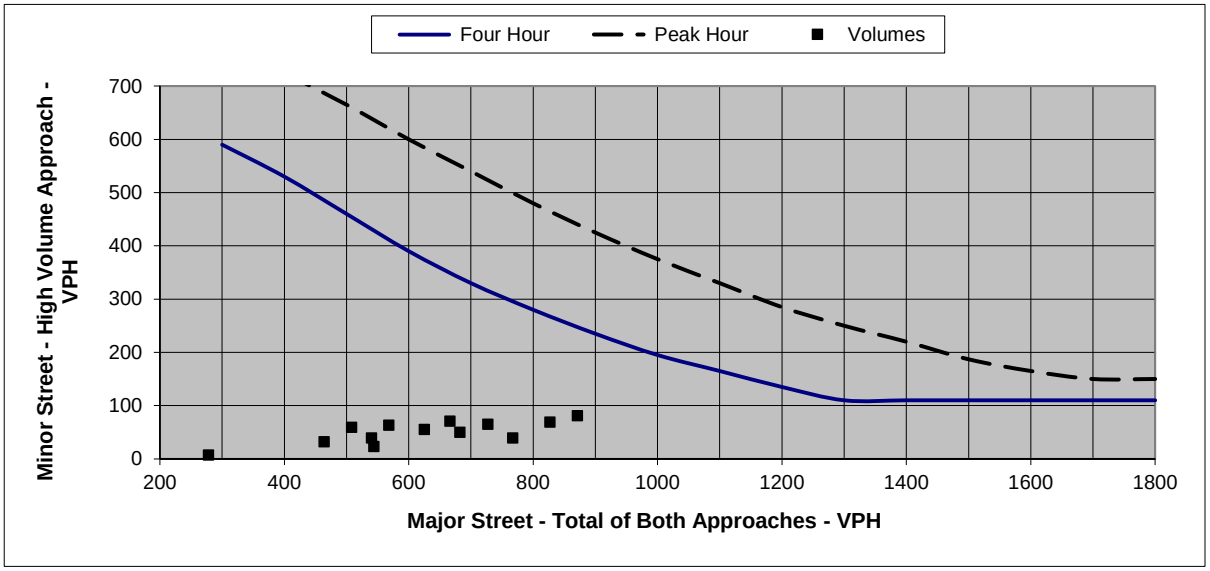

Figure 1. Four Hour and Peak Hour Warrant Analysis
Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	278	7	NO	NO
7:00 - 8:00	682	50	NO	NO
8:00 - 9:00	544	23	NO	NO
9:00 - 10:00	464	32	NO	NO
10:00 - 11:00	508	59	NO	NO
11:00 - 12:00	666	71	NO	NO
12:00 - 13:00	871	81	NO	NO
13:00 - 14:00	625	55	NO	NO
14:00 - 15:00	568	63	NO	NO
15:00 - 16:00	767	39	NO	NO
16:00 - 17:00	827	69	NO	NO
17:00 - 18:00	727	65	NO	NO
18:00 - 19:00	540	39	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A5i

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH 19 at Lyon St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH 19 at Lyon St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH 19 EB	3	4053
30	Major App3:	TH 19 WB	3	4014
30	Minor App2:	Lyon St NB	2	128
30	Minor App4:	Lyon St SB	2	653

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	80%		
	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	480	720	576
Minor Approach	160	80	128

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	154	124	0	7	278	7	NO / NO	NO / NO	NO / NO
7:00 - 8:00	406	276	11	50	682	50	YES / NO	NO / NO	YES / NO
8:00 - 9:00	303	241	7	23	544	23	YES / NO	NO / NO	NO / NO
9:00 - 10:00	244	220	9	32	464	32	NO / NO	NO / NO	NO / NO
10:00 - 11:00	261	247	12	59	508	59	YES / NO	NO / NO	NO / NO
11:00 - 12:00	347	319	13	71	666	71	YES / NO	NO / NO	YES / NO
12:00 - 13:00	406	465	9	81	871	81	YES / NO	**YES / YES**	YES / NO
13:00 - 14:00	309	316	6	55	625	55	YES / NO	NO / NO	YES / NO
14:00 - 15:00	277	291	16	63	568	63	YES / NO	NO / NO	NO / NO
15:00 - 16:00	371	396	10	39	767	39	YES / NO	YES / NO	YES / NO
16:00 - 17:00	384	443	11	69	827	69	YES / NO	YES / NO	YES / NO
17:00 - 18:00	319	408	11	65	727	65	YES / NO	YES / NO	YES / NO
18:00 - 19:00	272	268	13	39	540	39	YES / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4053**	**4014**	**128**	**653**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	1	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	1	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A5j

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH 19 at Lyon St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 60% of Full Volume Warrant Thresholds

LOCATION: TH 19 at Lyon St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH 19 EB	3	4053
30	Major App3:	TH 19 WB	3	4014
30	Minor App2:	Lyon St NB	2	128
30	Minor App4:	Lyon St SB	2	653

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

60%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	360	540	432
Minor Approach	120	60	96

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	154	124	0	7	278	7	NO / NO	NO / NO	NO / NO
7:00 - 8:00	406	276	11	50	682	50	YES / NO	YES / NO	YES / NO
8:00 - 9:00	303	241	7	23	544	23	YES / NO	YES / NO	YES / NO
9:00 - 10:00	244	220	9	32	464	32	YES / NO	NO / NO	YES / NO
10:00 - 11:00	261	247	12	59	508	59	YES / NO	NO / NO	YES / NO
11:00 - 12:00	347	319	13	71	666	71	YES / NO	**YES / YES**	YES / NO
12:00 - 13:00	406	465	9	81	871	81	YES / NO	**YES / YES**	YES / NO
13:00 - 14:00	309	316	6	55	625	55	YES / NO	YES / NO	YES / NO
14:00 - 15:00	277	291	16	63	568	63	YES / NO	**YES / YES**	YES / NO
15:00 - 16:00	371	396	10	39	767	39	YES / NO	YES / NO	YES / NO
16:00 - 17:00	384	443	11	69	827	69	YES / NO	**YES / YES**	YES / NO
17:00 - 18:00	319	408	11	65	727	65	YES / NO	**YES / YES**	YES / NO
18:00 - 19:00	272	268	13	39	540	39	YES / NO	YES / NO	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4053**	**4014**	**128**	**653**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	5	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	5	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A6a

2019 Existing - TH19 at Marshall St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Marshall St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH19 EB	3	3752
30	Major App3:	TH19 WB	3	3567
30	Minor App2:	Marshall St NB	1	198
30	Minor App4:	Marshall St SB	1	367

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	132	112	10	11	244	21	NO / NO
7:00 - 8:00	373	249	10	21	622	31	YES / NO
8:00 - 9:00	261	215	8	26	476	34	YES / NO
9:00 - 10:00	218	202	5	16	420	21	YES / NO
10:00 - 11:00	247	224	10	16	471	26	YES / NO
11:00 - 12:00	331	287	11	26	618	37	YES / NO
12:00 - 13:00	399	413	19	31	812	50	YES / NO
13:00 - 14:00	284	284	27	32	568	59	YES / NO
14:00 - 15:00	278	270	20	32	548	52	YES / NO
15:00 - 16:00	331	370	21	40	701	61	YES / NO
16:00 - 17:00	349	364	29	48	713	77	YES / NO
17:00 - 18:00	316	353	20	45	669	65	YES / NO
18:00 - 19:00	233	224	8	23	457	31	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**3752**	**3567**	**198**	**367**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	**0**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A6b

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Marshall St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Marshall St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3752
30	Major App3:	TH19 WB	3	3567
30	Minor App2:	Marshall St NB	1	69
30	Minor App4:	Marshall St SB	1	196

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	150	75	120

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	132	112	5	5	244	5	NO / NO	NO / NO	NO / NO
7:00 - 8:00	373	249	4	9	622	9	YES / NO	NO / NO	NO / NO
8:00 - 9:00	261	215	3	13	476	13	NO / NO	NO / NO	NO / NO
9:00 - 10:00	218	202	2	10	420	10	NO / NO	NO / NO	NO / NO
10:00 - 11:00	247	224	3	8	471	8	NO / NO	NO / NO	NO / NO
11:00 - 12:00	331	287	1	16	618	16	YES / NO	NO / NO	NO / NO
12:00 - 13:00	399	413	6	17	812	17	YES / NO	NO / NO	YES / NO
13:00 - 14:00	284	284	9	21	568	21	NO / NO	NO / NO	NO / NO
14:00 - 15:00	278	270	7	18	548	18	NO / NO	NO / NO	NO / NO
15:00 - 16:00	331	370	7	27	701	27	YES / NO	NO / NO	NO / NO
16:00 - 17:00	349	364	9	18	713	18	YES / NO	NO / NO	NO / NO
17:00 - 18:00	316	353	10	20	669	20	YES / NO	NO / NO	NO / NO
18:00 - 19:00	233	224	3	14	457	14	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3752**	**3567**	**69**	**196**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	0	8	Not satisfied

COMMENTS:

S:\KO\M\Mnt08\151024\8-planning\Traffic\Warrant Analysis\2019\[2019_TH19 at Marshall St_Warrant analysis.xlsx]AllWayStop

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A6c

2019 Existing - TH19 at Marshall St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Marshall St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019

OPERATOR: LJ

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	3752
30	Major App3:	TH19 WB	3	3567
30	Minor App2:	Marshall St NB	1	69
30	Minor App4:	Marshall St SB	1	196

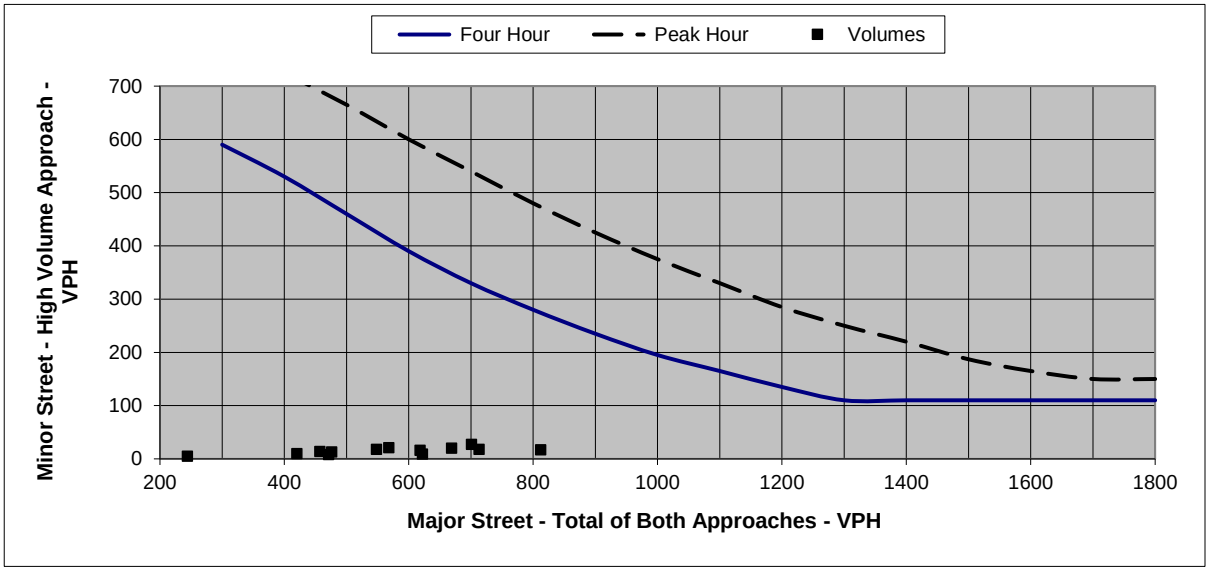

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	244	5	NO	NO
7:00 - 8:00	622	9	NO	NO
8:00 - 9:00	476	13	NO	NO
9:00 - 10:00	420	10	NO	NO
10:00 - 11:00	471	8	NO	NO
11:00 - 12:00	618	16	NO	NO
12:00 - 13:00	812	17	NO	NO
13:00 - 14:00	568	21	NO	NO
14:00 - 15:00	548	18	NO	NO
15:00 - 16:00	701	27	NO	NO
16:00 - 17:00	713	18	NO	NO
17:00 - 18:00	669	20	NO	NO
18:00 - 19:00	457	14	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

S:\KO\M\Mnt08\151024\8-planning\Traffic\Warrant Analysis\2019\[2019_TH19 at Marshall St_Warrant analysis.xlsx]AllWayStop

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibt A6d

2045 Future - TH19 at Marshall St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Marshall St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH19 EB	3	4239
30	Major App3:	TH19 WB	3	4031
30	Minor App2:	Marshall St NB	1	224
30	Minor App4:	Marshall St SB	1	412

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	149	127	10	11	276	21	NO / NO
7:00 - 8:00	422	281	11	24	703	35	YES / NO
8:00 - 9:00	295	243	8	30	538	38	YES / NO
9:00 - 10:00	247	228	6	19	475	25	YES / NO
10:00 - 11:00	278	253	11	18	531	29	YES / NO
11:00 - 12:00	374	324	12	29	698	41	YES / NO
12:00 - 13:00	451	467	23	35	918	58	YES / NO
13:00 - 14:00	321	321	31	36	642	67	YES / NO
14:00 - 15:00	314	305	23	36	619	59	YES / NO
15:00 - 16:00	374	419	24	45	793	69	YES / NO
16:00 - 17:00	394	410	33	53	804	86	YES / NO
17:00 - 18:00	357	400	23	51	757	74	YES / NO
18:00 - 19:00	263	253	9	25	516	34	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**4239**	**4031**	**224**	**412**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	**0**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A6e

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Marshall St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Marshall St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	TH19 EB	3	4239
30	Major App3:	TH19 WB	3	4031
30	Minor App2:	Marshall St NB	1	72
30	Minor App4:	Marshall St SB	1	224

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	150	75	120

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	149	127	5	5	276	5	NO / NO	NO / NO	NO / NO
7:00 - 8:00	422	281	4	10	703	10	YES / NO	NO / NO	NO / NO
8:00 - 9:00	295	243	3	15	538	15	NO / NO	NO / NO	NO / NO
9:00 - 10:00	247	228	2	11	475	11	NO / NO	NO / NO	NO / NO
10:00 - 11:00	278	253	3	9	531	9	NO / NO	NO / NO	NO / NO
11:00 - 12:00	374	324	1	19	698	19	YES / NO	NO / NO	NO / NO
12:00 - 13:00	451	467	6	20	918	20	YES / NO	YES / NO	YES / NO
13:00 - 14:00	321	321	10	25	642	25	YES / NO	NO / NO	NO / NO
14:00 - 15:00	314	305	8	20	619	20	YES / NO	NO / NO	NO / NO
15:00 - 16:00	374	419	7	31	793	31	YES / NO	NO / NO	YES / NO
16:00 - 17:00	394	410	9	21	804	21	YES / NO	NO / NO	YES / NO
17:00 - 18:00	357	400	11	22	757	22	YES / NO	NO / NO	YES / NO
18:00 - 19:00	263	253	3	16	516	16	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4239**	**4031**	**72**	**224**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	0	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.
10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A6f

2045 Future - TH19 at Marshall St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Marshall St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	TH19 EB	3	4239
30	Major App3:	TH19 WB	3	4031
30	Minor App2:	Marshall St NB	1	72
30	Minor App4:	Marshall St SB	1	224

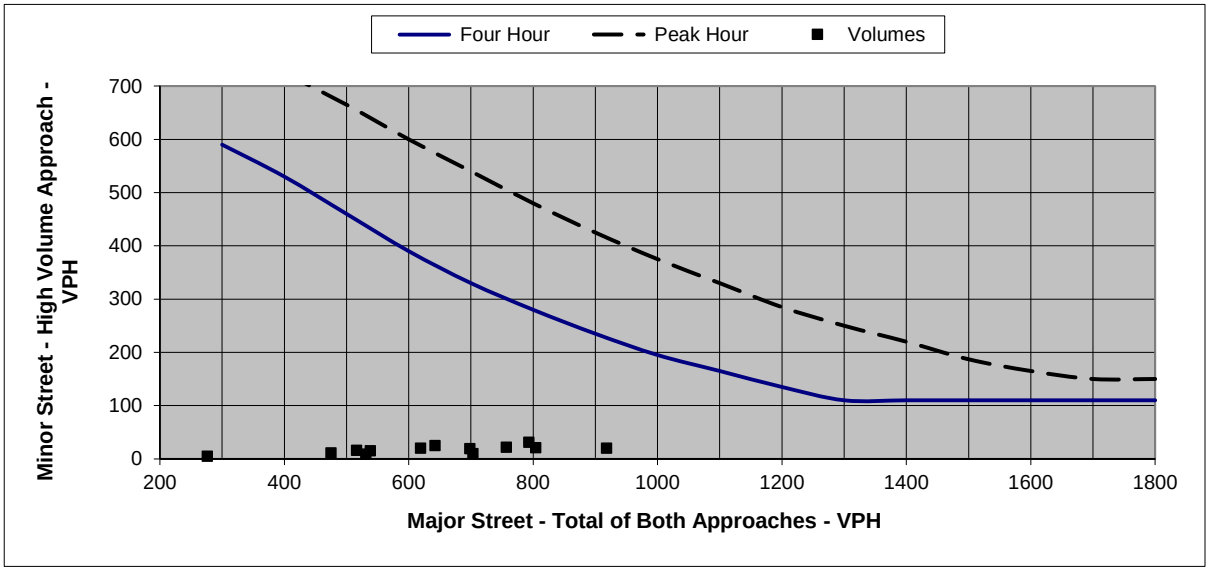

Figure 1. Four Hour and Peak Hour Warrant Analysis
Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	276	5	NO	NO
7:00 - 8:00	703	10	NO	NO
8:00 - 9:00	538	15	NO	NO
9:00 - 10:00	475	11	NO	NO
10:00 - 11:00	531	9	NO	NO
11:00 - 12:00	698	19	NO	NO
12:00 - 13:00	918	20	NO	NO
13:00 - 14:00	642	25	NO	NO
14:00 - 15:00	619	20	NO	NO
15:00 - 16:00	793	31	NO	NO
16:00 - 17:00	804	21	NO	NO
17:00 - 18:00	757	22	NO	NO
18:00 - 19:00	516	16	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

S:\KO\M\Mnt08\151024\8-planning\Traffic\Warrant Analysis\2045\[2045_TH19 at Marshall St_Warrant analysis.xlsx]SignalWarrant

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A7a

2019 Existing - TH19 at 3rd St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at 3rd St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH19 EB	2	3726
30	Major App3:	TH19 WB	2	4405
30	Minor App2:	N/A	2	0
30	Minor App4:	3rd St SB	0	568

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	134	146	0	19	280	19	NO / NO
7:00 - 8:00	381	308	0	60	689	60	YES / NO
8:00 - 9:00	258	248	0	36	506	36	YES / NO
9:00 - 10:00	217	246	0	35	463	35	YES / NO
10:00 - 11:00	240	267	0	44	507	44	YES / NO
11:00 - 12:00	348	382	0	40	730	40	YES / NO
12:00 - 13:00	384	512	0	59	896	59	YES / NO
13:00 - 14:00	288	368	0	54	656	54	YES / NO
14:00 - 15:00	285	343	0	45	628	45	YES / NO
15:00 - 16:00	321	475	0	45	796	45	YES / NO
16:00 - 17:00	340	427	0	54	767	54	YES / NO
17:00 - 18:00	311	410	0	41	721	41	YES / NO
18:00 - 19:00	219	273	0	36	492	36	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**3726**	**4405**	**0**	**568**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	**0**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A7b

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at 3rd St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at 3rd St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	2	3726
30	Major App3:	TH19 WB	2	4405
30	Minor App2:	N/A	2	0
30	Minor App4:	3rd St SB	0	508

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	200	100	160

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	134	146	0	17	280	17	NO / NO	NO / NO	NO / NO
7:00 - 8:00	381	308	0	51	689	51	YES / NO	NO / NO	NO / NO
8:00 - 9:00	258	248	0	31	506	31	NO / NO	NO / NO	NO / NO
9:00 - 10:00	217	246	0	29	463	29	NO / NO	NO / NO	NO / NO
10:00 - 11:00	240	267	0	39	507	39	NO / NO	NO / NO	NO / NO
11:00 - 12:00	348	382	0	35	730	35	YES / NO	NO / NO	YES / NO
12:00 - 13:00	384	512	0	53	896	53	YES / NO	NO / NO	YES / NO
13:00 - 14:00	288	368	0	52	656	52	YES / NO	NO / NO	NO / NO
14:00 - 15:00	285	343	0	44	628	44	YES / NO	NO / NO	NO / NO
15:00 - 16:00	321	475	0	41	796	41	YES / NO	NO / NO	YES / NO
16:00 - 17:00	340	427	0	47	767	47	YES / NO	NO / NO	YES / NO
17:00 - 18:00	311	410	0	35	721	35	YES / NO	NO / NO	YES / NO
18:00 - 19:00	219	273	0	34	492	34	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**3726**	**4405**	**0**	**508**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	0	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A7c

2019 Existing - TH19 at 3rd St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at 3rd St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	2	3726
30	Major App3:	TH19 WB	2	4405
30	Minor App2:	N/A	2	0
30	Minor App4:	3rd St SB	0	508

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

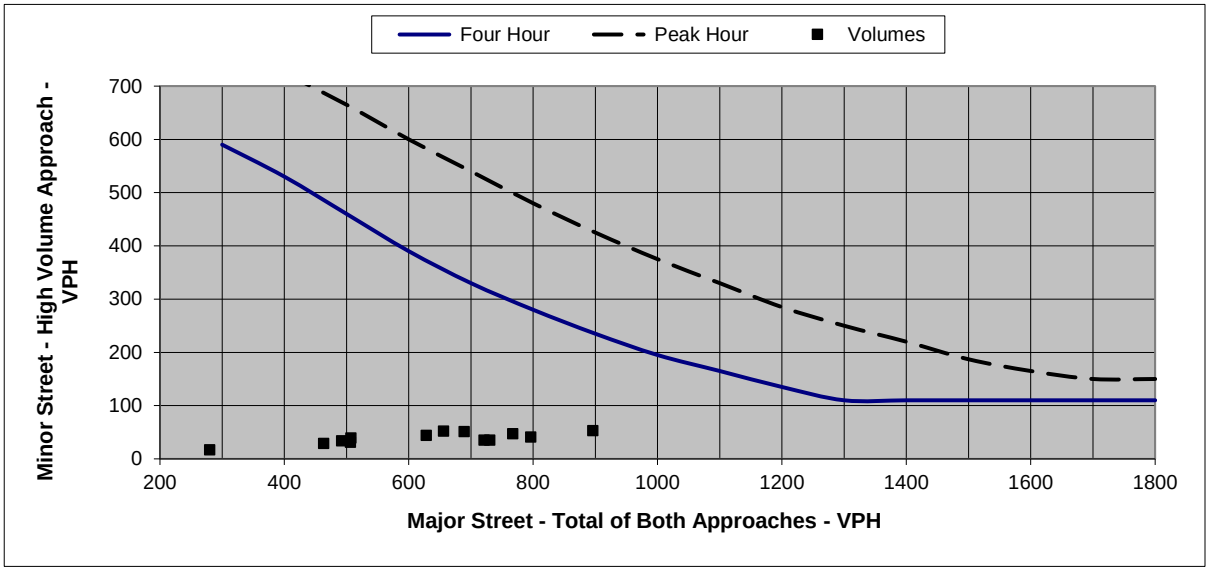

Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	280	17	NO	NO
7:00 - 8:00	689	51	NO	NO
8:00 - 9:00	506	31	NO	NO
9:00 - 10:00	463	29	NO	NO
10:00 - 11:00	507	39	NO	NO
11:00 - 12:00	730	35	NO	NO
12:00 - 13:00	896	53	NO	NO
13:00 - 14:00	656	52	NO	NO
14:00 - 15:00	628	44	NO	NO
15:00 - 16:00	796	41	NO	NO
16:00 - 17:00	767	47	NO	NO
17:00 - 18:00	721	35	NO	NO
18:00 - 19:00	492	34	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

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SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A7d

2045 Future - TH19 at 3rd St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at 3rd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH19 EB	2	4210
30	Major App3:	TH19 WB	2	4977
30	Minor App2:	N/A	2	0
30	Minor App4:	3rd St SB	0	641

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	152	166	0	22	318	22	YES / NO
7:00 - 8:00	430	348	0	68	778	68	YES / NO
8:00 - 9:00	292	280	0	40	572	40	YES / NO
9:00 - 10:00	246	279	0	40	525	40	YES / NO
10:00 - 11:00	272	301	0	49	573	49	YES / NO
11:00 - 12:00	393	431	0	46	824	46	YES / NO
12:00 - 13:00	434	578	0	66	1012	66	YES / NO
13:00 - 14:00	325	415	0	61	740	61	YES / NO
14:00 - 15:00	322	387	0	50	709	50	YES / NO
15:00 - 16:00	361	537	0	50	898	50	YES / NO
16:00 - 17:00	385	483	0	61	868	61	YES / NO
17:00 - 18:00	351	464	0	46	815	46	YES / NO
18:00 - 19:00	247	308	0	42	555	42	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**4210**	**4977**	**0**	**641**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	**0**	**8**

All-way Stop Warrant: **Not satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A7e

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at 3rd St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at 3rd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach
30	Major App1:	TH19 EB	2	4210
30	Major App3:	TH19 WB	2	4977
30	Minor App2:	N/A	2	0
30	Minor App4:	3rd St SB	0	575

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	200	100	160

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	152	166	0	20	318	20	NO / NO	NO / NO	NO / NO
7:00 - 8:00	430	348	0	59	778	59	YES / NO	NO / NO	YES / NO
8:00 - 9:00	292	280	0	35	572	35	NO / NO	NO / NO	NO / NO
9:00 - 10:00	246	279	0	33	525	33	NO / NO	NO / NO	NO / NO
10:00 - 11:00	272	301	0	43	573	43	NO / NO	NO / NO	NO / NO
11:00 - 12:00	393	431	0	39	824	39	YES / NO	NO / NO	YES / NO
12:00 - 13:00	434	578	0	60	1012	60	YES / NO	YES / NO	YES / NO
13:00 - 14:00	325	415	0	59	740	59	YES / NO	NO / NO	YES / NO
14:00 - 15:00	322	387	0	49	709	49	YES / NO	NO / NO	NO / NO
15:00 - 16:00	361	537	0	46	898	46	YES / NO	NO / NO	YES / NO
16:00 - 17:00	385	483	0	53	868	53	YES / NO	NO / NO	YES / NO
17:00 - 18:00	351	464	0	40	815	40	YES / NO	NO / NO	YES / NO
18:00 - 19:00	247	308	0	39	555	39	NO / NO	NO / NO	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4210**	**4977**	**0**	**575**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	0	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	0	8	Not satisfied
1A & 1B	Combination of Warrants	0	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	0	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A7f

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at 3rd St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at 3rd St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	2	4210
30	Major App3:	TH19 WB	2	4977
30	Minor App2:	N/A	2	0
30	Minor App4:	3rd St SB	0	575

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

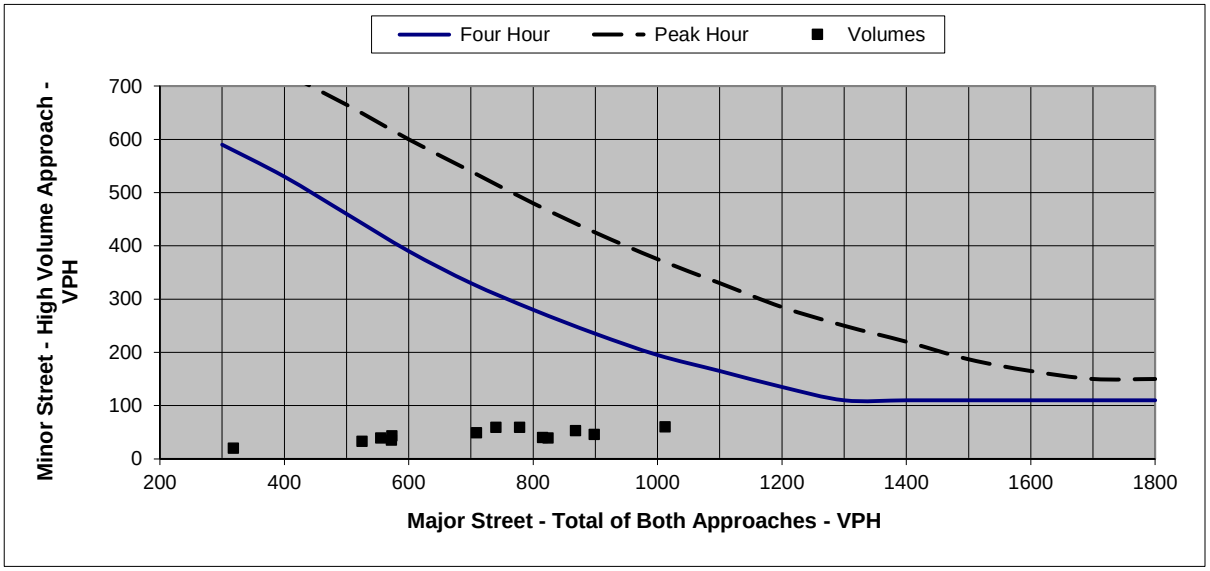


Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	318	20	NO	NO
7:00 - 8:00	778	59	NO	NO
8:00 - 9:00	572	35	NO	NO
9:00 - 10:00	525	33	NO	NO
10:00 - 11:00	573	43	NO	NO
11:00 - 12:00	824	39	NO	NO
12:00 - 13:00	1012	60	NO	NO
13:00 - 14:00	740	59	NO	NO
14:00 - 15:00	709	49	NO	NO
15:00 - 16:00	898	46	NO	NO
16:00 - 17:00	868	53	NO	NO
17:00 - 18:00	815	40	NO	NO
18:00 - 19:00	555	39	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

S:\KO\M\Mnt08\151024\8-planning\Traffic\Warrant Analysis\2045\[2045_TH19 at 3rd St_Warrant analysis.xlsx]Warrant Volume Data

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A8a

2019 Existing - TH19 at Bruce St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Bruce St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH19 EB	3	4323
30	Major App3:	TH19 WB	3	4983
30	Minor App2:	Bruce St NB	2	2371
30	Minor App4:	Bruce ST SB	2	1984

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement	
300	**200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	140	141	61	71	281	132	NO / NO
7:00 - 8:00	446	346	206	180	792	386	**YES / YES**
8:00 - 9:00	313	278	136	117	591	253	**YES / YES**
9:00 - 10:00	275	278	136	99	553	235	**YES / YES**
10:00 - 11:00	280	341	162	99	621	261	**YES / YES**
11:00 - 12:00	392	426	231	165	818	396	**YES / YES**
12:00 - 13:00	452	561	205	228	1013	433	**YES / YES**
13:00 - 14:00	338	398	199	165	736	364	**YES / YES**
14:00 - 15:00	322	372	193	148	694	341	**YES / YES**
15:00 - 16:00	381	528	231	181	909	412	**YES / YES**
16:00 - 17:00	385	467	197	172	852	369	**YES / YES**
17:00 - 18:00	344	490	245	220	834	465	**YES / YES**
18:00 - 19:00	255	357	169	139	612	308	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**4323**	**4983**	**2371**	**1984**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	12	**8**

All-way Stop Warrant: **Satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A8b

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Bruce St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Bruce St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	4323
30	Major App3:	TH19 WB	3	4983
30	Minor App2:	Bruce St NB	2	1215
30	Minor App4:	Bruce ST SB	2	1512

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	200	100	160

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	140	141	39	60	281	60	NO / NO	NO / NO	NO / NO
7:00 - 8:00	446	346	98	146	792	146	YES / NO	NO / YES	YES / NO
8:00 - 9:00	313	278	70	85	591	85	NO / NO	NO / NO	NO / NO
9:00 - 10:00	275	278	67	79	553	79	NO / NO	NO / NO	NO / NO
10:00 - 11:00	280	341	73	74	621	74	YES / NO	NO / NO	NO / NO
11:00 - 12:00	392	426	107	133	818	133	YES / NO	NO / YES	YES / NO
12:00 - 13:00	452	561	88	166	1013	166	YES / NO	**YES / YES**	**YES / YES**
13:00 - 14:00	338	398	114	120	736	120	YES / NO	NO / YES	YES / NO
14:00 - 15:00	322	372	107	109	694	109	YES / NO	NO / YES	NO / NO
15:00 - 16:00	381	528	133	137	909	137	YES / NO	**YES / YES**	YES / NO
16:00 - 17:00	385	467	104	134	852	134	YES / NO	NO / YES	YES / NO
17:00 - 18:00	344	490	128	167	834	167	YES / NO	NO / YES	**YES / YES**
18:00 - 19:00	255	357	87	102	612	102	YES / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4323**	**4983**	**1215**	**1512**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	2	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	2	8	Not satisfied
1A & 1B	Combination of Warrants	2	8	Not satisfied
Warrant 2	**Four Hour Volumes**	0	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	7	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A8c

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Bruce St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Bruce St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	4323
30	Major App3:	TH19 WB	3	4983
30	Minor App2:	Bruce St NB	2	1215
30	Minor App4:	Bruce ST SB	2	1512

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

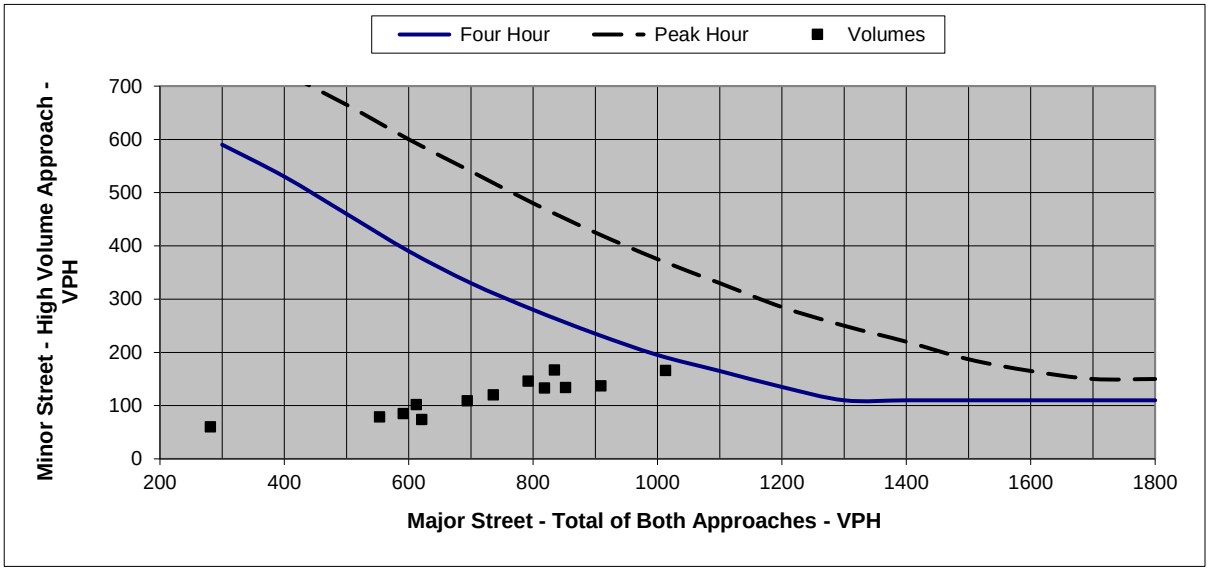


Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	281	60	NO	NO
7:00 - 8:00	792	146	NO	NO
8:00 - 9:00	591	85	NO	NO
9:00 - 10:00	553	79	NO	NO
10:00 - 11:00	621	74	NO	NO
11:00 - 12:00	818	133	NO	NO
12:00 - 13:00	1013	166	NO	NO
13:00 - 14:00	736	120	NO	NO
14:00 - 15:00	694	109	NO	NO
15:00 - 16:00	909	137	NO	NO
16:00 - 17:00	852	134	NO	NO
17:00 - 18:00	834	167	NO	NO
18:00 - 19:00	612	102	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A8d

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Bruce St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH19 at Bruce St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	4323
30	Major App3:	TH19 WB	3	4983
30	Minor App2:	Bruce St NB	2	1215
30	Minor App4:	Bruce ST SB	2	1512

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

80%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	480	720	576
Minor Approach	160	80	128

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	140	141	39	60	281	60	NO / NO	NO / NO	NO / NO
7:00 - 8:00	446	346	98	146	792	146	YES / NO	**YES / YES**	**YES / YES**
8:00 - 9:00	313	278	70	85	591	85	YES / NO	NO / YES	YES / NO
9:00 - 10:00	275	278	67	79	553	79	YES / NO	NO / NO	NO / NO
10:00 - 11:00	280	341	73	74	621	74	YES / NO	NO / NO	YES / NO
11:00 - 12:00	392	426	107	133	818	133	YES / NO	**YES / YES**	**YES / YES**
12:00 - 13:00	452	561	88	166	1013	166	**YES / YES**	**YES / YES**	**YES / YES**
13:00 - 14:00	338	398	114	120	736	120	YES / NO	**YES / YES**	YES / NO
14:00 - 15:00	322	372	107	109	694	109	YES / NO	NO / YES	YES / NO
15:00 - 16:00	381	528	133	137	909	137	YES / NO	**YES / YES**	**YES / YES**
16:00 - 17:00	385	467	104	134	852	134	YES / NO	**YES / YES**	**YES / YES**
17:00 - 18:00	344	490	128	167	834	167	**YES / YES**	**YES / YES**	**YES / YES**
18:00 - 19:00	255	357	87	102	612	102	YES / NO	NO / YES	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4323**	**4983**	**1215**	**1512**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	7	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	2	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	7	8	Not satisfied
1A & 1B	Combination of Warrants	6	8	Not satisfied

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A8e

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2019 Existing - TH19 at Bruce St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 60% of Full Volume Warrant Thresholds

LOCATION: TH19 at Bruce St
COUNTY: Lyon
REF. POINT: 0
DATE: 9/18/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	4323
30	Major App3:	TH19 WB	3	4983
30	Minor App2:	Bruce St NB	2	1215
30	Minor App4:	Bruce ST SB	2	1512

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

60%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	360	540	432
Minor Approach	120	60	96

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	140	141	39	60	281	60	NO / NO	NO / YES	NO / NO
7:00 - 8:00	446	346	98	146	792	146	**YES / YES**	**YES / YES**	**YES / YES**
8:00 - 9:00	313	278	70	85	591	85	YES / NO	**YES / YES**	YES / NO
9:00 - 10:00	275	278	67	79	553	79	YES / NO	**YES / YES**	YES / NO
10:00 - 11:00	280	341	73	74	621	74	YES / NO	**YES / YES**	YES / NO
11:00 - 12:00	392	426	107	133	818	133	**YES / YES**	**YES / YES**	**YES / YES**
12:00 - 13:00	452	561	88	166	1013	166	**YES / YES**	**YES / YES**	**YES / YES**
13:00 - 14:00	338	398	114	120	736	120	**YES / YES**	**YES / YES**	**YES / YES**
14:00 - 15:00	322	372	107	109	694	109	YES / NO	**YES / YES**	**YES / YES**
15:00 - 16:00	381	528	133	137	909	137	**YES / YES**	**YES / YES**	**YES / YES**
16:00 - 17:00	385	467	104	134	852	134	**YES / YES**	**YES / YES**	**YES / YES**
17:00 - 18:00	344	490	128	167	834	167	**YES / YES**	**YES / YES**	**YES / YES**
18:00 - 19:00	255	357	87	102	612	102	YES / NO	**YES / YES**	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4323**	**4983**	**1215**	**1512**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	**12**	8	**Satisfied**
Warrant 1A	Minimum Vehicular Volume	7	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	**12**	8	**Satisfied**
1A & 1B	Combination of Warrants	**9**	8	**Satisfied**

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

Exhibit A8f

2045 Future - TH19 at Bruce St
ALL WAY STOP
WARRANT ANALYSIS

LOCATION: TH19 at Bruce St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

85th% Speed	Approach Description		Lanes	Approach Total
30	Major App1:	TH19 EB	3	4886
30	Major App3:	TH19 WB	3	5629
30	Minor App2:	Bruce St NB	2	2682
30	Minor App4:	Bruce ST SB	2	2244

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MINOR APPROACH TOTAL Σ (APP.2 + APP. 4)	WARRANT MET MAJOR / MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO
6:00 - 7:00	159	159	69	81	318	150	YES / NO
7:00 - 8:00	504	391	233	204	895	437	**YES / YES**
8:00 - 9:00	353	314	154	133	667	287	**YES / YES**
9:00 - 10:00	311	315	153	111	626	264	**YES / YES**
10:00 - 11:00	317	385	184	112	702	296	**YES / YES**
11:00 - 12:00	443	481	261	187	924	448	**YES / YES**
12:00 - 13:00	511	634	232	258	1145	490	**YES / YES**
13:00 - 14:00	381	449	225	187	830	412	**YES / YES**
14:00 - 15:00	365	421	218	167	786	385	**YES / YES**
15:00 - 16:00	431	596	262	204	1027	466	**YES / YES**
16:00 - 17:00	435	528	223	194	963	417	**YES / YES**
17:00 - 18:00	388	554	277	249	942	526	**YES / YES**
18:00 - 19:00	288	402	191	157	690	348	**YES / YES**
19:00 - 20:00	0	0	0	0	0	0	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO
Daily	**4886**	**5629**	**2682**	**2244**			

	Met (Hr)	Required (Hr)
Hours met for warrant:	12	8

All-way Stop Warrant: **Satisfied**

REMARKS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A8g

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Bruce St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Bruce St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	4886
30	Major App3:	TH19 WB	3	5629
30	Minor App2:	Bruce St NB	2	1377
30	Minor App4:	Bruce ST SB	2	1709

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	600	900	720
Minor Approach	200	100	160

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	159	159	44	68	318	68	NO / NO	NO / NO	NO / NO
7:00 - 8:00	504	391	111	166	895	166	YES / NO	NO / YES	**YES / YES**
8:00 - 9:00	353	314	80	96	667	96	YES / NO	NO / NO	NO / NO
9:00 - 10:00	311	315	76	89	626	89	YES / NO	NO / NO	NO / NO
10:00 - 11:00	317	385	82	84	702	84	YES / NO	NO / NO	NO / NO
11:00 - 12:00	443	481	122	150	924	150	YES / NO	**YES / YES**	YES / NO
12:00 - 13:00	511	634	100	188	1145	188	YES / NO	**YES / YES**	**YES / YES**
13:00 - 14:00	381	449	129	136	830	136	YES / NO	NO / YES	YES / NO
14:00 - 15:00	365	421	121	123	786	123	YES / NO	NO / YES	YES / NO
15:00 - 16:00	431	596	150	154	1027	154	YES / NO	**YES / YES**	YES / NO
16:00 - 17:00	435	528	118	151	963	151	YES / NO	**YES / YES**	YES / NO
17:00 - 18:00	388	554	146	189	942	189	YES / NO	**YES / YES**	**YES / YES**
18:00 - 19:00	288	402	98	115	690	115	YES / NO	NO / YES	NO / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4886**	**5629**	**1377**	**1709**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	5	8	Not satisfied
Warrant 1A	Minimum Vehicular Volume	0	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	5	8	Not satisfied
1A & 1B	Combination of Warrants	3	8	Not satisfied
Warrant 2	**Four Hour Volumes**	1	4	Not satisfied
Warrant 3	**Peak Hour Volumes**	0	1	Not satisfied
Warrant 7	**Crash Experience**	**8**	8	Crashes Insufficient

COMMENTS:

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A8h

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Bruce St
SIGNAL WARRANT
ANALYSIS

LOCATION: TH19 at Bruce St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019

OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	4886
30	Major App3:	TH19 WB	3	5629
30	Minor App2:	Bruce St NB	2	1377
30	Minor App4:	Bruce ST SB	2	1709

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**

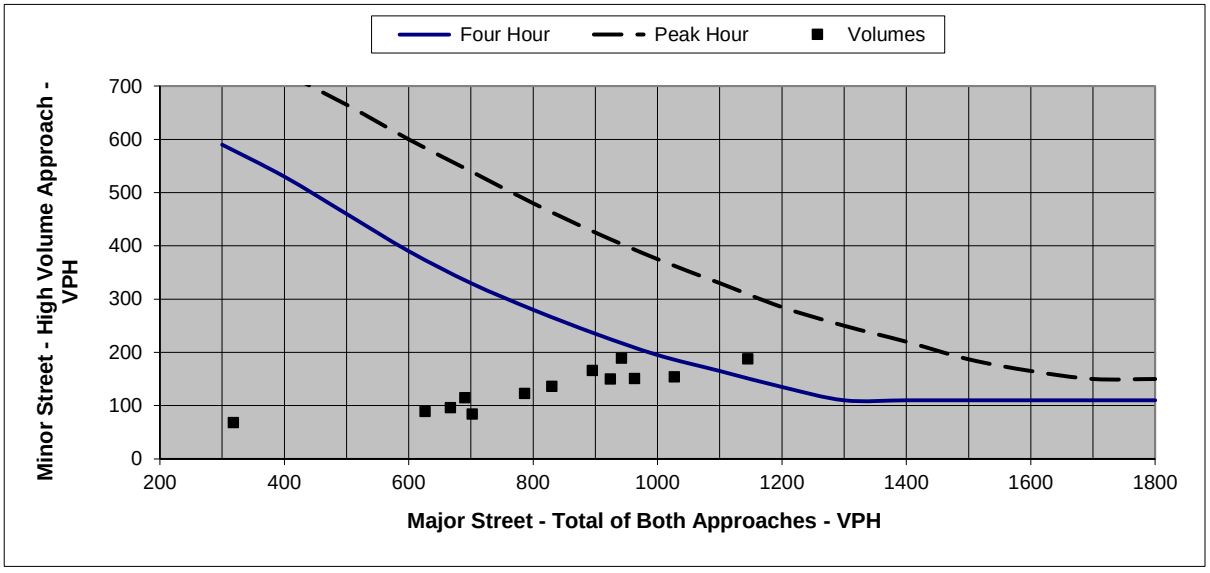


Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria (Graph)		
Major	Minor App.	Minor App.
Approach	Four Hour	Peak Hour
200		
300	590	
400	530	725
500	460	665
600	390	600
700	330	540
800	280	480
900	235	425
1000	195	375
1100	165	330
1200	135	285
1300	110	250
1400	110	220
1500	110	187
1600	110	165
1700	110	150
1800	110	150

Actual Hourly Count			Warrants Met:	
			Warrant 2	Warrant 3
HOUR	Sum Major App.	Max Minor App.	Four Hour	Peak Hour
0:00 - 1:00	0	0	NO	NO
1:00 - 2:00	0	0	NO	NO
2:00 - 3:00	0	0	NO	NO
3:00 - 4:00	0	0	NO	NO
4:00 - 5:00	0	0	NO	NO
5:00 - 6:00	0	0	NO	NO
6:00 - 7:00	318	68	NO	NO
7:00 - 8:00	895	166	NO	NO
8:00 - 9:00	667	96	NO	NO
9:00 - 10:00	626	89	NO	NO
10:00 - 11:00	702	84	NO	NO
11:00 - 12:00	924	150	NO	NO
12:00 - 13:00	1145	188	**YES**	NO
13:00 - 14:00	830	136	NO	NO
14:00 - 15:00	786	123	NO	NO
15:00 - 16:00	1027	154	NO	NO
16:00 - 17:00	963	151	NO	NO
17:00 - 18:00	942	189	NO	NO
18:00 - 19:00	690	115	NO	NO
19:00 - 20:00	0	0	NO	NO
20:00 - 21:00	0	0	NO	NO
21:00 - 22:00	0	0	NO	NO
22:00 - 23:00	0	0	NO	NO
23:00 - 24:00	0	0	NO	NO

SHORT ELLIOTT HENDRICKSON INC.

Exhibit A8i

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2045 Future - TH19 at Bruce St
SIGNAL WARRANT
ANALYSIS

Volume Threshold Reduced to 80% of Full Volume Warrant Thresholds

LOCATION: TH19 at Bruce St
COUNTY: Lyon
REF. POINT: 0
DATE: 11/14/2019
OPERATOR: LJ

85th% Speed	Approach	Description	Lanes	Approach
30	Major App1:	TH19 EB	3	4886
30	Major App3:	TH19 WB	3	5629
30	Minor App2:	Bruce St NB	2	1377
30	Minor App4:	Bruce ST SB	2	1709

40 MPH OR FASTER?	NO
POPULATION < 10,000?	NO
VOLUME REQ. AT 70%?	**NO**
CORRECTABLE CRASHES: (12-month period)	0

80%

	Minimum Volume Requirement		
	1A	1B	1A&B (80%)
Major Total	480	720	576
Minor Approach	160	80	128

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	MAJOR APPROACH TOTAL Σ (APP.1 + APP. 3)	MAX MINOR APPROACH (APP. 2 or 4)	WARRANT 1A - 8 hr MAJOR/MINOR	WARRANT 1B - 8 hr MAJOR/MINOR	WARRANT 1A & B MAJOR/MINOR
0:00 - 1:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
1:00 - 2:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
2:00 - 3:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
3:00 - 4:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
4:00 - 5:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
5:00 - 6:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
6:00 - 7:00	159	159	44	68	318	68	NO / NO	NO / NO	NO / NO
7:00 - 8:00	504	391	111	166	895	166	**YES / YES**	**YES / YES**	**YES / YES**
8:00 - 9:00	353	314	80	96	667	96	YES / NO	NO / YES	YES / NO
9:00 - 10:00	311	315	76	89	626	89	YES / NO	NO / YES	YES / NO
10:00 - 11:00	317	385	82	84	702	84	YES / NO	NO / YES	YES / NO
11:00 - 12:00	443	481	122	150	924	150	YES / NO	**YES / YES**	**YES / YES**
12:00 - 13:00	511	634	100	188	1145	188	**YES / YES**	**YES / YES**	**YES / YES**
13:00 - 14:00	381	449	129	136	830	136	YES / NO	**YES / YES**	**YES / YES**
14:00 - 15:00	365	421	121	123	786	123	YES / NO	**YES / YES**	YES / NO
15:00 - 16:00	431	596	150	154	1027	154	YES / NO	**YES / YES**	**YES / YES**
16:00 - 17:00	435	528	118	151	963	151	YES / NO	**YES / YES**	**YES / YES**
17:00 - 18:00	388	554	146	189	942	189	**YES / YES**	**YES / YES**	**YES / YES**
18:00 - 19:00	288	402	98	115	690	115	YES / NO	NO / YES	YES / NO
19:00 - 20:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
20:00 - 21:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
21:00 - 22:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
22:00 - 23:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
23:00 - 24:00	0	0	0	0	0	0	NO / NO	NO / NO	NO / NO
Daily	**4886**	**5629**	**1377**	**1709**					

		Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1	**Eight Hour Volumes**	**8**	8	**Satisfied**
Warrant 1A	Minimum Vehicular Volume	3	8	Not satisfied
Warrant 1B	Interruption of Continuous Flow	**8**	8	**Satisfied**
1A & 1B	Combination of Warrants	7	8	Not satisfied

COMMENTS:

Appendix B

Intersection Operations Measures of Effectiveness Tables and Reports

Table B1
TH 19 Marshall
Existing Conditions (2019)
AM / MD / PM Peak Hours

	Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Vehicle Queing Information (feet)											
																	Left Turn Lane				Through Lane (s)					Right Turn Lane			
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Thru [2] ---->	% Block Left [2] <----	Link Length (feet)	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Right [2] ---->	% Block Thru [2] <----	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]
AM Peak Hour	TH 19 at S 4th St	EB	10	136	34	180	3.0	A	0.6	A	0.4	A	0.7	A								758	20	36					
	(Minor Street Stop)	WB	83	179	20	282	2.9	A	1.3	A	0.8	A	1.7	A	3.5	A						195	20	78					
		NB	38	72	17	127	8.1	A	10.3	B	5.0	A	9.0	A								1544	44	88					
		SB	5	58	8	71	6.1	A	9.1	A	4.4	A	8.4	A								523	40	86					
	TH 19 at S 2nd St/CC Dr (Signal)	EB	135	7		142	20.9	C	9.1	A			19.7	B								264	72	163					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	2	71	56	129	29.9	C	23.9	C	6.3	A	16.0	B	13.7	B						945	36	137	4 %		50	21	72
		NB		214	9	223			16.4	B	2.9	A	15.8	B								799	73	183	1 %		150	20	20
		SB	15	67	159	241	21.6	C	9.3	A	5.7	A	8.0	A								1066	30	109			100	31	105
	TH 19 at Saratoga St (Signal)	EB	22	363	45	430	12.7	B	9.9	A	5.0	A	9.5	A			80	20	98		6 %	1066	82	233	6 %		120	20	101
		WB	34	233	17	284	16.0	B	7.2	A	4.0	A	8.0	A	10.6	B	150	20	71			735	52	158			150	20	29
		NB	36	89	43	168	19.8	B	18.2	B	6.5	A	15.7	B								886	52	148	1 %		100	20	96
		SB	22	68	27	117	19.8	B	17.8	B	4.2	A	14.8	B								802	40	114			100	20	39
	TH 19 at Main St/US59 (Signal)	EB	70	237	99	406	24.1	C	23.1	C	12.6	B	20.8	C			130	42	151		10 %	735	126	390	10 %		100	49	125
		WB	39	164	69	272	23.4	C	22.0	C	5.2	A	18.1	B	20.3	C	150	27	119		1 %	298	83	244	1 %		150	33	162
		NB	91	262	44	397	21.6	C	24.6	C	5.6	A	21.8	C			200	46	184		3 %	1161	124	334	3 %		350	20	44
		SB	122	241	80	443	20.9	C	24.2	C	3.9	A	19.7	B			150	64	174		6 %	802	118	312	6 %		400	20	50
	TH 19 at Lyon St (Signal)	EB	23	377	3	403	8.2	A	4.8	A	3.3	A	5.0	A			80	20	73		2 %	298	54	186	2 %		80	20	26
		WB	2	241	21	264	6.9	A	3.4	A	1.7	A	3.3	A	5.2	A	130	20	21			654	33	118			130	20	34
		NB	4	7	1	12	18.4	B	19.8	B	4.2	A	17.8	B			50	20	34			369	20	36					
		SB	41	3	27	71	18.4	B	19.4	B	3.4	A	12.8	B			100	22	65			798	20	43					
	TH 19 at Marshall St	EB	9	402		411	3.5	A	1.2	A			1.2	A			150	20	30			655		20					
	(Minor Street Stop)	WB	5	263	2	270	3.7	A	0.6	A	0.4	A	0.7	A	1.3	A	150	20	27			390							
		NB		3	8	11			8.7	A	4.5	A	5.5	A								385	20	52					
		SB	10	2	11	23	8.9	A	10.1	B	3.9	A	6.4	A								812	20	64					
	TH 19 at N 3rd St	EB	3	417		420	3.1	A	0.6	A			0.6	A			150		20			390							
	(Minor Street Stop)	WB		258	69	327			0.6	A	0.5	A	0.6	A	1.1	A						390					150		
		SB	44		12	56	10.1	B			3.6	A	8.6	A			350	21	57								100	20	42
	TH 19 at Bruce St (Signal)	EB	31	408	46	485	10.0	B	8.9	A	5.7	A	8.6	A			200	20	57			493	68	163					
		WB	60	271	41	372	10.6	B	8.5	A	2.2	A	8.1	A	10.7	B	200	29	71			1065	71	193			535	20	45
		NB	47	72	105	224	22.3	C	18.7	B	8.5	A	14.7	B			150	30	112		1 %	745	63	166					
		SB	67	84	37	188	23.2	C	16.3	B	6.8	A	16.8	B			150	43	124			764	52	144					
MD Peak Hour	TH 19 at S 4th St	EB	11	143	40	194	2.8	A	0.7	A	0.4	A	0.7	A								758	20	39					
	(Minor Street Stop)	WB	7	149	11	167	2.8	A	0.4	A	0.2	A	0.5	A	2.9	A						195	20	31					
		NB	34	50	9	93	7.3	A	8.1	A	4.1	A	7.4	A								1544	39	79					
		SB	7	70	38	115	7.4	A	8.4	A	4.3	A	6.9	A								523	40	73					
	TH 19 at S 2nd St/CC Dr (Signal)	EB	112	23		135	14.6	B	12.7	B			14.2	B								264	54	133					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	1	18	40	59	13.3	B	24.3	C	4.4	A	10.0	B	9.6	A						945	20	40			50	20	63
		NB		105	3	108			10.2	B	2.3	A	10.0	B								799	32	99					
		SB	32	131	126	289	12.7	B	9.2	A	4.3	A	7.6	A								1066	46	153	1 %		100	25	117
	TH 19 at Saratoga St (Signal)	EB	21	227	31	279	12.3	B	7.4	A	3.3	A	7.3	A			80	20	71		2 %	1066	47	148	2 %		120	20	45
		WB	40	256	31	327	12.5	B	7.6	A	3.9	A	7.8	A	9.4	A	150	20	65			735	54	167			150	20	71
		NB	33	55	36	124	18.6	B	17.0	B	3.9	A	13.6	B								886	38	94			100	20	33
		SB	34	74	42	150	18.5	B	16.7	B	4.4	A	13.6	B								802	44	106			100	20	59
	TH 19 at Main St/US59 (Signal)	EB	43	178	86	307	21.8	C	25.3	C	8.4	A	20.2	C			130	26	122		6 %	735	83	239	6 %		100	35	125
		WB	80	222	118	420	21.9	C	22.6	C	5.9	A	17.8	B	19.0	B	150	52	166		4 %	298	110	267	4 %		150	52	173
		NB	69	281	73	423	20.3	C	23.4	C	5.1	A	19.8	B			200	42	198		3 %	1161	140	324	3 %		350	23	127
		SB	113	285	56	454	19.3	B	21.3	C	4.7	A	18.7	B			150	55	174		5 %	802	124	286	5 %		400	20	46
	TH 19 at Lyon St (Signal)	EB	31	329	4	364	10.2	B	5.2	A	2.7	A	5.6	A			80	20	74		3 %	298	60	175	3 %		80	20	33
		WB	4	359	48	411	11.7	B	5.1	A	2.9	A	4.9	A	6.6	A	130	20	28		1 %	654	62	183	1 %		130	20	103
		NB	3	6	9	18	13.9	B	14.1	B	4.2	A	8.8	A			50	20	20			369	20	44					
		SB	68	4	58	130	22.5	C	19.6	B	6.0	A	14.6	B			100	33	83			798	22	58					
	TH 19 at Marshall St	EB	13	381	5	399	4.4	A	1.2	A	1.3	A	1.3	A			150	20	33			655							
	(Minor Street Stop)	WB	4	398	11	413	3.8	A	0.8	A	0.4	A	0.8	A	1.4	A	150	20	26			390		20					
		NB	2	4	13	19	9.0	A	9.9	A	4.6	A	6.3	A								385	20	35					
		SB	8	9	14	31	11.5	B	11.2	B	4.7	A	8.2	A								812	22	63					
	TH 19 at N 3rd St	EB	4	398		402	4.3	A	0.5	A			0.5	A			150	20	27			390							
	(Minor Street Stop)	WB		407	108	515			0.8	A	0.8	A	0.8	A	1.2	A						390					150		20
		SB	52	1	6	59	11.3	B			4.1	A	10.4	B			350	25	60								100	20	21
	TH 19 at Bruce St (Signal)	EB	38	370	44	452	9.7	A	8.3	A	4.8	A	8.1	A			200	22	57			493	61	120					
		WB	100	387	74	561	10.0	B	8.7	A	2.3	A	8.1	A	10.3	B	200	37	120			1065	91	208			535	20	50
		NB	35	53	117	205	22.5	C	19.8	B	7.6	A	13.3	B			150	23	76			745	58	147					
		SB	105	61	62	228	23.9	C	17.2	B	5.9	A	17.1	B			150	55	121			764	49	109					
PM Peak Hour	TH 19 at S 4th St	EB	10	172	81	263	2.4	A	1.2	A	0.7	A	1.1	A								758	20	30					
	(Minor Street Stop)	WB	8	118	7	133	3.4	A	0.4	A	0.1	A	0.6	A	3.6	A						195	20	48					
		NB	36	72	5	113	7.6	A	8.3	A	4.8	A	7.9	A								1544	38	76					
		SB	14	89	21	124	7.8	A	9.8	A	4.9	A	8.8	A								523	40	90					
	TH 19 at S 2nd St/CC Dr (Signal)	EB	137	21		158	13.6	B	9.6	A			12.8	B								264	64	162					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	1	17	28	46	0.0	A	23.7	C	4.5	A	11.1	B	9.5	A						945	20	64	1 %		50	20	60
		NB		94	4	98			9.6	A	2.2	A	9.3	A								799	27	94					
		SB	38	134	100	272	13.0	B	8.7	A	4.1	A	7.7	A								1066	47	150	1 %		100	23	92
	TH 19 at Saratoga St (Signal)	EB	13	229	35	277	11.5	B	7.3	A	3.5	A	7.0	A			80	20	33		1 %	1066	48	134	1 %		120	20	60
		WB	40	248	32	320	13.9	B	7.8	A	3.9	A	8.1	A	10.1	B	150	20	66			735	57	155			150	20	40
		NB	38	70	45	153	17.4	B	17.3	B	4.4	A	13.4	B								886	42	104			100	20	60
		SB	37	111	26	174	19.9	B	18.3	B	4.5	A	16.5	B								802	60	140	2 %		100	20	53
	TH 19 at Main St/US59 (Signal)	EB	62	170	100	332	24.5	C	29.0	C	12.1	B	23.0	C			130	36	118		6 %	735	86	254	6 %		100	42	125
		WB	104	194	115	413	24.5	C	26.9	C	6.2	A	20.6	C	21.6	C	150	59	174		3 %	298	105	256	3 %		150	48	173
		NB	66	311	53	430	22.8	C	22.8	C	4.4	A	20.5	C			200	39	154		3 %	1161	132	294	3 %		350	20	43
		SB	92	431	82	605	23.2	C	25.8	C	4.0	A	22.3	C			150	62	174		13 %	802	185	418	13 %		400	20	60
	TH 19 at Lyon St (Signal)	EB	31	277	7	315	11.0	B	4.8	A	2.4	A	5.3	A			80	20	70		1 %	298	45	151	1 %		80	20	31
		WB	15	346	49	410	8.2	A	5.0	A	2.1	A	4.8	A	6.2	A	130	20	46		1 %	654	59	166	1 %		130	20	49
		NB		8	12	20			17.4	B	5.0	A	9.3	A								369	20	42					
		SB	61	2	67	130	19.9	B	21.9	C	5.0	A	12.1	B			100	31	78			798	23	61					
	TH 19 at Marshall St	EB	24	314	1	339	4.4	A	1.2	A	1.1	A	1.4	A			150	20	33			655							
	(Minor Street Stop)	WB	13	380	6	399	3.0	A	0.8	A	0.4	A	0.9	A	1.6	A	150	20	30			390		20					
		NB	5	7	18	30	9.0	A	11.5	B	3.8	A	6.1	A								385	20	42					
		SB	6	13	30	49	10.3	B	10.2	B	4.4	A	6.5	A								812	28	66					
	TH 19 at N 3rd St	EB	10	328		338	3.6	A	0.5	A			0.6	A			150	20	31			390							
	(Minor Street Stop)	WB		394	81	475			0.7	A	0.6	A	0.7	A	1.2	A						390					150		20
		SB	48		5	53	10.6	B			3.8	A	10.0	B			350	24	61								100	20	21
	TH 19 at Bruce St (Signal)	EB	39	282	34	355	9.9	A	8.2	A	5.0	A	8.1	A			200	22	68			493	51	111					
		WB	80	369	67	516	9.5	A	9.3	A	2.5	A	8.4	A	10.6	B	200	31	87			1065	88	198			535	20	56
		NB	41	92	103	236	21.4	C	18.0	B	8.2	A	14.2	B			150	26	64			745	67	146					
		SB	79	76	62	217	23.3	C	17.1	B	6.5	A	16.2	B			150	44	106			764	50	117					

NOTES: TH 19 is the East-West Roadway; except where noted at Country Club Drive/2nd St.

NOTES **1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.**
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

Table B2
TH 19 Marshall
No Build Conditions (2045)
AM / MD / PM Peak Hours

Assumes 0.5% Growth Per Year (Factor 1.13)

	Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Vehicle Queing Information (feet)											
																	Left Turn Lane				Through Lane (s)					Right Turn Lane			
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Thru [2] ---->	% Block Left [2] <----	Link Length (feet)	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Right [2] ---->	% Block Thru [2] <----	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]
AM Peak Hour	TH 19 at S 4th St	EB	10	155	40	205	3.2	A	0.8	A	0.5	A	0.9	A								758	20	38					
	(Minor Street Stop)	WB	95	200	25	320	3.5	A	1.7	A	0.9	A	2.2	A	4.3	A						195	24	107					
		NB	45	80	20	145	9.9	A	12.6	B	7.2	A	11.0	B								1544	51	114					
		SB	5	65	10	80	6.6	A	9.9	A	5.0	A	9.1	A								523	37	82					
	TH 19 at S 2nd St/CC Dr (Signal)	EB	155	10		165	22.3	C	11.9	B			21.7	C								264	80	187					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	80	65	150	19.2	B	24.7	C	6.9	A	16.8	B	15.4	B						945	45	138	7 %		50	28	73
		NB		240	10	250			17.8	B	3.0	A	17.2	B								799	89	234	2 %				
		SB	15	75	180	270	23.8	C	10.8	B	7.1	A	9.1	A								1066	39	152	1 %	1 %	100	41	118
	TH 19 at Saratoga St (Signal)	EB	25	410	50	485	19.6	B	12.2	B	5.8	A	11.9	B			80	20	92		9 %	1066	106	307	9 %		120	20	134
		WB	40	265	20	325	18.7	B	8.3	A	4.9	A	9.4	A	12.3	B	150	20	106		1 %	735	66	221	1 %		150	20	60
		NB	40	100	50	190	20.4	C	17.9	B	7.7	A	15.7	B								886	55	166	2 %		100	22	98
		SB	25	75	30	130	20.0	C	18.5	B	4.9	A	15.7	B								802	42	139	1 %		100	20	83
	TH 19 at Main St/US59 (Signal)	EB	80	270	110	460	32.3	C	30.4	C	17.6	B	27.7	C			130	48	155		17 %	735	188	555	17 %		100	56	125
		WB	45	185	80	310	29.1	C	26.1	C	5.9	A	21.3	C	25.5	C	150	38	153		3 %	298	102	263	3 %		150	40	157
		NB	105	295	50	450	30.2	C	30.3	C	9.3	A	27.9	C			200	67	224		6 %	1161	162	519	6 %		350	21	189
		SB	140	270	90	500	27.5	C	28.2	C	5.5	A	23.9	C			150	77	175		9 %	802	143	396	9 %		400	22	70
	TH 19 at Lyon St (Signal)	EB	25	425	5	455	8.8	A	6.1	A	4.2	A	6.2	A			80	20	66		4 %	298	79	241	4 %		80	20	46
		WB	5	270	25	300	7.1	A	4.0	A	2.3	A	3.9	A	6.4	A	130	20	32			654	43	148			130	20	71
		NB	5	10	5	20	26.1	C	15.9	B	5.4	A	15.8	B			50	20	51		1 %	369	20	55					
		SB	45	5	30	80	20.6	C	17.7	B	4.8	A	14.5	B			100	23	68			798	20	54					
	TH 19 at Marshall St	EB	10	455		465	4.6	A	1.3	A			1.4	A			150	20	42			655		20					
	(Minor Street Stop)	WB	5	295	5	305	5.0	A	0.7	A	0.3	A	0.8	A	1.5	A	150	20	30			390							
		NB		5	10	15			9.0	A	6.2	A	7.1	A								385	20	62					
		SB	10	5	10	25	11.2	B	10.3	B	4.8	A	8.5	A								812	23	68					
	TH 19 at N 3rd St	EB	5	470		475	3.7	A	0.7	A			0.7	A			150	20	24			390							
	(Minor Street Stop)	WB		290	80	370			0.7	A	0.6	A	0.7	A	1.5	A						390					150		20
		SB	50		15	65	13.5	B			4.4	A	11.4	B			350	26	79								100	20	48
	TH 19 at Bruce St (Signal)	EB	35	460	50	545	11.2	B	9.6	A	7.1	A	9.5	A			200	20	58			493	78	171					
		WB	70	305	45	420	11.4	B	9.3	A	2.4	A	8.9	A	11.9	B	200	33	89			1065	82	202			535	20	59
		NB	55	80	120	255	25.9	C	20.0	C	9.5	A	16.3	B			150	39	129		1 %	745	72	196					
		SB	75	95	40	210	24.8	C	17.9	B	9.1	A	18.7	B			150	46	116			764	58	145					
MD Peak Hour	TH 19 at S 4th St	EB	10	160	45	215	3.0	A	0.8	A	0.5	A	0.8	A								758	20	36					
	(Minor Street Stop)	WB	10	170	10	190	3.0	A	0.5	A	0.2	A	0.6	A	3.3	A						195	20	50					
		NB	40	55	10	105	7.6	A	8.2	A	4.5	A	7.6	A								1544	40	83					
		SB	10	80	45	135	9.1	A	9.3	A	5.0	A	7.9	A								523	45	92					
	TH 19 at S 2nd St/CC Dr (Signal)	EB	125	25		150	17.1	B	15.4	B			16.8	B								264	68	162					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	45	70	27.0	C	23.0	C	4.4	A	11.3	B	11.2	B						945	20	46			50	20	46
		NB		120	5	125			12.2	B	2.4	A	11.8	B								799	38	110					
		SB	35	150	140	325	15.0	B	10.1	B	4.8	A	8.3	A								1066	52	143	1 %		100	30	117
	TH 19 at Saratoga St (Signal)	EB	25	255	35	315	13.0	B	7.8	A	3.6	A	7.7	A			80	20	75		2 %	1066	55	148	2 %		120	20	43
		WB	45	290	35	370	13.8	B	8.4	A	4.5	A	8.7	A	10.3	B	150	23	117		1 %	735	66	190	1 %		150	20	60
		NB	35	60	40	135	19.2	B	17.8	B	4.3	A	14.2	B								886	43	103			100	20	41
		SB	40	85	45	170	20.5	C	18.6	B	5.2	A	15.5	B								802	52	120	1 %		100	20	55
	TH 19 at Main St/US59 (Signal)	EB	50	200	95	345	25.7	C	28.8	C	9.8	A	23.1	C			130	34	137		10 %	735	108	249	10 %		100	50	125
		WB	90	250	135	475	24.1	C	26.9	C	6.8	A	20.7	C	22.4	C	150	61	174		6 %	298	130	311	6 %		150	54	166
		NB	80	320	80	480	22.1	C	27.5	C	6.1	A	23.0	C			200	50	203		7 %	1161	173	435	7 %		350	29	255
		SB	130	320	65	515	25.3	C	25.5	C	5.2	A	22.9	C			150	76	175		10 %	802	160	414	10 %		400	20	58
	TH 19 at Lyon St (Signal)	EB	35	370	5	410	12.8	B	5.8	A	2.6	A	6.4	A			80	21	86		4 %	298	68	197	4 %		80	20	31
		WB	5	405	55	465	11.5	B	5.8	A	3.2	A	5.6	A	7.4	A	130	20	33		1 %	654	74	201	1 %		130	20	92
		NB	5	5	10	20	25.2	C	20.8	C	5.0	A	14.0	B			50	20	32			369	20	50					
		SB	75	5	65	145	22.7	C	17.6	B	6.1	A	15.1	B			100	35	84			798	20	56					
	TH 19 at Marshall St	EB	15	430	5	450	5.0	A	1.3	A	1.2	A	1.4	A			150	20	31			655							
	(Minor Street Stop)	WB	5	450	10	465	4.4	A	0.9	A	0.5	A	0.9	A	1.6	A	150	20	30			390							
		NB	5	5	15	25	10.0	B	12.6	B	5.4	A	7.8	A								385	20	55					
		SB	10	10	15	35	13.7	B	10.2	B	5.0	A	9.0	A								812	24	57					
	TH 19 at N 3rd St	EB	5	450		455	4.2	A	0.6	A			0.6	A			150	20	30			390							
	(Minor Street Stop)	WB		460	120	580			0.9	A	0.9	A	0.9	A	1.4	A						390					150		20
		SB	60		5	65	12.8	B			5.7	A	12.3	B			350	25	57								100	20	21
	TH 19 at Bruce St (Signal)	EB	45	420	50	515	10.6	B	9.4	A	6.1	A	9.2	A			200	23	66			493	74	153					
		WB	115	435	85	635	11.1	B	10.2	B	2.4	A	9.3	A	11.5	B	200	45	118			1065	106	225			535	22	56
		NB	40	60	130	230	23.1	C	20.2	C	8.5	A	14.1	B			150	26	75			745	64	154					
		SB	120	70	70	260	25.3	C	18.9	B	7.8	A	18.9	B			150	62	126			764	57	128					
PM Peak Hour	TH 19 at S 4th St	EB	10	195	90	295	2.8	A	1.3	A	0.7	A	1.2	A								758	20	34					
	(Minor Street Stop)	WB	10	135	10	155	3.9	A	0.5	A	0.2	A	0.7	A	4.2	A						195	20	54					
		NB	40	80	5	125	9.5	A	9.1	A	4.8	A	9.1	A								1544	42	83					
		SB	15	100	25	140	10.1	B	10.8	B	5.9	A	9.9	A								523	46	123					
	TH 19 at S 2nd St/CC Dr (Signal)	EB	155	25		180	15.2	B	11.8	B			14.7	B								264	72	170					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	30	55	21.4	C	25.3	C	4.6	A	13.7	B	11.4	B						945	20	79	2 %		50	20	64
		NB		105	5	110			12.0	B	2.5	A	11.6	B								799	34	90					
		SB	45	150	115	310	14.3	B	10.3	B	5.0	A	8.9	A								1066	57	183	2 %		100	27	105
	TH 19 at Saratoga St (Signal)	EB	15	260	40	315	12.7	B	8.4	A	3.8	A	8.0	A			80	20	67		3 %	1066	59	159	3 %		120	20	44
		WB	45	280	35	360	15.7	B	8.5	A	3.9	A	9.0	A	11.1	B	150	23	118			735	63	177			150	20	34
		NB	45	80	50	175	19.7	B	17.9	B	4.6	A	14.6	B								886	51	116	1 %		100	20	69
		SB	40	125	30	195	21.2	C	18.7	B	5.1	A	17.1	B								802	63	133	2 %		100	20	63
	TH 19 at Main St/US59 (Signal)	EB	70	190	115	375	29.4	C	35.7	D	17.4	B	28.9	C			130	47	146		12 %	735	120	281	12 %	1 %	100	63	125
		WB	120	220	130	470	29.1	C	32.0	C	7.1	A	24.4	C	27.9	C	150	79	174		6 %	298	131	292	6 %		150	55	165
		NB	75	350	60	485	29.5	C	26.0	C	5.4	A	24.0	C			200	50	211		6 %	1161	164	365	6 %		350	20	81
		SB	105	485	95	685	33.8	C	37.7	D	5.4	A	32.6	C			150	82	175		25 %	802	286	634	25 %		400	37	285
	TH 19 at Lyon St (Signal)	EB	35	315	10	360	10.8	B	5.7	A	3.1	A	6.1	A			80	20	81		3 %	298	63	194	3 %		80	20	51
		WB	15	390	55	460	8.7	A	5.1	A	2.3	A	4.9	A	6.9	A	130	20	46		1 %	654	65	173	1 %		130	20	74
		NB		10	15	25			18.4	B	4.6	A	10.1	B							1 %	369	20	54					
		SB	70	5	75	150	21.7	C	21.7	C	6.8	A	14.3	B			100	35	82			798	26	72					
	TH 19 at Marshall St	EB	25	355	5	385	4.8	A	1.4	A	1.3	A	1.6	A			150	20	42			655							
	(Minor Street Stop)	WB	15	430	5	450	3.8	A	0.9	A	0.6	A	1.0	A	1.8	A	150	20	33			390		20					
		NB	5	10	20	35	10.1	B	9.7	A	4.9	A	7.0	A								385	22	45					
		SB	5	15	35	55	10.6	B	10.4	B	5.4	A	7.2	A								812	30	69					
	TH 19 at N 3rd St	EB	10	370		380	5.1	A	0.6	A			0.7	A			150	20	31			390							
	(Minor Street Stop)	WB		445	90	535			0.8	A	0.7	A	0.8	A	1.4	A						390					150		20
		SB	55		5	60	11.7	B			4.1	A	11.1	B			350	24	62								100	20	24
	TH 19 at Bruce St (Signal)	EB	45	320	40	405	10.8	B	9.0	A	5.7	A	8.9	A			200	24	65			493	59	129					
		WB	90	415	75	580	11.0	B	10.9	B	2.6	A	9.8	A	12.0	B	200	38	120		1 %	1065	110	243	1 %		535	20	52
		NB	45	105	115	265	24.2	C	19.7	B	9.5	A	16.0	B			150	29	104		1 %	745	77	174					
		SB	90	85	70	245	24.5	C	18.9	B	7.7	A	17.8	B			150	50	137			764	61	144					

NOTES: TH 19 is the East-West Roadway; except where noted at Country Club Drive/2nd St.

NOTES **1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.**
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

Table B3
TH 19 Marshall Assumes 0.5% Growth Per Year (Factor 1.13)
Build Conditions (2045) - Alternative 1 (Minor Street Stops at Lyon St and Country Club Dr)
AM / MD / PM Peak Hours

	Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Vehicle Queing Information (feet)											
																	Left Turn Lane				Through Lane (s)					Right Turn Lane			
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Thru [2] ---->	% Block Left [2] <----	Link Length (feet)	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Right [2] ---->	% Block Thru [2] <----	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]
AM Peak Hour	TH 19 at S 4th St	EB	10	155	40	205	3.4	A	0.7	A	0.5	A	0.8	A								758	20	46					
	(Minor Street Stop)	WB	95	200	25	320	3.2	A	1.3	A	0.7	A	1.8	A	3.9	A						195	21	96					
		NB	45	80	20	145	9.4	A	11.8	B	6.6	A	10.3	B								1544	52	123					
		SB	5	65	10	80	5.9	A	9.9	A	4.8	A	9.0	A								523	38	81					
	TH 19 at S 2nd St/CC Dr	EB	155	10		165	15.8	C	8.1	A			15.3	C								264	63	158					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	80	65	150	5.9	A	32.2	D	8.5	A	21.1	C	7.8	A						945	44	170	4 %		100	22	95
		NB		240	10	250			0.8	A	2.0	A	0.8	A														
	(Minor Street Stop)	SB	15	75	180	270	4.5	A	1.7	A	2.3	A	2.3	A								1066	20	32			100	20	20
	TH 19 at Saratoga St (Signal)	EB	25	410	50	485	14.6	B	9.2	A	3.8	A	8.9	A			80	20	104		7 %	1066	88	233	7 %		120	20	103
		WB	40	265	20	325	17.4	B	7.5	A	4.6	A	8.5	A	10.8	B	150	22	78			735	58	174			150	20	51
		NB	40	100	50	190	20.5	C	18.5	B	7.2	A	15.9	B								886	59	186	2 %		100	21	114
		SB	25	75	30	130	19.5	B	19.3	B	4.8	A	16.0	B								802	45	138	1 %		100	20	71
	TH 19 at Main St/US59 (Signal)	EB	80	270	110	460	29.2	C	29.8	C	16.4	B	26.5	C			130	51	154		17 %	735	168	500	17 %	1 %	100	58	125
		WB	45	185	80	310	26.9	C	25.9	C	5.2	A	20.7	C	24.6	C	150	39	147		3 %	298	104	275	3 %		150	39	161
		NB	105	295	50	450	28.1	C	29.5	C	7.3	A	26.7	C			200	67	224		6 %	1161	163	496	6 %		350	20	149
		SB	140	270	90	500	26.4	C	27.7	C	5.3	A	23.3	C			150	73	174		10 %	802	149	412	10 %		400	21	68
	TH 19 at Lyon St	EB	25	425	5	455	4.7	A	1.9	A	1.3	A	2.0	A			80	20	35			298		20			80		20
	(Minor Street Stop)	WB	5	270	25	300	4.0	A	1.2	A	0.8	A	1.2	A	2.6	A	130	20	24			654	20	36			130		20
		NB	5	10	5	20	10.4	B	12.7	B	5.3	A	10.3	B			50	20	40		1 %	369	20	56					
		SB	45	5	30	80	12.7	B	12.7	B	4.2	A	9.5	A			100	21	57			798	20	49					
	TH 19 at Marshall St	EB	10	455		465	3.4	A	0.7	A			0.8	A			150	20	39			655		20					
	(Minor Street Stop)	WB	5	295	5	305	3.7	A	0.6	A	0.4	A	0.6	A	1.1	A	150	20	24			390		20					
		NB		5	10	15			11.1	B	5.2	A	7.2	A								385	20	51					
		SB	10	5	10	25	10.6	B	9.8	A	4.7	A	8.1	A								812	23	77					
	TH 19 at N 3rd St	EB	5	470		475	3.4	A	0.6	A			0.6	A			150	20	22			390							
	(Minor Street Stop)	WB		290	80	370			0.6	A	0.6	A	0.6	A	1.4	A						390					150		20
		SB	50		15	65	13.8	B			3.6	A	11.4	B			350	27	81								100	20	38
	TH 19 at Bruce St (Signal)	EB	35	460	50	545	10.3	B	10.1	B	6.6	A	9.8	A			200	20	59			493	79	188					
		WB	70	305	45	420	11.5	B	9.2	A	2.2	A	8.8	A	11.8	B	200	33	82			1065	80	202			535	20	43
		NB	55	80	120	255	24.5	C	18.4	B	9.3	A	15.4	B			150	36	119			745	72	160					
		SB	75	95	40	210	24.7	C	18.6	B	8.1	A	18.8	B			150	49	154			764	59	150					
MD Peak Hour	TH 19 at S 4th St	EB	10	160	45	215	3.2	A	0.8	A	0.4	A	0.8	A								758	20	42					
	(Minor Street Stop)	WB	10	170	10	190	2.7	A	0.5	A	0.2	A	0.6	A	3.4	A						195	20	43					
		NB	40	55	10	105	7.8	A	8.6	A	5.0	A	8.0	A								1544	39	77					
		SB	10	80	45	135	8.7	A	9.4	A	5.3	A	8.0	A								523	46	96					
	TH 19 at S 2nd St/CC Dr	EB	125	25		150	9.7	A	6.9	A			9.2	A								264	48	113					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	45	70	8.0	A	11.1	B	4.1	A	6.4	A	3.9	A						945	20	42			100	20	40
		NB		120	5	125			0.4	A	2.0	A	0.5	A														
	(Minor Street Stop)	SB	35	150	140	325	3.8	A	2.0	A	2.1	A	2.2	A								1066	20	36			100		20
	TH 19 at Saratoga St (Signal)	EB	25	255	35	315	12.5	B	6.9	A	2.7	A	6.9	A			80	20	72		2 %	1066	53	138	2 %		120	20	37
		WB	45	290	35	370	13.4	B	8.6	A	4.5	A	8.8	A	9.9	A	150	21	91		1 %	735	66	195	1 %		150	20	51
		NB	35	60	40	135	19.0	B	18.1	B	4.4	A	14.3	B								886	44	103			100	20	42
		SB	40	85	45	170	18.4	B	17.5	B	5.0	A	14.4	B								802	52	139	1 %		100	20	67
	TH 19 at Main St/US59 (Signal)	EB	50	200	95	345	24.2	C	28.4	C	10.1	B	22.8	C			130	37	140		9 %	735	106	278	9 %		100	44	125
		WB	90	250	135	475	23.6	C	26.3	C	6.0	A	20.0	C	22.0	C	150	59	174		6 %	298	132	287	6 %		150	62	174
		NB	80	320	80	480	23.7	C	26.7	C	5.5	A	22.7	C			200	55	200		6 %	1161	165	360	6 %		350	22	94
		SB	130	320	65	515	24.5	C	25.4	C	6.0	A	22.7	C			150	71	174		10 %	802	154	400	10 %		400	20	63
	TH 19 at Lyon St	EB	35	370	5	410	5.6	A	1.9	A	1.3	A	2.2	A			80	20	46								80		20
	(Minor Street Stop)	WB	5	405	55	465	4.1	A	1.7	A	1.2	A	1.7	A	3.3	A	130	20	21			654	20	58			130	20	20
		NB	5	5	10	20	15.9	C	13.1	B	6.0	A	10.3	B			50	20	29			369	20	52					
		SB	75	5	65	145	15.0	C	13.1	B	5.7	A	10.8	B			100	33	77			798	22	48					
	TH 19 at Marshall St	EB	15	430	5	450	4.5	A	0.8	A	0.8	A	0.9	A			150	20	30			655		20					
	(Minor Street Stop)	WB	5	450	10	465	4.2	A	0.8	A	0.5	A	0.8	A	1.3	A	150	20	24			390		20					
		NB	5	5	15	25	9.3	A	10.0	B	4.5	A	6.6	A								385	20	47					
		SB	10	10	15	35	12.2	B	10.1	B	5.0	A	8.5	A								812	22	66					
	TH 19 at N 3rd St	EB	5	450		455	4.1	A	0.6	A			0.6	A			150	20	28			390							
	(Minor Street Stop)	WB		460	120	580			0.9	A	0.8	A	0.9	A	1.5	A						390					150		20
		SB	60		5	65	13.6	B			5.4	A	13.0	B			350	27	62								100	20	21
	TH 19 at Bruce St (Signal)	EB	45	420	50	515	10.6	B	9.8	A	6.7	A	9.6	A			200	23	61			493	75	157					
		WB	115	435	85	635	10.9	B	10.1	B	2.3	A	9.2	A	11.5	B	200	44	130			1065	105	240			535	22	55
		NB	40	60	130	230	24.2	C	20.0	C	8.6	A	14.3	B			150	27	69			745	65	155					
		SB	120	70	70	260	24.5	C	18.3	B	7.1	A	18.1	B			150	61	130			764	57	155					
PM Peak Hour	TH 19 at S 4th St	EB	10	195	90	295	2.7	A	1.4	A	0.8	A	1.3	A								758	20	42					
	(Minor Street Stop)	WB	10	135	10	155	3.8	A	0.5	A	0.2	A	0.7	A	4.2	A						195	20	58					
		NB	40	80	5	125	8.9	A	8.9	A	5.6	A	8.8	A								1544	43	81					
		SB	15	100	25	140	10.4	B	11.3	B	6.3	A	10.3	B								523	47	111					
	TH 19 at S 2nd St/CC Dr	EB	155	25		180	10.7	B	7.8	A			10.3	B								264	62	176					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	30	55	6.2	A	11.2	B	3.9	A	6.8	A	4.6	A						945	20	58			100	20	49
		NB		105	5	110			0.4	A	2.2	A	0.5	A														
	(Minor Street Stop)	SB	45	150	115	310	3.7	A	2.2	A	2.0	A	2.3	A								1066	20	44			100		20
	TH 19 at Saratoga St (Signal)	EB	15	260	40	315	13.2	B	7.5	A	3.1	A	7.2	A			80	20	46		2 %	1066	55	139	2 %		120	20	30
		WB	45	280	35	360	13.5	B	8.7	A	4.4	A	8.9	A	10.8	B	150	21	89			735	69	166			150	20	62
		NB	45	80	50	175	20.1	C	18.7	B	4.4	A	15.0	B								886	52	118	1 %		100	20	79
		SB	40	125	30	195	18.4	B	18.0	B	5.0	A	16.1	B								802	65	140	1 %		100	20	55
	TH 19 at Main St/US59 (Signal)	EB	70	190	115	375	29.4	C	33.4	C	16.8	B	27.6	C			130	45	143		12 %	735	114	269	12 %	1 %	100	57	125
		WB	120	220	130	470	28.7	C	32.3	C	6.5	A	24.2	C	29.2	C	150	84	174		8 %	298	142	298	8 %		150	61	175
		NB	75	350	60	485	30.8	C	26.6	C	5.6	A	24.7	C			200	52	213		6 %	1161	162	366	6 %		350	20	86
		SB	105	485	95	685	36.5	D	43.0	D	5.2	A	36.8	D			150	79	175		26 %	802	304	658	26 %		400	56	400
	TH 19 at Lyon St	EB	35	315	10	360	6.2	A	1.6	A	1.3	A	2.0	A			80	20	50								80		20
	(Minor Street Stop)	WB	15	390	55	460	4.0	A	1.6	A	1.1	A	1.6	A	3.2	A	130	20	30			654	20	56			130	20	20
		NB		10	15	25			12.7	B	5.1	A	8.1	A								369	20	44					
		SB	70	5	75	150	13.9	B	16.1	C	6.5	A	10.3	B			100	28	70			798	28	72					
	TH 19 at Marshall St	EB	25	355	5	385	4.6	A	0.8	A	0.6	A	1.0	A			150	20	44			655							
	(Minor Street Stop)	WB	15	430	5	450	3.5	A	0.9	A	0.6	A	1.0	A	1.6	A	150	20	35			390							
		NB	5	10	20	35	9.7	A	10.8	B	5.1	A	7.4	A								385	22	55					
		SB	5	15	35	55	13.2	B	10.9	B	5.6	A	7.7	A								812	31	80					
	TH 19 at N 3rd St	EB	10	370		380	4.6	A	0.5	A			0.6	A			150	20	31			390							
	(Minor Street Stop)	WB		445	90	535			0.9	A	0.8	A	0.9	A	1.4	A						390					150		20
		SB	55		5	60	12.3	B			4.8	A	11.7	B			350	25	63								100	20	21
	TH 19 at Bruce St (Signal)	EB	45	320	40	405	10.8	B	9.2	A	5.0	A	9.0	A			200	25	65			493	59	128					
		WB	90	415	75	580	10.8	B	11.0	B	2.8	A	9.9	A	12.1	B	200	38	118		1 %	1065	113	250	1 %		535	23	57
		NB	45	105	115	265	23.0	C	20.2	C	10.4	B	16.4	B			150	29	74			745	78	169					
		SB	90	85	70	245	24.8	C	19.2	B	7.4	A	17.9	B			150	50	121			764	59	148					

NOTES: TH 19 is the East-West Roadway; except where noted at Country Club Drive/2nd St.

NOTES **1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.**
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

Table B4
TH 19 Marshall Assumes 0.5% Growth Per Year (Factor 1.13)
Build Conditions (2045) - Alternative 2 (Minor Street Stops at Bruce St, Lyon St, Saratoga St and Country Club Dr)
AM / MD / PM Peak Hours

	Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Vehicle Queing Information (feet)											
																	Left Turn Lane				Through Lane (s)					Right Turn Lane			
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Thru [2] ---->	% Block Left [2] <----	Link Length (feet)	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Right [2] ---->	% Block Thru [2] <----	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]
AM Peak Hour	TH 19 at S 4th St	EB	10	155	40	205	3.7	A	0.8	A	0.5	A	0.9	A														
	(Minor Street Stop)	WB	95	200	25	320	3.0	A	1.3	A	0.7	A	1.8	A	4.1	A												
		NB	45	80	20	145	9.7	A	12.1	B	8.6	A	10.9	B														
		SB	5	65	10	80	7.5	A	9.9	A	5.8	A	9.2	A														
	TH 19 at S 2nd St/CC Dr	EB	155	10		165	16.2	C	6.9	A			15.6	C														
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	80	65	150	7.1	A	24.8	C	6.8	A	16.4	C	6.8	A						945	40	130	1 %		100	21	74
		NB		240	10	250			0.7	A	2.0	A	0.8	A								799		20					
	(Minor Street Stop)	SB	15	75	180	270	4.0	A	0.9	A	1.5	A	1.5	A								1066	20	30			100	20	26
	TH 19 at Saratoga St	EB	25	410	50	485	4.3	A	1.5	A	1.2	A	1.6	A			80	20	37			1066		20			120	20	20
	(Minor Street Stop)	WB	40	265	20	325	6.3	A	2.1	A	2.0	A	2.6	A	15.6	C	150	20	51			735		20			150		20
		NB	40	100	50	190	84.8	F	71.8	F	44.1	E	67.2	F								886	129	471	21 %		100	39	125
		SB	25	75	30	130	31.5	D	30.4	D	7.3	A	25.3	D								802	55	176	6 %		100	20	98
	TH 19 at Main St/US59 (Signal)	EB	80	270	110	460	26.6	C	25.8	C	12.8	B	22.8	C			130	49	146		16 %	735	166	429	16 %		100	56	125
		WB	45	185	80	310	26.3	C	26.4	C	5.2	A	20.9	C	23.8	C	150	39	158		4 %	298	101	267	4 %		150	40	172
		NB	105	295	50	450	29.2	C	28.7	C	8.7	A	26.6	C			200	67	217		5 %	1161	157	447	5 %		350	22	250
		SB	140	270	90	500	27.0	C	28.8	C	5.0	A	24.0	C			150	73	166		10 %	802	150	430	10 %		400	22	66
	TH 19 at Lyon St	EB	25	425	5	455	4.6	A	2.0	A	1.5	A	2.1	A			80	20	32										
	(Minor Street Stop)	WB	5	270	25	300	3.6	A	1.0	A	0.7	A	1.0	A	2.6	A	130	20	27			654		20			130		20
		NB	5	10	5	20	15.5	C	11.6	B	5.1	A	11.0	B			50	20	39			369	20	54					
		SB	45	5	30	80	13.0	B	13.4	B	3.7	A	9.5	A			100	22	66			798	20	48					
	TH 19 at Marshall St	EB	10	455		465	3.1	A	0.7	A			0.8	A			150	20	30			655		20					
	(Minor Street Stop)	WB	5	295	5	305	3.3	A	0.5	A	0.2	A	0.5	A	1.0	A	150	20	21			390		20					
		NB		5	10	15			9.4	A	4.9	A	6.4	A								385	20	55					
		SB	10	5	10	25	10.3	B	12.1	B	4.0	A	8.1	A								812	21	73					
	TH 19 at N 3rd St	EB	5	470		475	3.2	A	0.6	A			0.6	A			150	20	22			390							
	(Minor Street Stop)	WB		290	80	370			0.5	A	0.5	A	0.5	A	1.3	A						390					150		
		SB	50		15	65	13.2	B			3.8	A	11.0	B			350	25	76								100	20	40
	TH 19 at Bruce St	EB	35	460	50	545	4.2	A	1.0	A	0.7	A	1.2	A			200	20	46			493	20	23					
	(Minor Street Stop)	WB	70	305	45	420	5.5	A	1.1	A	0.4	A	1.8	A	12.2	B	200	23	68			1065		20			535	20	22
		NB	55	80	120	255	47.6	E	49.9	E	28.7	D	39.4	E			150	54	156		12 %	745	116	386					
		SB	75	95	40	210	32.2	D	28.6	D	22.5	C	28.7	D			150	50	157		3 %	764	72	235					
MD Peak Hour	TH 19 at S 4th St	EB	10	160	45	215	2.4	A	0.9	A	0.5	A	0.9	A								758	20	35					
	(Minor Street Stop)	WB	10	170	10	190	3.0	A	0.5	A	0.3	A	0.6	A	3.3	A						195	20	39					
		NB	40	55	10	105	8.0	A	8.3	A	4.5	A	7.8	A								1544	40	88					
		SB	10	80	45	135	7.8	A	9.2	A	4.8	A	7.6	A								523	44	95					
	TH 19 at S 2nd St/CC Dr	EB	125	25		150	10.1	B	7.5	A			9.7	A								264	48	117					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	45	70	5.8	A	11.4	B	3.9	A	6.2	A	3.7	A						945	20	36			100	20	42
		NB		120	5	125			0.4	A	2.0	A	0.5	A															
	(Minor Street Stop)	SB	35	150	140	325	3.3	A	1.3	A	1.4	A	1.6	A								1066	20	39			100		20
	TH 19 at Saratoga St	EB	25	255	35	315	4.7	A	1.2	A	0.9	A	1.4	A			80	20	50			1066	20	20			120	20	20
	(Minor Street Stop)	WB	45	290	35	370	5.1	A	2.5	A	2.3	A	2.8	A	5.3	A	150	20	42			735		20			150		20
		NB	35	60	40	135	14.2	B	13.4	B	4.7	A	11.0	B								886	37	96			100	20	43
		SB	40	85	45	170	15.4	C	16.1	C	5.6	A	13.2	B								802	48	126	1 %		100	20	71
	TH 19 at Main St/US59 (Signal)	EB	50	200	95	345	24.1	C	28.0	C	9.2	A	22.3	C			130	29	115		10 %	735	109	266	10 %		100	47	124
		WB	90	250	135	475	23.9	C	26.3	C	5.9	A	20.0	C	22.2	C	150	60	174		7 %	298	137	279	7 %		150	63	175
		NB	80	320	80	480	22.8	C	28.7	C	5.4	A	23.8	C			200	53	224		6 %	1161	174	419	6 %		350	26	190
		SB	130	320	65	515	24.9	C	25.2	C	4.7	A	22.5	C			150	74	175		9 %	802	155	395	9 %		400	20	52
	TH 19 at Lyon St	EB	35	370	5	410	5.7	A	1.9	A	1.2	A	2.2	A			80	20	50										
	(Minor Street Stop)	WB	5	405	55	465	4.7	A	1.6	A	1.3	A	1.6	A	3.4	A	130	20	30			654	20	44			130		20
		NB	5	5	10	20	13.7	B	15.7	C	5.0	A	9.9	A			50	20	28			369	20	42					
		SB	75	5	65	145	16.1	C	17.0	C	5.8	A	11.5	B			100	33	81			798	22	57					
	TH 19 at Marshall St	EB	15	430	5	450	3.7	A	0.8	A	0.5	A	0.9	A			150	20	32			655		20					
	(Minor Street Stop)	WB	5	450	10	465	3.8	A	0.8	A	0.4	A	0.8	A	1.3	A	150	20	24			390							
		NB	5	5	15	25	10.6	B	10.8	B	4.1	A	6.7	A								385	20	42					
		SB	10	10	15	35	11.7	B	10.9	B	4.6	A	8.4	A								812	22	60					
	TH 19 at N 3rd St	EB	5	450		455	6.0	A	0.6	A			0.7	A			150	20	33			390							
	(Minor Street Stop)	WB		460	120	580			0.7	A	0.7	A	0.7	A	1.5	A						390					150		20
		SB	60		5	65	14.1	B			4.6	A	13.4	B			350	28	65								100	20	21
	TH 19 at Bruce St	EB	45	420	50	515	5.0	A	0.9	A	0.5	A	1.2	A			200	20	51			493	20	26					
	(Minor Street Stop)	WB	115	435	85	635	5.0	A	1.4	A	0.6	A	1.9	A	7.3	A	200	27	67			1065		20			535	20	20
		NB	40	60	130	230	22.8	C	29.2	D	14.0	B	19.5	C			150	31	90		1 %	745	73	178					
		SB	120	70	70	260	27.7	D	23.6	C	9.4	A	21.7	C			150	61	133			764	58	148					
PM Peak Hour	TH 19 at S 4th St	EB	10	195	90	295	2.6	A	1.3	A	0.8	A	1.2	A								758	20	36					
	(Minor Street Stop)	WB	10	135	10	155	2.9	A	0.5	A	0.2	A	0.6	A	4.0	A						195	20	54					
		NB	40	80	5	125	8.3	A	8.7	A	4.7	A	8.4	A								1544	40	82					
		SB	15	100	25	140	10.4	B	10.7	B	5.4	A	9.7	A								523	46	106					
	TH 19 at S 2nd St/CC Dr	EB	155	25		180	10.1	B	6.9	A			9.7	A								264	61	159					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	30	55	9.3	A	11.6	B	4.3	A	7.4	A	4.0	A						945	20	62			100	20	37
		NB		105	5	110			0.4	A	2.0	A	0.5	A															
	(Minor Street Stop)	SB	45	150	115	310	3.0	A	1.2	A	1.1	A	1.4	A								1066	20	41			100	20	20
	TH 19 at Saratoga St	EB	15	260	40	315	3.7	A	1.2	A	0.9	A	1.3	A			80	20	24			1066		20			120		20
	(Minor Street Stop)	WB	45	280	35	360	5.3	A	2.3	A	1.9	A	2.6	A	6.0	A	150	20	40			735		20			150		20
		NB	45	80	50	175	15.3	C	14.7	B	4.8	A	12.0	B								886	45	97			100	20	57
		SB	40	125	30	195	15.6	C	16.4	C	5.4	A	14.5	B								802	57	148	2 %		100	20	70
	TH 19 at Main St/US59 (Signal)	EB	70	190	115	375	27.9	C	34.1	C	16.2	B	27.5	C			130	45	153		12 %	735	117	293	12 %	1 %	100	55	125
		WB	120	220	130	470	27.9	C	30.6	C	6.0	A	23.1	C	30.0	C	150	73	169		5 %	298	123	278	5 %		150	55	175
		NB	75	350	60	485	30.4	C	26.6	C	5.1	A	24.5	C			200	48	178		6 %	1161	165	392	6 %		350	20	115
		SB	105	485	95	685	37.2	D	47.2	D	6.2	A	40.0	D			150	75	175		26 %	802	325	751	26 %		400	70	335
	TH 19 at Lyon St	EB	35	315	10	360	5.1	A	1.7	A	1.2	A	2.0	A			80	20	46										
	(Minor Street Stop)	WB	15	390	55	460	4.1	A	1.4	A	1.0	A	1.4	A	2.9	A	130	20	33			654	20	64			130		20
		NB		10	15	25			13.4	B	5.4	A	8.6	A							1 %	369	20	56					
		SB	70	5	75	150	12.4	B	12.4	B	5.3	A	8.9	A			100	27	67			798	25	65					
	TH 19 at Marshall St	EB	25	355	5	385	4.3	A	0.8	A	0.8	A	1.0	A			150	20	41			655		20					
	(Minor Street Stop)	WB	15	430	5	450	3.5	A	0.8	A	0.4	A	0.9	A	1.6	A	150	20	33			390							
		NB	5	10	20	35	11.1	B	10.1	B	4.6	A	7.1	A								385	23	55					
		SB	5	15	35	55	11.9	B	11.0	B	5.2	A	7.4	A								812	30	69					
	TH 19 at N 3rd St	EB	10	370		380	4.1	A	0.5	A			0.6	A			150	20	35			390							
	(Minor Street Stop)	WB		445	90	535			0.7	A	0.6	A	0.7	A	1.3	A						390							
		SB	55		5	60	11.3	B			3.9	A	10.7	B			350	25	60								100	20	21
	TH 19 at Bruce St	EB	45	320	40	405	5.1	A	0.8	A	0.5	A	1.2	A			200	20	53			493	20	20					
	(Minor Street Stop)	WB	90	415	75	580	4.3	A	1.4	A	0.5	A	1.7	A	8.8	A	200	22	57			1065		20			535	20	23
		NB	45	105	115	265	23.2	C	31.9	D	21.5	C	25.9	D			150	33	131		6 %	745	94	257					
		SB	90	85	70	245	24.7	C	22.1	C	9.9	A	19.6	C			150	48	139		1 %	764	60	173					

NOTES: TH 19 is the East-West Roadway; except where noted at Country Club Drive/2nd St.

NOTES **1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.**
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

Table B5
TH 19 Marshall Assumes 0.5% Growth Per Year (Factor 1.13)
Build Conditions (2045) - Alternative 3 (Minor Street Stops at Lyon St and Country Club Dr) (All-way Stops at Saratoga St, Main St, and Bruce St)
AM / MD / PM Peak Hours

	Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Vehicle Queing Information (feet)											
																	Left Turn Lane				Through Lane (s)					Right Turn Lane			
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Thru [2] ---->	% Block Left [2] <----	Link Length (feet)	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Right [2] ---->	% Block Thru [2] <----	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]
AM Peak Hour	TH 19 at S 4th St	EB	10	155	40	205	3.0	A	0.8	A	0.4	A	0.8	A								758	20	40					
	(Minor Street Stop)	WB	95	200	25	320	3.0	A	1.2	A	0.8	A	1.7	A	4.0	A						195	20	81					
		NB	45	80	20	145	9.5	A	12.8	B	8.7	A	11.2	B								1544	53	127					
		SB	5	65	10	80	7.9	A	9.5	A	4.6	A	8.8	A								523	41	87					
	TH 19 at S 2nd St/CC Dr	EB	155	10		165	16.0	C	5.5	A			15.4	C								264	59	148					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	80	65	150	7.4	A	36.0	E	11.9	B	24.6	C	8.7	A						945	48	189	5 %		100	24	91
		NB		240	10	250			0.8	A	2.1	A	0.9	A								799		20					
	(Minor Street Stop)	SB	15	75	180	270	5.5	A	2.4	A	2.9	A	2.9	A								1066	20	28			100	20	20
	TH 19 at Saratoga St	EB	25	410	50	485	32.0	D	33.9	D	18.6	C	32.2	D			80	26	104		27 %	1066	167	542	27 %		120	39	145
	(All-way Stop)	WB	40	265	20	325	9.1	A	10.4	B	6.4	A	10.0	B	19.4	C	150	21	75		1 %	735	50	140	1 %		150	20	48
		NB	40	100	50	190	11.4	B	11.9	B	6.4	A	10.3	B								886	42	127	1 %		100	22	90
		SB	25	75	30	130	8.9	A	10.1	B	4.2	A	8.5	A								802	34	87			100	20	40
	TH 19 at Main St/US59	EB	80	270	110	460	35.8	E	43.8	E	26.3	D	38.2	E			130	59	144		26 %	735	168	498	26 %		100	67	125
	(All-way Stop)	WB	45	185	80	310	12.6	B	19.6	C	6.3	A	15.2	C	47.0	E	150	28	101		1 %	298	71	186	1 %		150	39	126
		NB	105	295	50	450	48.7	E	73.3	F	24.2	C	62.1	F			200	98	225		28 %	1161	247	824	28 %		350	84	339
		SB	140	270	90	500	51.4	F	83.4	F	9.2	A	61.1	F			150	98	175		39 %	802	258	598	39 %		400	80	378
	TH 19 at Lyon St	EB	25	425	5	455	4.9	A	2.3	A	2.4	A	2.4	A			80	20	33			298		20					
	(Minor Street Stop)	WB	5	270	25	300	3.8	A	0.9	A	0.7	A	0.9	A	2.7	A	130	20	33								130		20
		NB	5	10	5	20	14.0	B	12.2	B	4.1	A	10.6	B			50	20	43			369	20	54					
		SB	45	5	30	80	12.3	B	10.0	B	3.6	A	8.9	A			100	22	67			798	20	46					
	TH 19 at Marshall St	EB	10	455		465	2.5	A	0.4	A			0.4	A			150	20	31			655		20					
	(Minor Street Stop)	WB	5	295	5	305	3.9	A	0.5	A	0.4	A	0.6	A	0.8	A	150	20	27			390		20					
		NB		5	10	15			10.3	B	4.8	A	6.6	A								385	20	56					
		SB	10	5	10	25	10.1	B	11.8	B	3.8	A	7.9	A								812	23	76					
	TH 19 at N 3rd St	EB	5	470		475	3.0	A	0.4	A			0.4	A			150	20	20			390							
	(Minor Street Stop)	WB		290	80	370			0.4	A	0.4	A	0.4	A	1.2	A						390					150		
		SB	50		15	65	14.7	B			3.5	A	12.1	B			350	26	83								100	20	41
	TH 19 at Bruce St	EB	35	460	50	545	7.5	A	10.3	B	8.1	A	9.9	A			200	24	53			493	66	126					
	(All-way Stop)	WB	70	305	45	420	9.9	A	14.1	B	4.1	A	12.3	B	10.4	B	200	35	86		1 %	1065	80	203	1 %		535	26	66
		NB	55	80	120	255	9.1	A	12.3	B	8.3	A	9.7	A			150	27	69			745	59	139					
		SB	75	95	40	210	8.1	A	10.5	B	5.3	A	8.7	A			150	33	77			764	47	100					
MD Peak Hour	TH 19 at S 4th St	EB	10	160	45	215	2.6	A	0.8	A	0.4	A	0.8	A								758	20	42					
	(Minor Street Stop)	WB	10	170	10	190	3.1	A	0.4	A	0.2	A	0.5	A	3.3	A						195	20	38					
		NB	40	55	10	105	7.3	A	8.2	A	5.6	A	7.6	A								1544	38	74					
		SB	10	80	45	135	9.4	A	9.2	A	4.9	A	7.8	A								523	46	96					
	TH 19 at S 2nd St/CC Dr	EB	125	25		150	10.0	B	7.6	A			9.6	A								264	49	108					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	45	70	8.7	A	10.8	B	4.4	A	6.5	A	4.3	A						945	20	42			100	20	46
		NB		120	5	125			0.5	A	2.0	A	0.6	A															
	(Minor Street Stop)	SB	35	150	140	325	4.3	A	2.4	A	2.6	A	2.7	A								1066	20	27			100		20
	TH 19 at Saratoga St	EB	25	255	35	315	7.6	A	9.3	A	4.8	A	8.7	A			80	20	69		1 %	1066	48	100	1 %		120	20	44
	(All-way Stop)	WB	45	290	35	370	8.5	A	9.3	A	5.9	A	8.9	A	8.3	A	150	22	50			735	43	77			150	20	47
		NB	35	60	40	135	7.0	A	8.4	A	3.9	A	6.7	A								886	31	67			100	20	38
		SB	40	85	45	170	7.8	A	8.6	A	4.3	A	7.3	A								802	37	78			100	20	42
	TH 19 at Main St/US59	EB	50	200	95	345	16.1	C	22.3	C	10.8	B	18.2	C			130	28	93		5 %	735	68	177	5 %		100	37	115
	(All-way Stop)	WB	90	250	135	475	16.2	C	25.4	D	8.3	A	18.8	C	42.7	E	150	51	155		7 %	298	96	260	7 %		150	56	157
		NB	80	320	80	480	34.9	D	68.1	F	20.3	C	54.6	F			200	83	225		31 %	1161	258	725	31 %		350	95	375
		SB	130	320	65	515	69.2	F	82.9	F	9.4	A	70.2	F			150	104	175		40 %	802	318	717	40 %		400	137	522
	TH 19 at Lyon St	EB	35	370	5	410	6.0	A	2.1	A	1.8	A	2.4	A			80	20	43										
	(Minor Street Stop)	WB	5	405	55	465	5.0	A	2.0	A	1.4	A	2.0	A	3.5	A	130	20	43		1 %	654	20	76	1 %		130	20	24
		NB	5	5	10	20	15.9	C	11.5	B	4.8	A	9.3	A			50	20	29			369	20	54					
		SB	75	5	65	145	15.2	C	12.3	B	5.8	A	10.9	B			100	31	80			798	22	52					
	TH 19 at Marshall St	EB	15	430	5	450	3.6	A	0.5	A	0.6	A	0.6	A			150	20	31			655							
	(Minor Street Stop)	WB	5	450	10	465	3.3	A	0.7	A	0.3	A	0.7	A	1.1	A	150	20	27			390		20					
		NB	5	5	15	25	9.6	A	11.3	B	4.3	A	6.8	A								385	20	42					
		SB	10	10	15	35	11.3	B	9.6	A	4.6	A	7.9	A								812	24	71					
	TH 19 at N 3rd St	EB	5	450		455	3.4	A	0.4	A			0.4	A			150	20	24			390							
	(Minor Street Stop)	WB		460	120	580			0.6	A	0.5	A	0.6	A	1.2	A						390					150		20
		SB	60		5	65	13.6	B			3.9	A	12.9	B			350	26	60								100	20	21
	TH 19 at Bruce St	EB	45	420	50	515	7.8	A	9.3	A	7.2	A	9.0	A			200	24	60			493	64	113					
	(All-way Stop)	WB	115	435	85	635	10.2	B	16.7	C	4.2	A	13.8	B	10.6	B	200	46	161		3 %	1065	107	268	3 %		535	32	70
		NB	40	60	130	230	8.0	A	11.5	B	7.0	A	8.3	A			150	23	54			745	52	113					
		SB	120	70	70	260	8.8	A	10.3	B	5.0	A	8.2	A			150	40	80			764	47	99					
PM Peak Hour	TH 19 at S 4th St	EB	10	195	90	295	2.8	A	1.3	A	0.7	A	1.2	A								758	20	38					
	(Minor Street Stop)	WB	10	135	10	155	3.1	A	0.4	A	0.3	A	0.6	A	4.1	A						195	20	41					
		NB	40	80	5	125	8.1	A	9.2	A	4.7	A	8.7	A								1544	43	81					
		SB	15	100	25	140	10.4	B	11.0	B	5.5	A	10.0	B								523	45	104					
	TH 19 at S 2nd St/CC Dr	EB	155	25		180	10.4	B	7.0	A			9.9	A								264	61	135					
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	30	55	5.9	A	10.9	B	3.9	A	6.6	A	4.6	A						945	20	69			100	20	47
		NB		105	5	110			0.4	A	1.9	A	0.5	A															
	(Minor Street Stop)	SB	45	150	115	310	4.2	A	2.5	A	2.4	A	2.7	A								1066	20	45			100		20
	TH 19 at Saratoga St	EB	15	260	40	315	8.2	A	9.6	A	4.9	A	8.9	A			80	20	31		2 %	1066	52	109	2 %		120	20	43
	(All-way Stop)	WB	45	280	35	360	9.0	A	9.3	A	5.4	A	8.9	A	8.5	A	150	20	43			735	40	82			150	20	29
		NB	45	80	50	175	8.1	A	8.7	A	4.2	A	7.3	A								886	34	81			100	20	56
		SB	40	125	30	195	7.8	A	9.1	A	4.4	A	8.1	A								802	42	89			100	20	37
	TH 19 at Main St/US59	EB	70	190	115	375	16.2	C	21.6	C	12.5	B	17.8	C			130	35	103		3 %	735	60	169	3 %		100	41	119
	(All-way Stop)	WB	120	220	130	470	16.2	C	18.0	C	7.1	A	14.5	B	92.5	F	150	54	123		1 %	298	74	171	1 %		150	47	128
		NB	75	350	60	485	29.3	D	55.3	F	13.5	B	46.1	E			200	74	211		22 %	1161	208	529	22 %		350	51	244
		SB	105	485	95	685	239.7	F	251.1	F	37.6	E	219.7	F			150	150	175		99 %	802	819	842	99 %		400	809	841
	TH 19 at Lyon St	EB	35	315	10	360	5.7	A	2.0	A	2.0	A	2.4	A			80	20	42			298		20					
	(Minor Street Stop)	WB	15	390	55	460	3.8	A	1.3	A	0.9	A	1.3	A	3.0	A	130	20	37			654	20	20			130		20
		NB		10	15	25			14.0	B	4.3	A	8.2	A								369	20	46					
		SB	70	5	75	150	12.0	B	13.5	B	5.1	A	8.6	A			100	28	63			798	25	73					
	TH 19 at Marshall St	EB	25	355	5	385	3.2	A	0.5	A	0.4	A	0.7	A			150	20	37			655							
	(Minor Street Stop)	WB	15	430	5	450	3.3	A	0.7	A	0.3	A	0.8	A	1.3	A	150	20	35			390							
		NB	5	10	20	35	11.3	B	9.7	A	4.4	A	6.9	A								385	21	53					
		SB	5	15	35	55	10.0	B	10.0	B	5.0	A	6.8	A								812	30	68					
	TH 19 at N 3rd St	EB	10	370		380	5.0	A	0.3	A			0.4	A			150	20	33			390							
	(Minor Street Stop)	WB		445	90	535			0.6	A	0.5	A	0.6	A	1.1	A						390		20					
		SB	55		5	60	11.1	B			4.0	A	10.5	B			350	25	53								100	20	21
	TH 19 at Bruce St	EB	45	320	40	405	7.5	A	8.2	A	5.8	A	7.9	A			200	25	57			493	49	80					
	(All-way Stop)	WB	90	415	75	580	10.1	B	17.3	C	4.1	A	14.5	B	10.5	B	200	43	158		3 %	1065	109	273	3 %		535	32	72
		NB	45	105	115	265	8.2	A	10.4	B	6.3	A	8.2	A			150	26	60			745	54	100					
		SB	90	85	70	245	7.9	A	10.1	B	5.0	A	7.8	A			150	35	71			764	46	92					

NOTES: TH 19 is the East-West Roadway; except where noted at Country Club Drive/2nd St.

NOTES **1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.**
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

Table B6
TH 19 Marshall Assumes 0.5% Growth Per Year (Factor 1.13)
Build Conditions (2045) - Alternative 4 (Minor Street Stop at Lyon St) (Single Lane roundabouts at 4th St, Country Club Dr, Saratoga St, Marshal St, and Bruce St) (Multi-lane roundabout at Main St)
AM / MD / PM Peak Hours

	Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Vehicle Queing Information (feet)											
																	Left Turn Lane				Through Lane (s)					Right Turn Lane			
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Thru [2] ---->	% Block Left [2] <----	Link Length (feet)	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Right [2] ---->	% Block Thru [2] <----	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]
AM Peak Hour	TH 19 at Lyon St	EB	25	425	5	455	5.7	A	2.6	A	3.6	A	2.8	A			80	20	31			288		20					
	(Minor Street Stop)	WB	5	270	25	300	3.4	A	0.7	A	0.5	A	0.7	A	2.8	A	130	20	28			635	20	20			130		20
		NB	5	10	5	20	9.8	A	12.0	B	3.8	A	9.4	A			50	20	38		1 %	369	20	58					
		SB	45	5	30	80	12.4	B	10.1	B	3.7	A	9.0	A			100	23	66			798	20	54					
	TH 19 at N 3rd St	EB	5	470		475	4.3	A	0.3	A			0.3	A			150	20	25			390							
	(Minor Street Stop)	WB		290	80	370			0.5	A	0.5	A	0.5	A	1.2	A						390					150		
		SB	50		15	65	14.9	B			4.0	A	12.4	B			350	26	73								100	20	43
MD Peak Hour	TH 19 at Lyon St	EB	35	370	5	410	6.2	A	2.2	A	1.7	A	2.5	A			80	20	47										
	(Minor Street Stop)	WB	5	405	55	465	4.7	A	1.7	A	1.2	A	1.7	A	3.5	A	130	20	43		1 %	635	20	54	1 %		130	20	20
		NB	5	5	10	20	13.2	B	12.3	B	4.1	A	8.4	A			50	20	25			369	20	42					
		SB	75	5	65	145	15.1	C	11.4	B	7.3	A	11.5	B			100	32	**86**			798	25	69					
	TH 19 at N 3rd St	EB	5	450		455	4.4	A	0.3	A			0.3	A			150	20	35			390							
	(Minor Street Stop)	WB		460	120	580			0.7	A	0.6	A	0.7	A	1.3	A						390					150		20
		SB	60		5	65	15.3	C			4.1	A	14.4	B			350	27	73								100	20	21
PM Peak Hour	TH 19 at Lyon St	EB	35	315	10	360	5.6	A	2.1	A	1.8	A	2.4	A			80	20	35										
	(Minor Street Stop)	WB	15	390	55	460	3.6	A	1.6	A	0.8	A	1.6	A	3.6	A	130	20	45		1 %	635	20	51	1 %		130	20	35
		NB		10	15	25			12.9	B	4.2	A	7.7	A								369	20	45					
		SB	70	5	75	150	15.6	C	20.2	C	8.5	A	12.2	B			100	29	71		1 %	798	27	79					
	TH 19 at N 3rd St	EB	10	370		380	4.4	A	0.3	A			0.4	A			150	20	31			390							
	(Minor Street Stop)	WB		445	90	535			0.6	A	0.5	A	0.6	A	1.2	A						390							
		SB	55		5	60	12.0	B			4.0	A	11.3	B			350	25	65								100	20	24

NOTES: TH 19 is the East-West Roadway; except where noted at Country Club Drive/2nd St.

NOTES
1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	AM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at S 4th St
E/W Street Name	TH 19
N/S Street Name	S 4th St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.70
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	10	155	40	0	95	200	25	0	45	80	20	0	5	65	10
Percent Heavy Vehicles, %	3	10	17	3	3	10	5	0	3	5	4	0	3	0	9	25
Flow Rate (v_{PCE}), pc/h	0	16	259	59	0	149	300	36	0	68	119	29	0	7	101	18
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		334			485			216			126	
Entry Volume, veh/h		293			457			208			114	
Circulating Flow (v_c), pc/h	257			203			282			517		
Exiting Flow (v_{ex}), pc/h	295			386			171			309		
Capacity (c_{pce}), pc/h		1062			1122			1035			814	
Capacity (c), veh/h		932			1058			998			737	
v/c Ratio (x)		0.31			0.43			0.21			0.15	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		7.2			8.1			5.6			6.5	
Lane LOS		A			A			A			A	
95% Queue, veh		1.4			2.2			0.8			0.5	
Approach Delay, s/veh	7.2			8.1			5.6			6.5		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	7.2						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	MD
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at S 4th St
E/W Street Name	TH 19
N/S Street Name	S 4th St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.87
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	10	160	45	0	10	170	10	0	40	55	10	0	10	80	45
Percent Heavy Vehicles, %	3	9	6	3	3	0	6	0	3	3	6	0	3	14	4	3
Flow Rate (v_{PCE}), pc/h	0	13	195	53	0	11	207	11	0	47	67	11	0	13	96	53
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		261			229			125			162	
Entry Volume, veh/h		247			217			120			155	
Circulating Flow (v_c), pc/h	120			127			221			265		
Exiting Flow (v_{ex}), pc/h	219			307			91			160		
Capacity (c_{pce}), pc/h		1221			1212			1101			1053	
Capacity (c), veh/h		1157			1150			1056			1009	
v/c Ratio (x)		0.21			0.19			0.11			0.15	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		5.0			4.8			4.4			5.0	
Lane LOS		A			A			A			A	
95% Queue, veh		0.8			0.7			0.4			0.5	
Approach Delay, s/veh	5.0			4.8			4.4			5.0		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	4.9						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	PM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at S 4th St
E/W Street Name	TH 19
N/S Street Name	S 4th St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.74
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	10	195	90	0	10	135	10	0	40	80	5	0	15	100	25
Percent Heavy Vehicles, %	3	0	2	0	3	18	6	0	3	0	0	0	3	0	0	5
Flow Rate (v_{PCE}), pc/h	0	14	269	122	0	16	193	14	0	54	108	7	0	20	135	35
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		405			223			169			190	
Entry Volume, veh/h		400			210			169			188	
Circulating Flow (v_c), pc/h	171			176			303			263		
Exiting Flow (v_{ex}), pc/h	296			282			136			273		
Capacity (c_{pce}), pc/h		1159			1153			1013			1055	
Capacity (c), veh/h		1144			1084			1013			1046	
v/c Ratio (x)		0.35			0.19			0.17			0.18	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		6.6			5.1			5.1			5.1	
Lane LOS		A			A			A			A	
95% Queue, veh		1.6			0.7			0.6			0.7	
Approach Delay, s/veh	6.6			5.1			5.1			5.1		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	5.7						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	AM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Country Club Dr
E/W Street Name	TH 19/2nd St
N/S Street Name	TH 19/Country Club Dr
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.71
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	155	10	20	0	5	80	65	0	60	240	10	0	15	75	180
Percent Heavy Vehicles, %	3	10	14	0	3	0	4	2	3	2	3	0	3	0	1	8
Flow Rate (v_{PCE}), pc/h	0	240	16	28	0	7	117	93	0	86	348	14	0	21	107	274
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		284			217			448			402	
Entry Volume, veh/h		260			211			436			381	
Circulating Flow (v_c), pc/h	135			674			277			210		
Exiting Flow (v_{ex}), pc/h	51			477			681			142		
Capacity (c_{pce}), pc/h		1202			694			1040			1114	
Capacity (c), veh/h		1102			674			1013			1055	
v/c Ratio (x)		0.24			0.31			0.43			0.36	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		5.5			9.3			8.4			7.1	
Lane LOS		A			A			A			A	
95% Queue, veh		0.9			1.3			2.2			1.7	
Approach Delay, s/veh	5.5			9.3			8.4			7.1		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	7.6						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	MD
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Country Club Dr
E/W Street Name	TH 19/2nd St
N/S Street Name	TH 19/Country Club Dr
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.88
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	125	25	25	0	5	20	45	0	25	120	5	0	35	150	140
Percent Heavy Vehicles, %	3	7	4	0	3	0	0	3	3	0	2	0	3	3	2	6
Flow Rate (v_{PCE}), pc/h	0	152	30	28	0	6	23	53	0	28	139	6	0	41	174	169
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		210			82			173			384	
Entry Volume, veh/h		199			80			170			370	
Circulating Flow (v_c), pc/h	221			319			223			57		
Exiting Flow (v_{ex}), pc/h	77			220			344			208		
Capacity (c_{pce}), pc/h		1101			997			1099			1302	
Capacity (c), veh/h		1043			978			1082			1254	
v/c Ratio (x)		0.19			0.08			0.16			0.29	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		5.2			4.4			4.7			5.5	
Lane LOS		A			A			A			A	
95% Queue, veh		0.7			0.3			0.6			1.2	
Approach Delay, s/veh	5.2			4.4			4.7			5.5		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	5.2						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	AM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Country Club Dr
E/W Street Name	TH 19/2nd St
N/S Street Name	TH 19/Country Club Dr
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.85
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	155	25	35	0	5	20	30	0	20	105	5	0	45	150	115
Percent Heavy Vehicles, %	3	11	0	0	3	50	17	7	3	6	5	44	3	2	1	10
Flow Rate (v_{PCE}), pc/h	0	202	29	41	0	9	28	38	0	25	130	8	0	54	178	149
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		272			75			163			381	
Entry Volume, veh/h		252			65			153			365	
Circulating Flow (v_c), pc/h	241			357			285			62		
Exiting Flow (v_{ex}), pc/h	91			202			370			228		
Capacity (c_{pce}), pc/h		1079			959			1032			1295	
Capacity (c), veh/h		1000			837			968			1240	
v/c Ratio (x)		0.25			0.08			0.16			0.29	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		6.1			5.1			5.2			5.6	
Lane LOS		A			A			A			A	
95% Queue, veh		1.0			0.3			0.6			1.2	
Approach Delay, s/veh	6.1			5.1			5.2			5.6		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	5.6						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	AM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Saratoga St
E/W Street Name	TH 19
N/S Street Name	Saratoga St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.71
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	25	410	50	0	40	265	20	0	40	100	50	0	25	75	30
Percent Heavy Vehicles, %	3	5	6	2	3	3	5	0	3	6	1	2	3	9	6	0
Flow Rate (v_{PCE}), pc/h	0	37	612	72	0	58	392	28	0	60	142	72	0	38	112	42
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		721			478			274			192	
Entry Volume, veh/h		683			458			268			183	
Circulating Flow (v_c), pc/h	208			239			687			510		
Exiting Flow (v_{ex}), pc/h	722			494			207			242		
Capacity (c_{pce}), pc/h		1116			1081			685			820	
Capacity (c), veh/h		1058			1035			669			780	
v/c Ratio (x)		0.65			0.44			0.40			0.23	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		12.6			8.4			10.9			7.2	
Lane LOS		B			A			B			A	
95% Queue, veh		4.9			2.3			1.9			0.9	
Approach Delay, s/veh	12.6			8.4			10.9			7.2		
Approach LOS	B			A			B			A		
Intersection Delay, s/veh | LOS	10.5						B					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	MD
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Saratoga St
E/W Street Name	TH 19
N/S Street Name	Saratoga St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.93
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	25	255	35	0	45	290	35	0	35	60	40	0	40	85	45
Percent Heavy Vehicles, %	3	10	4	0	3	0	4	3	3	6	2	0	3	3	5	0
Flow Rate (v_{PCE}), pc/h	0	30	285	38	0	48	324	39	0	40	66	43	0	44	96	48
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		353			411			149			188	
Entry Volume, veh/h		339			397			145			182	
Circulating Flow (v_c), pc/h	188			136			359			412		
Exiting Flow (v_{ex}), pc/h	372			412			135			182		
Capacity (c_{pce}), pc/h		1139			1201			957			907	
Capacity (c), veh/h		1095			1162			934			878	
v/c Ratio (x)		0.31			0.34			0.16			0.21	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		6.3			6.4			5.3			6.2	
Lane LOS		A			A			A			A	
95% Queue, veh		1.3			1.5			0.6			0.8	
Approach Delay, s/veh	6.3			6.4			5.3			6.2		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	6.2						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	PM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Saratoga St
E/W Street Name	TH 19
N/S Street Name	Saratoga St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.91
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	15	260	40	0	45	280	35	0	45	80	50	0	40	125	30
Percent Heavy Vehicles, %	3	0	3	0	0	0	2	0	3	0	0	2	3	3	1	0
Flow Rate (v_{PCE}), pc/h	0	16	294	44	0	49	314	38	0	49	88	56	0	45	139	33
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		354			401			193			217	
Entry Volume, veh/h		345			395			192			214	
Circulating Flow (v_c), pc/h	233			153			355			412		
Exiting Flow (v_{ex}), pc/h	395			396			142			232		
Capacity (c_{pce}), pc/h		1088			1181			961			907	
Capacity (c), veh/h		1062			1162			955			895	
v/c Ratio (x)		0.33			0.34			0.20			0.24	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		6.6			6.4			5.7			6.5	
Lane LOS		A			A			A			A	
95% Queue, veh		1.4			1.5			0.7			0.9	
Approach Delay, s/veh	6.6			6.4			5.7			6.5		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	6.4						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	AM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Main St
E/W Street Name	TH 19
N/S Street Name	Saratoga St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.74
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	80	270	110	0	45	185	80	0	105	295	50	0	140	270	90
Percent Heavy Vehicles, %	3	3	5	10	3	8	6	4	3	2	7	0	3	3	9	0
Flow Rate (v_{PCE}), pc/h	0	111	383	164	0	66	265	112	0	145	427	68	0	195	398	122
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		658			443			640			715	
Entry Volume, veh/h		622			419			609			676	
Circulating Flow (v_c), pc/h	659			683			689			476		
Exiting Flow (v_{ex}), pc/h	646			532			650			628		
Capacity (c_{pce}), pc/h		705			688			683			849	
Capacity (c), veh/h		666			650			651			803	
v/c Ratio (x)		0.93			0.64			0.94			0.84	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		45.1			18.2			46.3			27.6	
Lane LOS		E			C			E			D	
95% Queue, veh		12.8			4.7			12.8			9.9	
Approach Delay, s/veh	45.1			18.2			46.3			27.6		
Approach LOS	E			C			E			D		
Intersection Delay, s/veh | LOS	35.5						E					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	MD
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Main St
E/W Street Name	TH 19
N/S Street Name	Saratoga St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.94
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	50	200	95	0	90	250	135	0	80	320	80	0	130	320	65
Percent Heavy Vehicles, %	3	5	3	7	3	1	3	3	3	6	13	3	3	6	8	0
Flow Rate (v_{PCE}), pc/h	0	56	219	108	0	97	274	148	0	90	385	88	0	147	368	69
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		383			519			563			584	
Entry Volume, veh/h		367			506			511			548	
Circulating Flow (v_c), pc/h	612			531			422			461		
Exiting Flow (v_{ex}), pc/h	454			433			589			573		
Capacity (c_{pce}), pc/h		739			803			897			862	
Capacity (c), veh/h		708			782			815			810	
v/c Ratio (x)		0.52			0.65			0.63			0.68	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		13.0			15.8			14.7			16.6	
Lane LOS		B			C			B			C	
95% Queue, veh		3.0			4.8			4.5			5.4	
Approach Delay, s/veh	13.0			15.8			14.7			16.6		
Approach LOS	B			C			B			C		
Intersection Delay, s/veh | LOS	15.2						C					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	PM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Main St
E/W Street Name	TH 19
N/S Street Name	Saratoga St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.93
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	70	190	115	0	120	220	130	0	75	350	60	0	105	485	95
Percent Heavy Vehicles, %	3	5	0	4	3	2	2	3	3	2	5	0	3	0	2	0
Flow Rate (v_{PCE}), pc/h	0	79	204	129	0	132	241	144	0	82	395	65	0	113	532	102
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		412			517			542			747	
Entry Volume, veh/h		403			505			522			737	
Circulating Flow (v_c), pc/h	777			556			396			455		
Exiting Flow (v_{ex}), pc/h	382			425			618			793		
Capacity (c_{pce}), pc/h		625			783			921			868	
Capacity (c), veh/h		611			765			887			855	
v/c Ratio (x)		0.66			0.66			0.59			0.86	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		19.8			16.7			12.6			28.3	
Lane LOS		C			C			B			D	
95% Queue, veh		4.9			5.1			3.9			10.8	
Approach Delay, s/veh	19.8			16.7			12.6			28.3		
Approach LOS	C			C			B			D		
Intersection Delay, s/veh | LOS	20.2						C					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	AM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Main St
E/W Street Name	TH 19
N/S Street Name	Saratoga St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.74
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	2	0	0	0	2	0
Lane Assignment			LTR				LTR		LT		TR		LT		TR	
Volume (V), veh/h	0	80	270	110	0	45	185	80	0	105	295	50	0	140	270	90
Percent Heavy Vehicles, %	3	3	5	10	3	8	6	4	3	2	7	0	3	3	9	0
Flow Rate (v_{PCE}), pc/h	0	111	383	164	0	66	265	112	0	145	427	68	0	195	398	122
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.3276			4.3276		4.5436	4.5436		4.5436	4.5436	
Follow-Up Headway (s)		2.5352			2.5352		2.5352	2.5352		2.5352	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		658			443		301	339		336	379	
Entry Volume, veh/h		622			419		286	323		318	359	
Circulating Flow (v_c), pc/h	659			683			689			476		
Exiting Flow (v_{ex}), pc/h	646			532			650			628		
Capacity (c_{pce}), pc/h		811			795		759	759		921	921	
Capacity (c), veh/h		766			751		722	722		871	871	
v/c Ratio (x)		0.81			0.56		0.40	0.45		0.36	0.41	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		25.6			13.4		10.2	11.2		8.3	9.0	
Lane LOS		D			B		B	B		A	A	
95% Queue, veh		8.7			3.5		1.9	2.3		1.7	2.0	
Approach Delay, s/veh	25.6			13.4			10.7			8.7		
Approach LOS	D			B			B			A		
Intersection Delay, s/veh | LOS	14.6						B					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	MD
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Main St
E/W Street Name	TH 19
N/S Street Name	Saratoga St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.94
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	2	0	0	0	2	0
Lane Assignment			LTR				LTR		LT		TR		LT		TR	
Volume (V), veh/h	0	50	200	95	0	90	250	135	0	80	320	80	0	130	320	65
Percent Heavy Vehicles, %	3	5	3	7	3	1	3	3	3	6	13	3	3	6	8	0
Flow Rate (v_{PCE}), pc/h	0	56	219	108	0	97	274	148	0	90	385	88	0	147	368	69
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.3276			4.3276		4.5436	4.5436		4.5436	4.5436	
Follow-Up Headway (s)		2.5352			2.5352		2.5352	2.5352		2.5352	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		383			519		265	298		274	310	
Entry Volume, veh/h		367			506		240	271		258	291	
Circulating Flow (v_c), pc/h	612			531			422			461		
Exiting Flow (v_{ex}), pc/h	454			433			589			573		
Capacity (c_{pce}), pc/h		844			904		967	967		933	933	
Capacity (c), veh/h		809			881		878	878		877	877	
v/c Ratio (x)		0.45			0.57		0.27	0.31		0.29	0.33	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		10.4			12.3		7.0	7.5		7.3	7.8	
Lane LOS		B			B		A	A		A	A	
95% Queue, veh		2.4			3.7		1.1	1.3		1.2	1.5	
Approach Delay, s/veh	10.4			12.3			7.2			7.5		
Approach LOS	B			B			A			A		
Intersection Delay, s/veh | LOS	9.3						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	PM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Main St
E/W Street Name	TH 19
N/S Street Name	Saratoga St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.93
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	2	0	0	0	2	0
Lane Assignment			LTR				LTR		LT		TR		LT		TR	
Volume (V), veh/h	0	70	190	115	0	120	220	130	0	75	350	60	0	105	485	95
Percent Heavy Vehicles, %	3	5	0	4	3	2	2	3	3	2	5	0	3	0	2	0
Flow Rate (v_{PCE}), pc/h	0	79	204	129	0	132	241	144	0	82	395	65	0	113	532	102
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	2				2				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.3276			4.3276		4.5436	4.5436		4.5436	4.5436	
Follow-Up Headway (s)		2.5352			2.5352		2.5352	2.5352		2.5352	2.5352	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		412			517		255	287		351	396	
Entry Volume, veh/h		403			505		245	276		346	390	
Circulating Flow (v_c), pc/h	777			556			396			455		
Exiting Flow (v_{ex}), pc/h	382			425			618			793		
Capacity (c_{pce}), pc/h		734			885		990	990		939	939	
Capacity (c), veh/h		718			865		953	953		925	925	
v/c Ratio (x)		0.56			0.58		0.26	0.29		0.37	0.42	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		14.0			12.7		6.4	6.8		8.1	8.8	
Lane LOS		B			B		A	A		A	A	
95% Queue, veh		3.5			3.9		1.0	1.2		1.8	2.1	
Approach Delay, s/veh	14.0			12.7			6.6			8.5		
Approach LOS	B			B			A			A		
Intersection Delay, s/veh | LOS	10.0						B					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	AM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at S 4th St
E/W Street Name	TH 19
N/S Street Name	Marshall St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.78
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	10	445	0	0	5	295	5	0	0	5	10	0	10	5	10
Percent Heavy Vehicles, %	3	11	3	0	3	0	5	0	3	0	0	13	3	10	50	9
Flow Rate (v_{PCE}), pc/h	0	14	588	0	0	6	397	6	0	0	6	14	0	14	10	14
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		602			409			20			38	
Entry Volume, veh/h		583			390			18			32	
Circulating Flow (v_c), pc/h	30			20			616			403		
Exiting Flow (v_{ex}), pc/h	616			411			26			16		
Capacity (c_{pce}), pc/h		1338			1352			736			915	
Capacity (c), veh/h		1297			1290			677			776	
v/c Ratio (x)		0.45			0.30			0.03			0.04	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		7.3			5.5			5.6			5.0	
Lane LOS		A			A			A			A	
95% Queue, veh		2.4			1.3			0.1			0.1	
Approach Delay, s/veh	7.3			5.5			5.6			5.0		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	6.5						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	MD
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at S 4th St
E/W Street Name	TH 19
N/S Street Name	Marshall St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.95
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	15	430	5	0	5	450	10	0	5	5	15	0	10	10	15
Percent Heavy Vehicles, %	3	0	3	0	3	0	3	27	3	0	0	0	3	13	0	0
Flow Rate (v_{PCE}), pc/h	0	16	466	5	0	5	488	13	0	5	5	16	0	12	11	16
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		487			506			26			39	
Entry Volume, veh/h		473			489			26			38	
Circulating Flow (v_c), pc/h	28			26			494			498		
Exiting Flow (v_{ex}), pc/h	494			509			34			21		
Capacity (c_{pce}), pc/h		1341			1344			834			830	
Capacity (c), veh/h		1304			1299			834			801	
v/c Ratio (x)		0.36			0.38			0.03			0.05	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		6.1			6.3			4.6			5.0	
Lane LOS		A			A			A			A	
95% Queue, veh		1.7			1.8			0.1			0.1	
Approach Delay, s/veh	6.1			6.3			4.6			5.0		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	6.1						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	PM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at S 4th St
E/W Street Name	TH 19
N/S Street Name	Marshall St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.96
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	25	355	5	0	15	430	5	0	5	10	20	0	5	15	35
Percent Heavy Vehicles, %	3	0	0	0	3	0	2	17	3	0	0	0	3	17	0	3
Flow Rate (v_{PCE}), pc/h	0	26	370	5	0	16	457	6	0	5	10	21	0	6	16	38
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		401			479			36			60	
Entry Volume, veh/h		401			469			36			58	
Circulating Flow (v_c), pc/h	38			41			402			478		
Exiting Flow (v_{ex}), pc/h	397			500			42			37		
Capacity (c_{pce}), pc/h		1328			1323			916			847	
Capacity (c), veh/h		1328			1296			916			820	
v/c Ratio (x)		0.30			0.36			0.04			0.07	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		5.4			6.2			4.3			5.1	
Lane LOS		A			A			A			A	
95% Queue, veh		1.3			1.7			0.1			0.2	
Approach Delay, s/veh	5.4			6.2			4.3			5.1		
Approach LOS	A			A			A			A		
Intersection Delay, s/veh | LOS	5.7						A					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	AM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Bruce St
E/W Street Name	TH 19
N/S Street Name	Bruce St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.75
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	35	460	50	0	70	305	45	0	55	80	120	0	75	95	40
Percent Heavy Vehicles, %	3	0	4	2	3	0	4	2	3	4	7	2	3	4	6	5
Flow Rate (v_{PCE}), pc/h	0	47	638	68	0	93	423	61	0	76	114	163	0	104	134	56
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		753			577			353			294	
Entry Volume, veh/h		727			560			339			280	
Circulating Flow (v_c), pc/h	331			237			789			592		
Exiting Flow (v_{ex}), pc/h	905			555			222			295		
Capacity (c_{pce}), pc/h		985			1084			617			754	
Capacity (c), veh/h		951			1051			593			718	
v/c Ratio (x)		0.76			0.53			0.57			0.39	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		18.7			9.9			16.7			10.1	
Lane LOS		C			A			C			B	
95% Queue, veh		7.7			3.2			3.6			1.9	
Approach Delay, s/veh	18.7			9.9			16.7			10.1		
Approach LOS	C			A			C			B		
Intersection Delay, s/veh | LOS	14.5						B					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	MD
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Bruce St
E/W Street Name	TH 19
N/S Street Name	Bruce St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.96
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	45	420	50	0	115	435	85	0	40	60	130	0	120	70	70
Percent Heavy Vehicles, %	3	0	3	3	3	0	3	1	3	0	3	0	3	1	6	4
Flow Rate (v_{PCE}), pc/h	0	47	451	54	0	120	467	89	0	42	64	135	0	126	77	76
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		552			676			241			279	
Entry Volume, veh/h		537			662			239			270	
Circulating Flow (v_c), pc/h	323			153			624			629		
Exiting Flow (v_{ex}), pc/h	712			585			200			251		
Capacity (c_{pce}), pc/h		993			1181			730			727	
Capacity (c), veh/h		966			1155			725			704	
v/c Ratio (x)		0.56			0.57			0.33			0.38	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		11.1			10.1			9.0			10.2	
Lane LOS		B			B			A			B	
95% Queue, veh		3.5			3.8			1.4			1.8	
Approach Delay, s/veh	11.1			10.1			9.0			10.2		
Approach LOS	B			B			A			B		
Intersection Delay, s/veh | LOS	10.3						B					

HCS7 Roundabouts Report

General Information

Analyst	JDA
Agency or Co.	SEH
Date Performed	8/13/2019
Analysis Year	2045
Time Analyzed	PM
Project Description	TH 19 ICE Study

Site Information

Intersection	TH 19 at Bruce St
E/W Street Name	TH 19
N/S Street Name	Bruce St
Analysis Time Period (hrs)	0.25
Peak Hour Factor	0.90
Jurisdiction	MnDOT

Volume Adjustments and Site Characteristics

Approach	EB				WB				NB				SB			
Movement	U	L	T	R	U	L	T	R	U	L	T	R	U	L	T	R
Number of Lanes (N)	0	0	1	0	0	0	1	0	0	0	1	0	0	0	1	0
Lane Assignment			LTR				LTR				LTR				LTR	
Volume (V), veh/h	0	45	320	40	0	90	415	75	0	45	105	115	0	90	85	70
Percent Heavy Vehicles, %	3	3	0	0	3	0	2	1	3	0	1	1	3	0	1	2
Flow Rate (v_{PCE}), pc/h	0	52	356	44	0	100	470	84	0	50	118	129	0	100	95	79
Right-Turn Bypass	None				None				None				None			
Conflicting Lanes	1				1				1				1			
Pedestrians Crossing, p/h	0				0				0				0			

Critical and Follow-Up Headway Adjustment

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Critical Headway (s)		4.9763			4.9763			4.9763			4.9763	
Follow-Up Headway (s)		2.6087			2.6087			2.6087			2.6087	

Flow Computations, Capacity and v/c Ratios

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Entry Flow (v_e), pc/h		452			654			297			274	
Entry Volume, veh/h		450			644			295			272	
Circulating Flow (v_c), pc/h	295			220			508			620		
Exiting Flow (v_{ex}), pc/h	585			599			254			239		
Capacity (c_{pce}), pc/h		1021			1103			822			733	
Capacity (c), veh/h		1018			1086			815			727	
v/c Ratio (x)		0.44			0.59			0.36			0.37	

Delay and Level of Service

Approach	EB			WB			NB			SB		
Lane	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass	Left	Right	Bypass
Lane Control Delay (d), s/veh		8.5			11.0			8.7			9.7	
Lane LOS		A			B			A			A	
95% Queue, veh		2.3			4.1			1.7			1.7	
Approach Delay, s/veh	8.5			11.0			8.7			9.7		
Approach LOS	A			B			A			A		
Intersection Delay, s/veh | LOS	9.7						A					

Table B7
TH 19 Marshall Assumes 0.5% Growth Per Year (Factor 1.13)
Build Conditions (2045) - Alternative 5 (RI/RO at Marvin Schwan and Lyon St, 3/4 Access at Greeley St and Marshall St)
AM / MD / PM Peak Hours

	Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Vehicle Queing Information (feet)													
																	Left Turn Lane				Through Lane (s)				Right Turn Lane					
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Thru [2] <----	% Block Left [2] <----	Link Length (feet)	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Right [2] ---->	% Block Thru [2] <----	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	
AM Peak Hour	TH 19 at S 4th St	EB	10	155	40	205	4.3	A	0.9	A	0.6	A	1.0	A								758	20	52						
	(Minor Street Stop)	WB	95	200	25	320	3.8	A	1.8	A	1.1	A	2.3	A	4.7	A						195	27	129						
		NB	45	80	20	145	10.6	B	14.3	B	9.0	A	12.4	B								1544	55	138						
		SB	5	65	10	80	6.4	A	11.0	B	6.2	A	10.1	B								523	42	100						
	TH 19 at S 2nd St/CC Dr (Signal)	EB	155	10		165	21.9	C	12.5	B			21.3	C								273	90	201						
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	80	65	150	21.8	C	26.9	C	7.3	A	18.2	B	14.8	B						954	46	160	8 %		50	27	74	
		NB		240	10	250			17.3	B	2.9	A	16.7	B								804	83	207	2 %					
		SB	15	75	180	270	21.9	C	7.8	A	5.6	A	7.1	A								464	37	134		1 %	100	37	112	
	TH 19 at Greeley St	EB	10	440	25	475	5.1	A	2.2	A	1.8	A	2.2	A								464	20	90						
	(3/4 Access)	WB	10	345	5	360	5.2	A	1.6	A	1.9	A	1.7	A	2.1	A						538	20	90						
		NB			35	35					5.4	A	5.4	A								460	21	46						
		SB			5	5					4.1	A	4.1	A								451	20	30						
	TH 19 at Saratoga St (Signal)	EB	25	405	50	480	17.4	B	11.5	B	4.7	A	11.1	B			80	20	97		10 %	538	110	320	10 %		120	20	121	
		WB	100	255	20	375	20.3	C	8.5	A	3.1	A	11.4	B	13.0	B	150	47	139		1 %	449	64	211	1 %		150	20	27	
		NB	75	105	50	230	19.2	B	20.9	C	9.3	A	17.8	B								886	72	211	5 %		100	24	124	
		SB	30	80	30	140	18.8	B	18.8	B	4.3	A	15.7	B								802	50	141	1 %		100	20	81	
	TH 19 at Marvin Schwan Memorial Dr	EB		435	25	460			5.5	A	4.1	A	5.4	A								449	36	275						
	(RI/RO)	WB		380		380			1.2	A			1.2	A	3.6	A													
		NB			25	25					7.1	A	7.1	A								728	20	63						
	TH 19 at Main St/US59 (Signal)	EB	105	245	110	460	26.7	C	27.7	C	11.4	B	23.6	C			200	65	214		16 %	230	132	258	16 %		100	58	125	
		WB	50	180	80	310	26.3	C	28.0	C	5.4	A	21.9	C	26.0	C	250	37	144		4 %	304	107	267	4 %		150	42	175	
		NB	110	305	50	465	33.3	C	31.6	C	9.1	A	29.6	C			200	74	225		7 %	1161	177	491	7 %		350	23	211	
		SB	185	275	90	550	31.9	C	31.5	C	5.8	A	27.4	C			150	92	175		11 %	802	171	509	11 %		400	22	76	
	TH 19 at Lyon St	EB		470	5	475			2.0	A	2.0	A	2.0	A															
	(RI/RO)	WB		275	25	300			2.5	A	2.3	A	2.5	A	2.2	A						301		20						
		NB			5	5					4.5	A	4.5	A								368	20	26						
		SB			30	30					3.2	A	3.2	A								797	20	38						
	TH 19 at Redwood St	EB	25	445		470	6.6	A	9.6	A			9.4	A			125	20	90		2 %	301	79	162						
	(Minor Street Stop)	WB	10	300	5	315	6.4	A	8.1	A	4.7	A	8.0	A	8.7	A	125	20	35			302	65	122						
		NB	5	10	5	20	5.3	A	7.2	A	3.4	A	5.8	A								338	20	40						
		SB	5	10	5	20	4.6	A	6.8	A	3.1	A	5.3	A								334	20	49						
	TH 19 at Marshall St	EB		455		455			2.4	A			2.4	A								655								
	(RI/RO)	WB		300	5	305			0.7	A	0.4	A	0.7	A	1.8	A						390								
		NB			10	10					6.3	A	6.3	A								385	20	57						
		SB			10	10					4.1	A	4.1	A								812	20	47						
	TH 19 at N 3rd St	EB	5	460		465	4.3	A	0.3	A			0.3	A			150	20	25			390								
	(Minor Street Stop)	WB		290	80	370			0.7	A	0.6	A	0.7	A	1.6	A						390					150		20	
		SB	60		15	75	16.9	C			4.4	A	14.4	B			350	30	103								100	20	61	
	TH 19 at Bruce St (Signal)	EB	35	460	50	545	10.4	B	9.6	A	6.4	A	9.4	A			200	20	61			493	75	159						
		WB	70	305	45	420	11.0	B	9.6	A	2.3	A	9.1	A	11.8	B	200	33	76			1065	84	228			535	20	51	
		NB	55	80	120	255	23.8	C	19.2	B	9.5	A	15.6	B			150	35	113		1 %	745	71	164						
		SB	75	95	40	210	24.1	C	19.4	B	8.1	A	18.9	B			150	43	110			764	62	149						
MD Peak Hour	TH 19 at S 4th St	EB	10	160	45	215	2.7	A	0.8	A	0.5	A	0.8	A								758	20	36						
	(Minor Street Stop)	WB	10	170	10	190	3.2	A	0.5	A	0.3	A	0.6	A	3.3	A						195	20	32						
		NB	40	55	10	105	7.7	A	8.5	A	4.7	A	7.8	A								1544	41	87						
		SB	10	80	45	135	7.6	A	9.2	A	4.7	A	7.6	A								523	44	89						
	TH 19 at S 2nd St/CC Dr (Signal)	EB	125	25		150	17.3	B	13.9	B			16.7	B								273	67	171						
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	45	70	27.3	C	24.0	C	4.5	A	11.7	B	11.3	B						954	20	63			50	20	70	
		NB		120	5	125			11.6	B	2.1	A	11.2	B								804	38	99						
		SB	35	150	140	325	14.4	B	11.8	B	3.9	A	8.7	A								464	60	162	2 %		100	32	119	
	TH 19 at Greeley St	EB	5	285	5	295	4.2	A	1.3	A	0.9	A	1.3	A								464	20	40						
	(3/4 Access)	WB	40	340	5	385	4.0	A	1.9	A	1.7	A	2.1	A	1.8	A						538	20	73						
		NB			30	30					3.7	A	3.7	A								460	21	59						
		SB			5	5					3.9	A	3.9	A								451	20	33						
	TH 19 at Saratoga St (Signal)	EB	25	250	35	310	12.7	B	7.1	A	2.7	A	7.1	A			80	20	76		2 %	538	55	137	2 %		120	20	49	
		WB	100	280	35	415	13.1	B	8.1	A	2.8	A	8.9	A	10.3	B	150	39	131		1 %	449	68	191	1 %		150	20	28	
		NB	55	65	40	160	21.1	C	17.0	B	4.3	A	15.2	B								886	51	128	1 %		100	20	53	
		SB	45	90	45	180	18.9	B	17.4	B	5.5	A	14.8	B								802	56	137	1 %		100	20	68	
	TH 19 at Marvin Schwan Memorial Dr	EB		315	15	330			1.7	A	1.1	A	1.7	A								449	20	47						
	(RI/RO)	WB		390		390			1.3	A			1.3	A	1.6	A													
		NB			35	35					4.7	A	4.7	A								728	20	56						
	TH 19 at Main St/US59 (Signal)	EB	85	165	95	345	25.3	C	29.5	C	8.7	A	22.7	C			200	51	170		8 %	230	96	232	8 %		100	43	125	
		WB	95	245	135	475	25.7	C	30.8	C	6.2	A	22.8	C	26.2	C	250	61	214		8 %	304	138	296	8 %		150	61	175	
		NB	85	325	80	490	25.7	C	32.6	C	6.6	A	27.2	C			200	65	224		9 %	1161	199	482	9 %		350	33	220	
		SB	205	325	65	595	35.6	D	31.6	C	5.1	A	30.1	C			150	111	175		13 %	802	216	638	13 %		400	29	230	
	TH 19 at Lyon St	EB		445	5	450			1.8	A	1.4	A	1.8	A															
	(RI/RO)	WB		410	55	465			2.7	A	2.3	A	2.7	A	2.5	A						301	20	20						
		NB			10	10					4.7	A	4.7	A								368	20	22						
		SB			65	65					5.0	A	5.0	A								797	21	52						
	TH 19 at Redwood St	EB	30	405	5	440	6.3	A	8.8	A	6.0	A	8.6	A			125	20	43		1 %	301	72	144						
	(Minor Street Stop)	WB	30	430	10	470	6.8	A	9.7	A	7.9	A	9.5	A	8.7	A	125	21	82		1 %	302	86	167						
		NB	15	10	25	50	5.4	A	7.2	A	3.5	A	4.8	A								338	29	68						
		SB	10	15	10	35	5.3	A	6.7	A	3.3	A	5.3	A								334	21	42						
	TH 19 at Marshall St	EB		430	5	435			2.4	A	2.0	A	2.4	A								655								
	(RI/RO)	WB		455	10	465			0.9	A	0.4	A	0.9	A	1.7	A						390								
		NB			15	15					3.9	A	3.9	A								385	20	38						
		SB			15	15					4.1	A	4.1	A								812	20	33						
	TH 19 at N 3rd St	EB	5	440		445	4.6	A	0.3	A			0.3	A			150	20	33			390								
	(Minor Street Stop)	WB		460	120	580			0.9	A	0.9	A	0.9	A	1.6	A						390					150		20	
		SB	70		5	75	15.5	C			5.9	A	14.9	B			350	31	75								100	20	23	
	TH 19 at Bruce St (Signal)	EB	45	420	50	515	11.3	B	9.4	A	6.2	A	9.3	A			200	24	70			493	71	138						
		WB	115	435	85	635	10.8	B	9.6	A	2.6	A	8.9	A	11.3	B	200	41	118			1065	108	218			535	23	65	
		NB	40	60	130	230	23.9	C	20.1	C	8.4	A	14.1	B			150	28	74			745	65	155						
		SB	120	70	70	260	25.8	C	18.4	B	7.4	A	18.9	B			150	61	126			764	54	117						
PM Peak Hour	TH 19 at S 4th St	EB	10	195	90	295	2.8	A	1.3	A	0.7	A	1.2	A								758	20	24						
	(Minor Street Stop)	WB	10	135	10	155	3.3	A	0.4	A	0.2	A	0.6	A	3.9	A						195	20	46						
		NB	40	80	5	125	8.0	A	8.9	A	4.0	A	8.4	A								1544	41	89						
		SB	15	100	25	140	10.4	B	10.1	B	5.5	A	9.3	A								523	44	102						
	TH 19 at S 2nd St/CC Dr (Signal)	EB	155	25		180	15.7	B	10.1	B			14.9	B								273	73	175						
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	30	55	25.9	C	24.8	C	4.6	A	13.9	B	11.0	B						954	20	71	2 %		50	20	66	
		NB		105	5	110			9.6	A	2.6	A	9.3	A								804	30	81						
		SB	45	150	115	310	14.7	B	11.2	B	3.7	A	8.9	A								464	62	198	2 %		100	27	118	
	TH 19 at Greeley St	EB	5	275	20	300	4.1	A	1.4	A	1.2	A	1.4	A								464	20	33						
	(3/4 Access)	WB	35	320	10	365	4.1	A	2.0	A	1.3	A	2.2	A	2.0	A						538	20	94						
		NB			35	35					3.5	A	3.5	A								460	21	53						
		SB			10	10					4.0	A	4.0	A								451	20	33						
	TH 19 at Saratoga St (Signal)	EB	15	255	40	310	13.2	B	7.5	A	2.5	A	7.1	A			80	20	63		2 %	538	54	144	2 %		120	20	54	
		WB	80	270	35	385	13.5	B	9.1	A	3.2	A	9.5	A	11.4	B	150	34	140		1 %	449	74	217	1 %		150	20	83	
		NB	70	85	50	205	22.0	C	20.0	C	4.8	A	17.0	B								886	62	153	2 %		100	20	92	
		SB	45	130	30	205	18.6	B	17.8	B	5.1	A	16.1	B								802	65	138	1 %		100	20	66	
	TH 19 at Marvin Schwan Memorial Dr	EB		330	10	340			1.6	A	1.3	A	1.6	A								449	20	31						
	(RI/RO)	WB		390		390			1.3	A			1.3	A	1.6	A													
		NB			45	45					4.4	A	4.4	A								728	25	72						
	TH 19 at Main St/US59 (Signal)	EB	105	155	115	375	27.4	C	33.1	C	15.9	B	26.2	C			200	57	160		8 %	230	94	224	8 %	1 %	100	54	125	
		WB	135	220	130	485	27.0	C	33.3	C	6.6	A	24.4	C	30.8	C	250	80	221		8 %	304	141	303	8 %		150	66	175	
		NB	75	360	60	495	28.2	C	28.5	C	4.7	A	25.6	C			200	58	213		7 %	1161	180	375	7 %		350	20	112	
		SB	175	490	95	760	44.6	D	45.8	D	6.2	A	40.6	D			150	109	175		26 %	802	337	710	26 %		400	97	378	
	TH 19 at Lyon St	EB		385	10	395			1.7	A	1.3	A	1.7	A															
	(RI/RO)	WB		405	55	460			2.8	A	2.4	A	2.8	A	2.6	A						301	20	39						
		NB			15	15					3.9	A	3.9	A								368	20	34						
		SB			75	75					5.7	A	5.7	A								797	25	66						
	TH 19 at Redwood St	EB	40	345	5	390	6.3	A	7.8	A	5.9	A	7.6	A			125	24	49			301	59	104						
	(Minor Street Stop)	WB	30	440	5	475	6.7	A	10.1	B	7.3	A	9.9	A	8.6	A	125	22	85		2 %	302	88	190						
		NB	25	15	10	50	5.7	A	7.5	A	3.1	A	5.7	A								338	27	68						
		SB	5	15	15	35	4.8	A	6.9	A	3.5	A	5.1	A								334	21	47						
	TH 19 at Marshall St	EB		355	5	360			2.3	A	2.3	A	2.3	A								655								
	(RI/RO)	WB		445	5	450			0.9	A	0.6	A	0.9	A	1.7	A						390								
		NB			20	20					4.1	A	4.1	A								385	20	40						
		SB			35	35					5.2	A	5.2	A								812	23	61						
	TH 19 at N 3rd St	EB	10	365		375	5.2	A	0.2	A			0.3	A			150	20	35			390								
	(Minor Street Stop)	WB		445	90	535			0.8	A	0.7	A	0.8	A	1.4	A						390		20						
		SB	60		5	65	12.9	B			6.0	A	12.4	B			350	28	70								100	20	23	
	TH 19 at Bruce St (Signal)	EB	45	320	40	405	10.9	B	8.9	A	5.1	A	8.7	A			200	25	61			493	56	110						
		WB	90	415	75	580	11.0	B	10.4	B	2.6	A	9.5	A	12.0	B	200	35	105			1065	106	245			535	21	58	
		NB	45	105	115	265	24.3	C	20.4	C	10.2	B	16.6	B			150	31	93		1 %	745	79	188						
		SB	90	85	70	245	25.2	C	19.2	B	7.5	A	18.1	B			150	51	113			764	60	148						

NOTES: TH 19 is the East-West Roadway; except where noted at Country Club Drive/2nd St.

NOTES
1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

Table B8
TH 19 Marshall Assumes 0.5% Growth Per Year (Factor 1.13)
Build Conditions (2045) - Alternative 6 (Roundabout at 4th St and Country Club Dr, Minor Street stop at Lyon St, RI/RO at Marshall St)
AM / MD / PM Peak Hours

	Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Vehicle Queing Information (feet)											
																	Left Turn Lane				Through Lane (s)					Right Turn Lane			
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Thru [2] ---->	% Block Left [2] <----	Link Length (feet)	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Right [2] ---->	% Block Thru [2] <----	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]
AM Peak Hour	TH 19 at Greeley St	EB	10	440	25	475	3.2	A	1.2	A	1.0	A	1.2	A								451	20	54					
	(Minor Street Stop)	WB	10	320	5	335	5.3	A	1.6	A	1.5	A	1.7	A	2.2	A						538	20	66					
		NB	25	5	35	65	15.5	C	20.9	C	6.7	A	11.2	B								460	34	79					
		SB	5	5	5	15	13.4	B	8.6	A	4.0	A	8.7	A								451	20	37					
	TH 19 at Saratoga St (Signal)	EB	25	410	50	485	19.0	B	11.5	B	7.3	A	11.5	B			80	20	104		11 %	538	110	324					
		WB	40	265	20	325	19.1	B	8.0	A	5.5	A	9.2	A	12.0	B	150	21	93		1 %	449	61	180					
		NB	40	100	50	190	19.4	B	18.0	B	8.1	A	15.7	B								899	63	169	3 %		100	27	104
		SB	25	75	30	130	20.7	C	17.7	B	5.2	A	15.4	B								815	52	137	2 %		100	20	106
	TH 19 at Marvin Schwan Memorial Dr	EB		435	25	460			7.4	A	5.7	A	7.3	A								449	49	326					
	(Minor Street Stop)	WB	60	320		380	8.2	A	1.4	A			2.5	A	5.3	A	60	21	64			230		20					
		NB	10		25	35	11.0	B			7.7	A	8.6	A								728	23	66					
	TH 19 at Main St/US59 (Signal)	EB	80	270	110	460	25.2	C	28.3	C	11.9	B	23.8	C			130	54	148		19 %	230	141	263	19 %		100	57	125
		WB	45	185	80	310	27.4	C	25.3	C	5.3	A	20.4	C	24.7	C	150	37	156		3 %	304	103	248	3 %		150	40	172
		NB	105	295	50	450	29.5	C	30.0	C	7.2	A	27.4	C			200	70	224		6 %	1161	165	463	6 %		350	22	207
		SB	140	270	90	500	29.8	C	30.6	C	4.8	A	25.7	C			150	82	175		12 %	802	158	471	12 %		400	20	55
	TH 19 at Lyon St	EB	25	425	5	455	4.6	A	2.2	A	1.9	A	2.3	A			80	20	33										
	(Minor Street Stop)	WB	5	270	25	300	5.0	A	2.6	A	2.3	A	2.6	A	3.7	A	130	20	25			301	20	20			130		20
		NB	5	10	5	20	14.8	B	13.3	B	5.5	A	11.7	B								368	20	53					
		SB	45	5	30	80	17.0	C	18.7	C	6.9	A	13.3	B								797	32	87					
	TH 19 at Redwood St	EB	25	445		470	6.6	A	9.2	A			9.1	A			125	20	64		1 %	301	77	150					
	(Minor Street Stop)	WB	10	300	5	315	6.2	A	8.2	A	6.1	A	8.1	A	8.5	A	125	20	47			302	66	128					
		NB	5	10	5	20	5.6	A	6.3	A	2.8	A	5.3	A								338	20	43					
		SB	5	10	5	20	5.6	A	7.0	A	2.9	A	5.6	A								334	20	53					
	TH 19 at Marshall St	EB		455		455			2.5	A			2.5	A								655							
	(RI/RO)	WB		300	5	305			0.7	A	0.3	A	0.7	A	1.8	A						390							
		NB			10	10					4.7	A	4.7	A								385	20	49					
		SB			10	10					4.1	A	4.1	A								812	20	41					
	TH 19 at N 3rd St	EB	5	460		465	3.2	A	0.3	A			0.3	A			150	20	24			390							
	(Minor Street Stop)	WB		290	80	370			0.6	A	0.6	A	0.6	A	1.5	A						390					150		
		SB	60		15	75	15.6	C			4.1	A	13.3	B			350	30	91								100	20	56
	TH 19 at Bruce St (Signal)	EB	35	460	50	545	9.7	A	10.1	B	6.9	A	9.8	A			200	20	52			493	77	161					
		WB	70	305	45	420	11.2	B	9.6	A	2.4	A	9.1	A	12.1	B	200	34	96			1065	82	208			535	20	61
		NB	55	80	120	255	26.3	C	20.6	C	9.9	A	16.8	B			150	37	131		1 %	745	75	187					
		SB	75	95	40	210	23.3	C	18.5	B	9.6	A	18.5	B			150	44	122			764	61	144					
MD Peak Hour	TH 19 at Greeley St	EB	5	285	5	295	3.7	A	0.5	A	0.4	A	0.6	A								451	20	30					
	(Minor Street Stop)	WB	40	330	5	375	4.0	A	1.9	A	1.3	A	2.1	A	1.8	A						538	20	84					
		NB	10	5	30	45	9.7	A	10.0	B	3.9	A	5.9	A								460	26	58					
		SB	5	5	5	15	8.3	A	8.7	A	4.4	A	7.1	A								451	20	42					
	TH 19 at Saratoga St (Signal)	EB	25	255	35	315	13.0	B	6.6	A	3.6	A	6.8	A			80	20	65		2 %	538	55	133					
		WB	45	290	35	370	12.6	B	7.6	A	5.3	A	8.0	A	9.6	A	150	20	103		1 %	449	65	197					
		NB	35	60	40	135	18.4	B	16.7	B	4.5	A	13.5	B								899	44	119	1 %		100	20	49
		SB	40	85	45	170	20.6	C	17.7	B	5.8	A	15.2	B								815	59	124	1 %		100	21	67
	TH 19 at Marvin Schwan Memorial Dr	EB		315	15	330			2.0	A	2.0	A	2.0	A								449	20	92					
	(Minor Street Stop)	WB	55	335		390	4.3	A	1.6	A			2.0	A	2.2	A	60	20	52			230	20	23					
		NB	10		35	45	9.7	A			4.6	A	5.7	A								728	22	64					
	TH 19 at Main St/US59 (Signal)	EB	50	200	95	345	24.6	C	29.1	C	9.5	A	23.1	C			130	33	142		12 %	230	113	234	12 %		100	47	125
		WB	90	250	135	475	23.7	C	25.4	C	5.6	A	19.5	B	22.3	C	150	59	174		5 %	304	131	278	5 %		150	54	175
		NB	80	320	80	480	23.7	C	28.4	C	5.8	A	23.9	C			200	52	224		7 %	1161	172	445	7 %		350	27	156
		SB	130	320	65	515	25.3	C	25.6	C	4.8	A	22.9	C			150	76	174		9 %	802	154	388	9 %		400	20	59
	TH 19 at Lyon St	EB	35	370	5	410	5.7	A	2.0	A	1.7	A	2.3	A			80	20	55								80		20
	(Minor Street Stop)	WB	5	405	55	465	7.1	A	2.8	A	2.3	A	2.8	A	4.7	A	130	20	30			301	20	58			130		20
		NB	5	5	10	20	17.0	C	16.8	C	6.5	A	11.7	B								368	20	47					
		SB	75	5	65	145	21.2	C	21.5	C	11.4	B	16.8	C								797	50	138					
	TH 19 at Redwood St	EB	30	405	5	440	6.3	A	8.4	A	5.8	A	8.2	A			125	20	42			301	67	125					
	(Minor Street Stop)	WB	30	430	10	470	6.7	A	9.8	A	6.8	A	9.5	A	8.5	A	125	21	88		1 %	302	85	170					
		NB	15	10	25	50	5.3	A	7.0	A	3.4	A	4.7	A								338	27	60					
		SB	10	15	10	35	6.1	A	6.6	A	3.4	A	5.5	A								334	21	47					
	TH 19 at Marshall St	EB		430	5	435			2.4	A	2.1	A	2.4	A								655							
	(RI/RO)	WB		455	10	465			0.9	A	0.4	A	0.9	A	1.7	A						390							
		NB			15	15					4.1	A	4.1	A								385	20	31					
		SB			15	15					3.7	A	3.7	A								812	20	35					
	TH 19 at N 3rd St	EB	5	440		445	5.1	A	0.3	A			0.4	A			150	20	28			390							
	(Minor Street Stop)	WB		460	120	580			0.8	A	0.8	A	0.8	A	1.6	A						390					150		20
		SB	70		5	75	15.3	C			5.2	A	14.6	B			350	32	77								100	20	21
	TH 19 at Bruce St (Signal)	EB	45	420	50	515	10.7	B	9.3	A	5.3	A	9.0	A			200	25	70			493	69	141					
		WB	115	435	85	635	10.8	B	10.0	B	2.4	A	9.1	A	11.5	B	200	41	106			1065	107	232			535	21	54
		NB	40	60	130	230	23.2	C	21.1	C	9.0	A	14.6	B			150	27	72			745	67	146					
		SB	120	70	70	260	26.6	C	19.1	B	7.8	A	19.5	B			150	68	144			764	56	143					
PM Peak Hour	TH 19 at Greeley St	EB	5	275	20	300	2.9	A	0.7	A	0.8	A	0.7	A								451	20	27					
	(Minor Street Stop)	WB	35	305	10	350	4.7	A	2.0	A	2.0	A	2.3	A	2.1	A						538	20	91					
		NB	15	5	35	55	9.8	A	9.7	A	3.9	A	6.0	A								460	29	65					
		SB	5	5	10	20	10.2	B	9.8	A	4.4	A	7.2	A								451	20	51					
	TH 19 at Saratoga St (Signal)	EB	15	260	40	315	12.3	B	7.1	A	4.2	A	7.0	A			80	20	45		3 %	538	60	149					
		WB	45	280	35	360	12.4	B	8.7	A	6.1	A	8.9	A	10.8	B	150	20	55		1 %	449	71	196					
		NB	45	80	50	175	18.3	B	17.9	B	5.1	A	14.3	B								899	56	127	2 %		100	26	88
		SB	40	125	30	195	20.9	C	18.6	B	5.6	A	17.1	B								815	70	149	3 %		100	20	81
	TH 19 at Marvin Schwan Memorial Dr	EB		330	10	340			1.9	A	1.1	A	1.9	A								449	20	109					
	(Minor Street Stop)	WB	35	355		390	4.2	A	1.4	A			1.7	A	2.1	A	60	20	35										
		NB	10		45	55	10.2	B			5.0	A	5.9	A								728	28	73					
	TH 19 at Main St/US59 (Signal)	EB	70	190	115	375	26.9	C	33.7	C	16.4	B	27.1	C			130	48	139		13 %	230	117	261	13 %	1 %	100	64	125
		WB	120	220	130	470	28.4	C	31.1	C	6.3	A	23.6	C	27.8	C	150	77	174		7 %	304	139	303	7 %		150	58	175
		NB	75	350	60	485	27.2	C	26.5	C	5.1	A	24.0	C			200	51	211		6 %	1161	167	360	6 %		350	20	151
		SB	105	485	95	685	33.7	C	39.4	D	5.2	A	33.8	C			150	74	175		26 %	802	286	690	26 %		400	31	269
	TH 19 at Lyon St	EB	35	315	10	360	5.4	A	2.0	A	1.6	A	2.3	A			80	20	41			304		20					
	(Minor Street Stop)	WB	15	390	55	460	5.8	A	2.8	A	2.4	A	2.9	A	4.5	A	130	20	33			301	20	36			130		20
		NB		10	15	25			15.5	C	5.3	A	9.4	A								368	20	50					
		SB	70	5	75	150	18.5	C	13.9	B	10.1	B	14.1	B								797	46	130					
	TH 19 at Redwood St	EB	40	345	5	390	6.4	A	8.3	A	5.2	A	8.1	A			125	23	42			301	60	116					
	(Minor Street Stop)	WB	30	440	5	475	7.2	A	10.2	B	7.3	A	10.0	B	8.8	A	125	23	98		2 %	302	91	189					
		NB	25	15	10	50	5.9	A	6.7	A	3.5	A	5.7	A								338	29	62					
		SB	5	15	15	35	4.9	A	6.9	A	3.7	A	5.2	A								334	21	49					
	TH 19 at Marshall St	EB		355	5	360			2.3	A	2.2	A	2.3	A								655							
	(RI/RO)	WB		445	5	450			1.0	A	0.4	A	1.0	A	1.8	A						390							
		NB			20	20					3.7	A	3.7	A								385	20	33					
		SB			35	35					5.4	A	5.4	A								812	22	57					
	TH 19 at N 3rd St	EB	10	365		375	4.3	A	0.2	A			0.3	A			150	20	28			390							
	(Minor Street Stop)	WB		445	90	535			0.9	A	0.8	A	0.9	A	1.4	A						390					150		20
		SB	60		5	65	12.9	B			5.3	A	12.3	B			350	28	70								100	20	23
	TH 19 at Bruce St (Signal)	EB	45	320	40	405	10.7	B	9.1	A	5.2	A	8.9	A			200	23	66			493	59	116					
		WB	90	415	75	580	10.4	B	10.7	B	2.9	A	9.6	A	11.8	B	200	35	114		1 %	1065	108	228	1 %		535	25	73
		NB	45	105	115	265	25.2	C	19.2	B	9.7	A	16.1	B			150	29	95		1 %	745	76	186					
		SB	90	85	70	245	24.8	C	17.7	B	7.5	A	17.4	B			150	50	114			764	58	125					

NOTES: TH 19 is the East-West Roadway; except where noted at Country Club Drive/2nd St.

NOTES
1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

Table B9

TH 19 Marshall Assumes 0.5% Growth Per Year (Factor 1.13)

Build Conditions (2045) - Alternative 7 (Minor Street stop at Country Club Dr and Lyon St, All-way Stop at Saratoga St, 3/4 Access at Greeley St and Redwood St, RI/RO at Marvin Schwan Memorial Dr and Marshall St)

AM / MD / PM Peak Hours

	Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Vehicle Queing Information (feet)													
																	Left Turn Lane				Through Lane (s)				Right Turn Lane				
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) [2]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Thru [3] ---->	% Block Left [3] <----	Link Length (feet)	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Right [3] ---->	% Block Thru [3] <----	Storage (feet) [2]	Avg. Queue (feet) [1]	Max Queue (feet) [1]
AM Peak Hour	TH 19 at S 4th St	EB	10	155	40	205	3.3	A	2.0	A	0.9	A	1.8	A								758	20	81						
	(Minor Street Stop)	WB	95	200	25	320	3.2	A	1.3	A	0.7	A	1.8	A	4.4	A						195	21	102						
		NB	45	80	20	145	9.8	A	12.9	B	9.2	A	11.4	B								1544	51	125						
		SB	5	65	10	80	5.3	A	10.0	B	5.2	A	9.1	A								523	40	96						
	TH 19 at S 2nd St/CC Dr	EB	155	10		165	18.4	C	8.3	A			17.8	C								273	66	157						
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	80	65	150	5.9	A	27.1	D	9.9	A	18.9	C	7.4	A						954	42	162	8 %	1 %	50	28	75	
		NB		240	10	250			0.9	A	2.1	A	0.9	A								804		20						
	(Minor Street Stop)	SB	15	75	180	270	3.1	A	0.3	A	0.7	A	0.7	A								464	20	22			100	20	20	
	TH 19 at Greeley St	EB	10	440	25	475	6.6	A	7.9	A	5.0	A	7.7	A								464	38	244						
	(3/4 Access)	WB	10	345	5	360	6.2	A	2.5	A	2.9	A	2.6	A	5.9	A						538	20	63						
		NB			35	35					15.9	C	15.9	C								460	23	65						
		SB			5	5					3.9	A	3.9	A								451	20	28						
	TH 19 at Saratoga St	EB	25	405	50	480	42.7	E	45.7	E	38.4	E	44.8	E			80	38	105		48 %	538	219	509						
	(All-way Stop)	WB	100	255	20	375	9.6	A	14.8	B	14.3	B	13.4	B	25.1	D	150	39	131		2 %	449	74	208						
		NB	75	105	50	230	13.3	B	14.7	B	7.4	A	12.7	B								899	60	174	4 %		100	33	106	
		SB	30	80	30	140	9.1	A	11.0	B	5.0	A	9.3	A								815	45	112			100	20	49	
	TH 19 at Marvin Schwan Memorial Dr	EB		435	25	460			3.9	A	2.9	A	3.8	A								449	20	159						
	(RI/RO)	WB		380		380			1.1	A			1.1	A	2.7	A													
		NB			25	25					5.7	A	5.7	A								728	20	52						
	TH 19 at Main St/US59 (Signal)	EB	80	270	110	460	21.1	C	24.0	C	7.2	A	19.5	B			200	46	174		19 %	230	143	256	19 %		100	64	125	
		WB	45	185	80	310	24.4	C	23.5	C	4.7	A	18.8	B	22.7	C	150	36	154		3 %	304	95	240	3 %		150	36	150	
		NB	105	295	50	450	29.1	C	32.2	C	9.1	A	28.9	C			200	62	224		7 %	1161	172	536	7 %		350	21	215	
		SB	140	270	90	500	24.8	C	24.3	C	13.2	B	22.4	C			150	69	166		2 %	802	84	205	2 %					
	TH 19 at Lyon St	EB	25	425	5	455	4.7	A	2.2	A	2.1	A	2.3	A			80	20	35			304		20			80		20	
	(Minor Street Stop)	WB	5	265	25	295	7.6	A	2.5	A	2.3	A	2.6	A	4.1	A	130	20	27			301		20			130		20	
		NB	10	20	5	35	18.5	C	14.5	B	6.3	A	14.5	B								368	22	74						
		SB	50	15	30	95	15.5	C	16.9	C	7.4	A	13.2	B								797	36	100						
	TH 19 at Redwood St	EB	25	450		475	6.6	A	9.0	A			8.9	A			125	20	56		1 %	301	74	151						
	(3/4 Access)	WB	10	300	5	315	6.0	A	7.9	A	5.6	A	7.8	A	8.4	A	125	20	36			302	63	112						
		NB			5	5					3.3	A	3.3	A								338	20	28						
		SB			5	5					2.6	A	2.6	A								334	20	31						
	TH 19 at Marshall St	EB		455		455			2.4	A			2.4	A								655								
	(RI/RO)	WB		300	5	305			0.6	A	0.3	A	0.6	A	1.7	A						390								
		NB			10	10					4.0	A	4.0	A								385	20	51						
		SB			10	10					3.4	A	3.4	A								812	20	49						
	TH 19 at N 3rd St	EB	5	460		465	3.2	A	0.3	A			0.3	A			150	20	22			390								
	(Minor Street Stop)	WB		290	80	370			0.6	A	0.6	A	0.6	A	1.4	A						390					150			
		SB	60		15	75	14.1	B			4.0	A	12.1	B			350	28	74								100	20	47	
	TH 19 at Bruce St (Signal)	EB	35	460	50	545	10.9	B	10.1	B	7.1	A	9.9	A			200	20	54			493	81	183						
		WB	70	305	45	420	11.2	B	9.6	A	2.5	A	9.1	A	12.3	B	200	35	122			1065	80	206			535	20	52	
		NB	55	80	120	255	24.5	C	20.9	C	10.6	B	16.8	B			150	37	127		1 %	745	75	206						
		SB	75	95	40	210	25.5	C	19.9	B	9.1	A	19.8	B			150	45	126			764	58	141						
MD Peak Hour	TH 19 at S 4th St	EB	10	160	45	215	2.6	A	0.9	A	0.5	A	0.9	A								758	20	41						
	(Minor Street Stop)	WB	10	170	10	190	3.4	A	0.4	A	0.2	A	0.5	A	3.3	A						195	20	36						
		NB	40	55	10	105	7.6	A	8.8	A	4.3	A	7.9	A								1544	43	86						
		SB	10	80	45	135	8.7	A	9.1	A	4.9	A	7.7	A								523	45	98						
	TH 19 at S 2nd St/CC Dr	EB	125	25		150	9.9	A	7.6	A			9.5	A								273	49	128						
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	45	70	7.3	A	9.8	A	4.1	A	6.0	A	3.2	A						954	20	29			50	20	56	
		NB		120	5	125			0.4	A	2.0	A	0.5	A								804		20						
	(Minor Street Stop)	SB	35	150	140	325	2.3	A	0.6	A	0.5	A	0.7	A								464	20	33			100		20	
	TH 19 at Greeley St	EB	5	285	5	295	3.6	A	0.7	A	0.6	A	0.7	A								464	20	29						
	(3/4 Access)	WB	40	340	5	385	4.5	A	2.5	A	2.8	A	2.7	A	1.9	A						538	20	58						
		NB			30	30					3.3	A	3.3	A								460	21	52						
		SB			5	5					4.1	A	4.1	A								451	20	31						
	TH 19 at Saratoga St	EB	25	250	35	310	7.2	A	9.3	A	5.3	A	8.7	A			80	20	67		2 %	538	50	118						
	(All-way Stop)	WB	100	280	35	415	8.0	A	11.2	B	8.0	A	10.2	B	8.9	A	150	32	90			449	67	155						
		NB	55	65	40	160	7.9	A	9.0	A	4.7	A	7.5	A								899	43	90			100	26	50	
		SB	45	90	45	180	7.1	A	8.7	A	4.9	A	7.4	A								815	42	86			100	25	54	
	TH 19 at Marvin Schwan Memorial Dr	EB		315	15	330			2.5	A	2.2	A	2.5	A								449	20	37						
	(RI/RO)	WB		390		390			1.2	A			1.2	A	1.9	A													
		NB			35	35					4.1	A	4.1	A								728	20	61						
	TH 19 at Main St/US59 (Signal)	EB	50	200	95	345	20.8	C	23.7	C	5.4	A	18.2	B			200	30	92		11 %	230	102	215	11 %		100	49	125	
		WB	90	250	135	475	21.7	C	23.2	C	5.1	A	17.8	B	20.0	C	150	56	161		4 %	304	119	275	4 %		150	50	174	
		NB	80	320	80	480	21.9	C	27.9	C	6.2	A	23.3	C			200	49	177		6 %	1161	168	433	6 %		350	29	246	
		SB	130	320	65	515	22.7	C	21.1	C	11.7	B	20.3	C			150	64	157		1 %	802	90	206	1 %					
	TH 19 at Lyon St	EB	35	370	5	410	5.7	A	2.0	A	1.3	A	2.3	A			80	20	54			304		20			80		20	
	(Minor Street Stop)	WB	5	390	55	450	8.3	A	2.8	A	2.5	A	2.8	A	5.4	A	130	20	32			301	20	31			130	20	20	
		NB	20	15	10	45	15.4	C	15.0	C	5.9	A	13.2	B								368	25	74						
		SB	85	20	65	170	21.0	C	19.8	C	13.5	B	18.0	C								797	56	131						
	TH 19 at Redwood St	EB	30	415	5	450	6.4	A	8.2	A	4.8	A	8.0	A			125	20	48			301	65	118						
	(3/4 Access)	WB	30	430	10	470	6.5	A	9.2	A	7.1	A	9.0	A	8.3	A	125	20	75		1 %	302	80	161						
		NB			25	25					3.3	A	3.3	A								338	20	38						
		SB			10	10					3.1	A	3.1	A								334	20	33						
	TH 19 at Marshall St	EB		430	5	435			2.4	A	1.9	A	2.4	A								655								
	(RI/RO)	WB		455	10	465			0.9	A	0.4	A	0.9	A	1.7	A						390								
		NB			15	15					4.4	A	4.4	A								385	20	35						
		SB			15	15					4.8	A	4.8	A								812	20	35						
	TH 19 at N 3rd St	EB	5	440		445	4.1	A	0.3	A			0.3	A			150	20	33			390								
	(Minor Street Stop)	WB		460	120	580			0.9	A	0.9	A	0.9	A	1.6	A						390					150		20	
		SB	70		5	75	14.7	B			5.1	A	14.1	B			350	32	76								100	20	21	
	TH 19 at Bruce St (Signal)	EB	45	420	50	515	10.8	B	9.6	A	6.1	A	9.4	A			200	24	68			493	71	152						
		WB	115	435	85	635	11.3	B	9.8	A	2.4	A	9.1	A	11.6	B	200	48	145		1 %	1065	106	239	1 %		535	24	60	
		NB	40	60	130	230	25.0	C	21.1	C	8.9	A	14.9	B			150	26	79			745	63	156						
		SB	120	70	70	260	24.4	C	21.4	C	8.5	A	19.3	B			150	62	140			764	58	144						
PM Peak Hour	TH 19 at S 4th St	EB	10	195	90	295	2.7	A	1.3	A	0.7	A	1.2	A								758	20	40						
	(Minor Street Stop)	WB	10	135	10	155	3.3	A	0.4	A	0.2	A	0.6	A	4.0	A						195	20	39						
		NB	40	80	5	125	8.4	A	9.0	A	5.7	A	8.7	A								1544	43	80						
		SB	15	100	25	140	10.7	B	10.2	B	5.0	A	9.3	A								523	43	101						
	TH 19 at S 2nd St/CC Dr	EB	155	25		180	9.6	A	5.9	A			9.1	A								273	56	126						
	Note: WB is NB 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19	WB	5	20	30	55	5.5	A	10.6	B	3.8	A	6.4	A	3.5	A						954	20	58	1 %		50	20	61	
		NB		105	5	110			0.4	A	2.2	A	0.5	A																
	(Minor Street Stop)	SB	45	150	115	310	2.2	A	0.6	A	0.5	A	0.8	A								464	20	23			100		20	
	TH 19 at Greeley St	EB	5	275	20	300	3.2	A	0.9	A	1.0	A	0.9	A								464	20	37						
	(3/4 Access)	WB	35	320	10	365	5.0	A	2.4	A	2.3	A	2.6	A	1.9	A						538	20	57						
		NB			35	35					3.5	A	3.5	A								460	23	64						
		SB			10	10					3.5	A	3.5	A								451	20	33						
	TH 19 at Saratoga St	EB	15	255	40	310	6.7	A	9.9	A	6.6	A	9.3	A			80	20	45		3 %	538	53	127						
	(All-way Stop)	WB	80	270	35	385	8.3	A	11.2	B	7.2	A	10.2	B	9.2	A	150	29	84			449	65	142						
		NB	70	85	50	205	8.6	A	9.3	A	5.0	A	8.0	A								899	44	90			100	27	60	
		SB	45	130	30	205	8.2	A	9.5	A	4.9	A	8.5	A								815	50	96			100	20	51	
	TH 19 at Marvin Schwan Memorial Dr	EB		330	10	340			2.3	A	2.0	A	2.3	A								449	20	20						
	(RI/RO)	WB		390		390			1.2	A			1.2	A	1.9	A														
		NB			45	45					4.1	A	4.1	A								728	23	63						
	TH 19 at Main St/US59 (Signal)	EB	70	190	115	375	22.6	C	28.1	C	6.7	A	20.5	C			200	43	148		12 %	230	102	208	12 %		100	60	125	
		WB	120	220	130	470	23.6	C	25.4	C	5.3	A	19.4	B	21.2	C	150	70	168		3 %	304	110	255	3 %		150	51	175	
		NB	75	350	60	485	22.9	C	27.4	C	5.2	A	24.0	C			200	47	211		6 %	1161	168	385	6 %		350	20	176	
		SB	105	485	95	685	22.7	C	22.0	C	12.8	B	20.8	C			150	56	164		5 %	802	126	262	5 %					
	TH 19 at Lyon St	EB	35	315	10	360	5.8	A	2.0	A	1.5	A	2.4	A			80	20	45											
	(Minor Street Stop)	WB	15	365	55	435	5.5	A	2.7	A	2.5	A	2.8	A	5.0	A	130	20	31			301	20	24			130	20	20	
		NB	25	25	15	65	15.1	C	15.6	C	6.0	A	13.2	B								368	31	84						
		SB	75	20	75	170	16.0	C	16.1	C	9.6	A	13.2	B								797	48	115						
	TH 19 at Redwood St	EB	40	350	5	395	5.8	A	7.6	A	4.7	A	7.4	A			125	20	38			301	53	94						
	(3/4 Access)	WB	30	440	5	475	6.5	A	9.2	A	7.4	A	9.0	A	8.1	A	125	20	52		1 %	302	80	160						
		NB			10	10					2.8	A	2.8	A								338	20	50						
		SB			15	15					3.2	A	3.2	A								334	20	40						
	TH 19 at Marshall St	EB		355	5	360			2.3	A	2.1	A	2.3	A								655								
	(RI/RO)	WB		445	5	450			0.9	A	0.4	A	0.9	A	1.7	A						390								
		NB			20	20					3.6	A	3.6	A								385	20	36						
		SB			35	35					5.1	A	5.1	A								812	22	53						
	TH 19 at N 3rd St	EB	10	365		375	4.4	A	0.2	A			0.3	A			150	20	33			390								
	(Minor Street Stop)	WB		445	90	535			0.8	A	0.7	A	0.8	A	1.3	A						390					150		20	
		SB	60		5	65	12.1	B			4.1	A	11.5	B			350	27	77								100	20	24	
	TH 19 at Bruce St (Signal)	EB	45	320	40	405	10.9	B	8.9	A	4.6	A	8.7	A			200	22	68			493	56	108						
		WB	90	415	75	580	10.9	B	10.5	B	2.9	A	9.6	A	11.9	B	200	34	79			1065	104	218			535	24	55	
		NB	45	105	115	265	23.0	C	19.4	B	10.3	B	16.1	B			150	29	90		1 %	745	80	166						
		SB	90	85	70	245	25.7	C	18.8	B	7.7	A	18.2	B			150	50	120			764	59	144						

NOTES: TH 19 is the East-West Roadway; except where noted at Country Club Drive/2nd St.

NOTES 1. If the reported queue is greater than zero (0), but less than ft, a minimum of ft is reported.
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.

Appendix C

Intersection Layouts and Cost Estimates

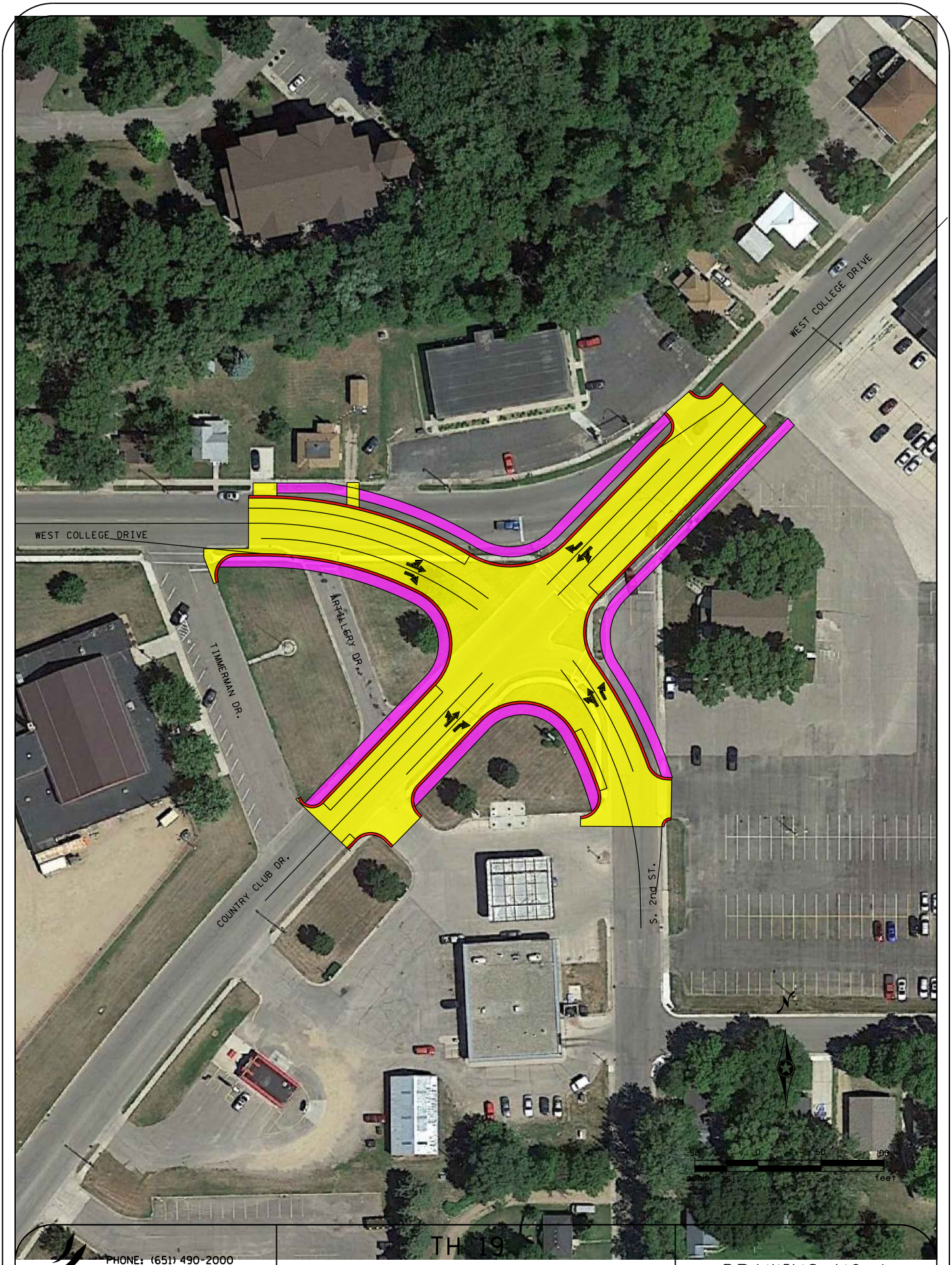

SHED
GAR.
1-S-F OFFICES 310
BIT.
CONC.
GAR.
GRAV.
1-S-F HO.
1-1/2 S-F HO.
CONC.
1-S-F HO.
GRAV.
BIT.
SIGN
WEST COLLEGE DRIVE
JOE ST.
COUNTRY CLUB DR.
S. 2nd ST.
1-S-F
ARTILLERY DR.
SIGN
SIGN
SIGN
CANOPY
1-S-F CENEX
XC
XC
XC

Construction Cost Estimate

TH 19 / Country Club Dr. Replace In-Kind

Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	$75.00	1,648	$ 123,582
4" Concrete Walk	sq ft	$10.00	5,112	$ 51,120
Class 6 Aggregate Base (1)	cu yd	$40.00	905	$ 36,191
Subgrade Excavation (1)	cu yd	$10.00	1,620	$ 16,202
Common Excavation	cu yd	$10.00	1,810	$ 18,096
Common Borrow	cu yd	$8.00	2,714	$ 21,715
Select Granular Borrow	cu yd	$20.00	1,620	$ 32,404
Curb and Gutter Design B618	lin ft	$20.00	2,016	$ 40,320
(a) Subtotal Paving and Grading				**$ 339,630**
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		5.0%		$ 16,982
Minor City Utilities		5.0%		$ 16,982
Signing, Striping, Traffic Control		5.0%		$ 16,982
Erosion Control and Turf Establishment		5.0%		$ 16,982
(b) Subtotal Utilities, Removals, Drainage, Etc.				**$ 67,926**
DRAINAGE				
Storm Sewer		24.0%		$ 81,511
(c) Subtotal Drainage				**$ 81,511**
STRUCTURES/SIGNALS/MISC. COST				
Lighting		$7,000	3	$ 21,000
Intersection ADA	each	$ 6,000.00	7	$ 42,000
Signal System	each	$ 250,000.00	1	$ 250,000
				$ -
(d) Subtotal Structural				**$ 313,000**
(a+b+c+d) Subtotal Construction				**$ 802,068**
Risk & Contingency		15.0%		$ 120,310
TMP		5.0%		$ 40,103
Mobilization		10.0%		$ 80,207
(e) Subtotal Miscellaneous				**$ 240,620**
(a+b+c+d+e) Total Construction				**$ 1,042,688**
Inflation Adjusted Construction Cost for 2021 (1.14 factor)				**$ 1,188,664**
Design & Construction Engineering		20.0%		$ 208,538
RW Cost				
Total RW			1	$ -
Total RW				**$ -**

Total Estimated Cost	**$ 1,397,202**



SEH
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3535 VADNAIS CENTER DR.
ST. PAUL, MN 55110

TH 19

MARSHALL DOWNTOWN
STOP CONTROL ALT.

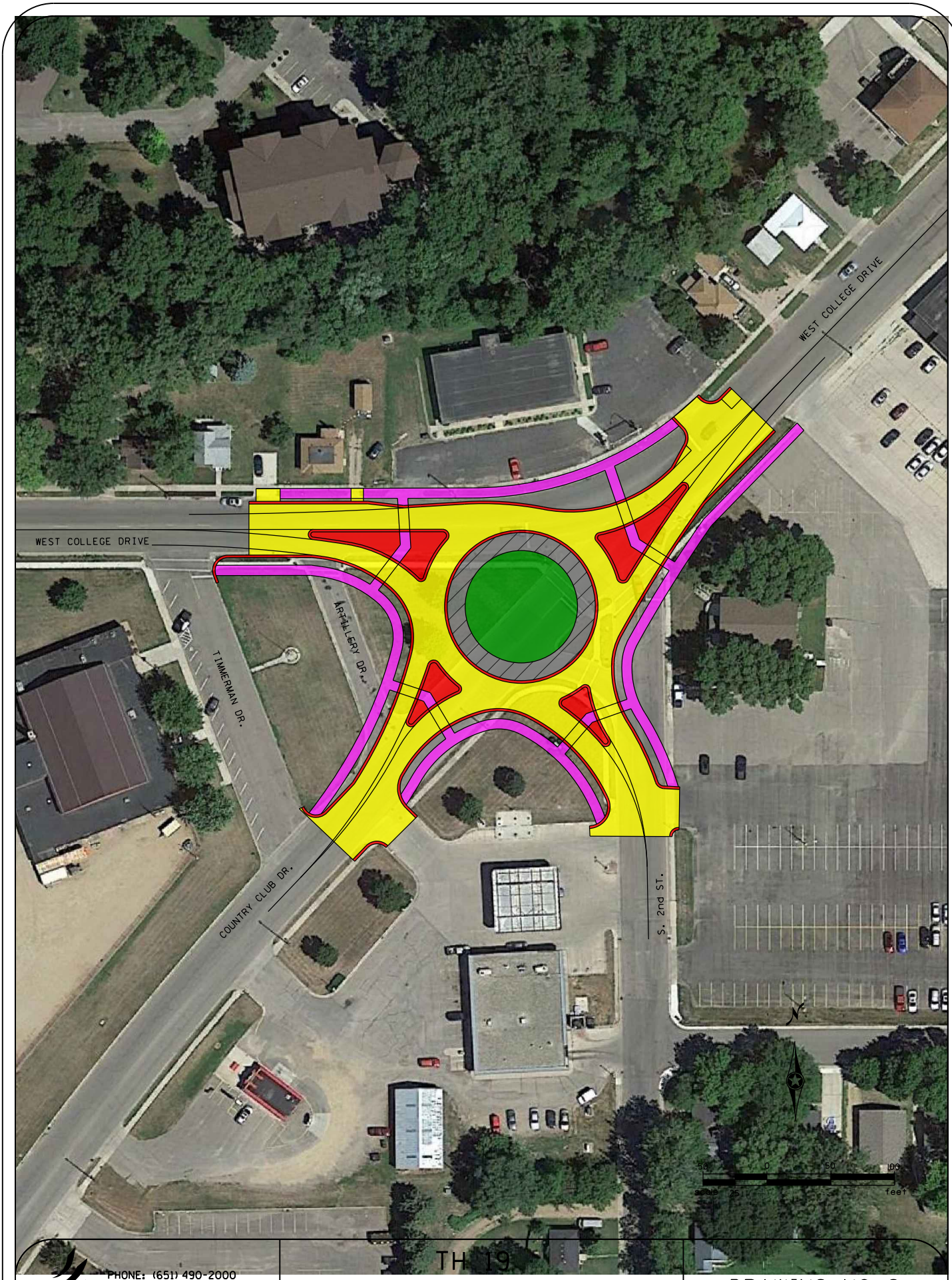
DRAWING NO. 1

Construction Cost Estimate

TH 19 / Country Club Dr. Stop Control

Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	$75.00	1,585	$ 118,910
4" Concrete Walk	sq ft	$10.00	10,792	$ 107,920
Class 6 Aggregate Base (1)	cu yd	$40.00	979	$ 39,173
Subgrade Excavation (1)	cu yd	$10.00	1,559	$ 15,590
Common Excavation	cu yd	$10.00	1,959	$ 19,587
Common Borrow	cu yd	$8.00	2,938	$ 23,504
Select Granular Borrow	cu yd	$20.00	1,559	$ 31,179
Curb and Gutter Design B618	lin ft	$20.00	1,513	$ 30,260
(a) Subtotal Paving and Grading				**$ 386,123**
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		5.0%		$ 19,306
Minor City Utilities		5.0%		$ 19,306
Signing, Striping, Traffic Control		5.0%		$ 19,306
Erosion Control and Turf Establishment		5.0%		$ 19,306
(b) Subtotal Utilities, Removals, Drainage, Etc.				**$ 77,225**
DRAINAGE				
Storm Sewer		24.0%		$ 92,669
(c) Subtotal Drainage				**$ 92,669**
STRUCTURES/SIGNALS/MISC. COST				
Lighting		$7,000	4	$ 28,000
Intersection ADA	each	$ 6,000.00	14	$ 84,000
Signal System	each	$ 250,000.00	0	$ -
				$ -
(d) Subtotal Structural				**$ 112,000**
(a+b+c+d) Subtotal Construction				**$ 668,017**
Risk & Contingency		15.0%		$ 100,203
TMP		5.0%		$ 33,401
Mobilization		10.0%		$ 66,802
(e) Subtotal Miscellaneous				**$ 200,405**
(a+b+c+d+e) Total Construction				**$ 868,422**
Inflation Adjusted Construction Cost for 2021 (1.14 factor)				**$ 990,001**
Design & Construction Engineering		20.0%		$ 173,684
RW Cost				
Total RW	sq. ft.	$3.00	2553	$ 7,659
Total RW				**$ 7,659**

Total Estimated Cost	**$ 1,171,344**



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ST. PAUL, MN 55110

TH 19

MARSHALL DOWNTOWN
ROUNDABOUT ALT.

DRAWING NO. 2

Construction Cost Estimate

TH 19 / Country Club Dr. Roundabout

Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	$75.00	1,269	$ 95,149
4" Concrete Walk	sq ft	$10.00	14,366	$ 143,660
8" Concrete pavement	sq yd	$70.00	498	$ 34,891
Class 6 Aggregate Base (1)	cu yd	$40.00	973	$ 38,913
Subgrade Excavation (1)	cu yd	$10.00	1,573	$ 15,732
Common Excavation	cu yd	$10.00	1,946	$ 19,457
Common Borrow	cu yd	$8.00	2,919	$ 23,348
Select Granular Borrow	cu yd	$20.00	1,573	$ 31,464
Curb and Gutter Design B618	lin ft	$20.00	2,796	$ 55,920
(a) Subtotal Paving and Grading				**$ 458,535**
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		5.0%		$ 22,927
Minor City Utilities		5.0%		$ 22,927
Signing, Striping, Traffic Control		5.0%		$ 22,927
Erosion Control and Turf Establishment		5.0%		$ 22,927
(b) Subtotal Utilities, Removals, Drainage, Etc.				**$ 91,707**
DRAINAGE				
Storm Sewer		24.0%		$ 110,048
(c) Subtotal Drainage				**$ 110,048**
STRUCTURES/SIGNALS/MISC. COST				
Roundabout Lighting		$7,000	8	$ 56,000
Roundabout Landscaping		$30,000	1	$ 30,000
Intersection ADA	each	$ 6,000.00	21	$ 126,000
Signal System	each	$ 250,000.00	0	$ -
				$ -
(d) Subtotal Structural				**$ 212,000**
(a+b+c+d) Subtotal Construction				**$ 872,290**
Risk & Contingency		15.0%		$ 130,843
TMP		5.0%		$ 43,614
Mobilization		10.0%		$ 87,229
(e) Subtotal Miscellaneous				**$ 261,687**
(a+b+c+d+e) Total Construction				**$ 1,133,977**
Inflation Adjusted Construction Cost for 2021 (1.14 factor)				**$ 1,292,734**
Design & Construction Engineering		20.0%		$ 226,795
RW Cost				
Total RW	sq. ft.	$3.00	3058	$ 9,174
Total RW				**$ 9,174**

Total Estimated Cost	**$ 1,528,703**

Appendix D

Intersection Count Data

Location: TH 19 at S 4th Street
Count Date: 5/23/2019
Counted By: CA

TURNING MOVEMENT COUNT DATA

All Vehicles

	4th Street				TH19				4th Street				TH19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	0	3	2	0	2	13	2	0	4	9	0	2	0	11	0	0	46
6:15	0	1	2	0	1	12	4	0	8	14	0	0	0	10	4	1	56
6:30	1	1	0	0	1	16	1	0	10	26	0	0	1	11	3	2	71
6:45	0	3	1	0	1	19	3	0	7	35	1	0	2	18	4	0	94
7:00	1	7	0	0	4	20	1	0	7	13	0	1	1	13	1	0	68
7:15	0	18	1	1	9	26	1	4	10	20	2	1	1	29	6	2	123
7:30	0	13	5	1	34	41	4	5	7	15	3	8	5	30	14	9	171
7:45	0	15	2	0	36	84	11	1	4	23	9	0	4	37	9	11	234
8:00	5	12	0	0	4	28	4	0	17	14	3	0	0	37	5	3	129
8:15	2	7	2	2	6	10	2	0	7	17	3	0	1	24	7	0	88
8:30	3	14	1	0	6	10	1	0	7	12	0	0	0	17	3	1	74
8:45	3	5	6	1	2	19	2	0	6	8	1	0	4	17	3	0	76
9:00	1	11	3	0	0	9	0	0	2	10	2	0	1	20	2	0	61
9:15	1	6	4	0	0	12	4	0	8	9	6	0	2	10	4	1	66
9:30	2	6	2	0	5	17	2	0	1	8	1	0	1	37	4	4	86
9:45	1	8	3	0	3	19	1	3	3	15	0	2	1	20	6	0	80
10:00	0	7	3	0	4	18	1	0	3	6	1	0	1	21	7	0	72
10:15	0	10	1	0	0	15	1	0	5	12	2	0	0	22	4	1	72
10:30	2	10	5	2	2	11	2	0	5	12	3	1	0	20	6	0	78
10:45	1	11	4	1	1	16	2	0	3	6	0	0	2	24	3	2	73
11:00	0	9	4	0	2	13	1	0	4	6	3	0	1	22	13	1	78
11:15	1	10	3	1	2	27	2	0	4	8	2	0	2	36	4	0	101
11:30	0	14	7	0	0	17	3	0	5	15	2	0	1	29	9	0	102
11:45	2	14	4	1	4	26	2	1	9	9	0	1	5	47	7	0	129
12:00	2	25	5	0	4	36	2	0	6	16	4	0	3	42	14	0	159
12:15	0	12	8	2	2	30	4	0	7	11	0	0	1	38	8	0	121
12:30	4	16	11	0	0	39	1	0	9	16	4	0	5	30	12	0	147
12:45	1	17	14	0	1	41	4	0	12	7	1	0	2	28	6	0	134
13:00	1	13	4	0	2	46	2	0	6	14	5	0	2	28	7	0	130
13:15	2	17	6	0	2	19	1	1	7	13	1	0	2	25	3	2	98
13:30	2	14	2	0	3	21	0	0	11	15	1	1	1	24	9	5	103
13:45	1	11	1	0	1	22	1	1	10	5	0	0	4	28	6	0	90
14:00	0	7	0	1	1	14	0	0	11	12	4	0	1	26	4	1	80
14:15	4	18	2	0	2	24	1	0	12	9	1	0	1	22	6	5	102
14:30	0	17	3	0	9	22	2	1	4	18	0	0	3	25	9	1	112
14:45	0	17	4	0	6	12	3	1	5	13	1	1	0	24	6	0	91
15:00	2	12	4	0	19	33	1	5	6	15	11	19	1	24	9	24	137
15:15	2	19	4	0	5	36	4	1	9	24	3	5	5	28	2	7	141
15:30	3	24	4	1	7	21	1	0	8	6	4	0	2	34	9	2	123
15:45	3	18	5	2	4	23	3	0	11	23	9	0	3	25	9	0	136
16:00	1	21	2	1	3	27	2	0	7	19	3	0	5	30	10	0	130
16:15	1	12	3	2	4	32	2	0	7	11	2	2	2	34	14	2	124
16:30	3	21	4	0	1	19	2	0	8	13	2	0	1	50	16	3	140
16:45	2	21	6	1	2	29	1	1	11	18	1	0	4	34	18	3	147
17:00	8	31	7	0	4	41	2	0	10	18	1	0	3	56	32	2	213
17:15	1	16	4	1	1	26	2	0	7	23	1	0	2	25	15	1	123
17:30	3	15	3	1	2	27	2	0	8	12	0	0	1	32	16	1	121
17:45	0	15	3	0	1	25	1	1	13	8	1	0	2	37	11	2	117
18:00	1	15	1	0	0	18	2	0	5	4	0	0	0	19	6	0	71
18:15	1	21	0	2	0	13	0	1	7	8	0	0	1	18	3	2	72
18:30	2	9	3	0	1	20	2	0	7	9	2	1	0	12	7	2	74
18:45	1	10	3	8	2	26	1	1	12	11	2	0	2	24	1	2	95
Total	77	679	181	32	218	1240	106	28	382	693	108	45	95	1384	396	105	5559
Cars+	76	646	172	20	192	1147	103	18	360	672	105	32	91	1265	383	68	5212
SU Trucks	1	22	7	12	7	43	2	10	17	17	3	13	3	49	9	37	180
Buses	0	10	2	0	19	3	1	0	2	2	0	0	1	1	3	0	44
Semi Trucks	0	1	0	0	0	47	0	0	3	2	0	0	0	69	1	0	123
% SU	1.3	3.2	3.9	37.5	3.2	3.5	1.9	35.7	4.5	2.5	2.8	28.9	3.2	3.5	2.3	35.2	
Trucks	3.2				3.3				3.1				3.3				3.2
% Buses	0.0	1.5	1.1	0.0	8.7	0.2	0.9	0.0	0.5	0.3	0.0	0.0	1.1	0.1	0.8	0.0	
	1.3				1.5				0.3				0.3				0.8
% Semi	0.0	0.1	0.0	0.0	0.0	3.8	0.0	0.0	0.8	0.3	0.0	0.0	0.0	5.0	0.3	0.0	
Trucks	0.1				3.0				0.4				3.7				2.2

Location: TH 19 at Country Club Drive
Count Date: 5/23/2019
Counted By: JDA

TURNING MOVEMENT COUNT DATA

All Vehicles

	TH 19				S 2nd St				Country Club Dr				TH 19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	1	6	11	0	1	1	6	0	3	12	0	0	8	0	3	0	52
6:15	3	5	8	0	0	2	6	1	8	8	0	0	9	0	1	0	50
6:30	2	9	10	0	2	0	7	0	6	19	0	0	9	0	3	0	67
6:45	1	8	17	0	0	5	12	0	2	15	0	0	15	0	2	0	77
7:00	5	13	16	0	0	6	5	0	5	20	0	0	8	1	5	0	84
7:15	2	9	21	0	2	9	10	0	5	32	1	1	27	2	4	0	124
7:30	4	24	45	0	0	23	13	5	11	71	3	8	32	2	2	0	230
7:45	5	15	72	0	0	31	18	2	28	76	3	0	40	1	5	0	294
8:00	4	19	21	0	0	8	15	0	8	35	2	0	36	2	5	0	155
8:15	3	15	13	0	1	4	2	0	2	17	0	0	21	1	6	0	85
8:30	9	14	12	1	0	2	6	1	3	23	1	0	17	0	4	0	91
8:45	4	15	16	0	0	2	7	0	4	23	2	0	19	0	4	0	96
9:00	2	9	14	0	0	0	6	0	0	18	0	1	20	1	4	1	74
9:15	7	13	12	0	0	3	7	0	5	20	1	0	14	1	3	0	86
9:30	2	15	19	0	2	1	8	0	3	9	0	0	28	2	6	0	95
9:45	7	8	17	0	0	4	6	0	3	19	1	0	17	1	3	0	86
10:00	12	17	17	0	0	0	7	0	3	16	0	0	18	1	3	0	94
10:15	6	27	14	0	0	3	6	0	1	25	0	0	19	0	7	0	108
10:30	6	10	12	0	0	2	6	1	1	18	1	0	21	1	3	0	81
10:45	12	11	15	0	0	2	5	0	1	18	2	0	20	2	3	0	91
11:00	9	17	17	0	1	3	9	0	2	13	0	1	22	2	3	0	98
11:15	6	22	19	0	0	1	6	0	5	20	3	0	34	2	5	0	123
11:30	5	18	18	0	0	5	5	0	1	14	0	2	25	2	4	0	97
11:45	7	27	21	0	0	6	10	0	5	17	2	0	35	4	9	0	143
12:00	10	43	33	0	1	4	8	0	5	20	0	0	38	9	4	0	175
12:15	14	24	26	0	0	3	4	1	8	24	2	0	26	5	8	0	144
12:30	5	32	34	0	0	2	15	0	7	29	0	0	27	3	6	0	160
12:45	3	32	33	0	0	9	13	1	3	32	1	0	21	6	6	0	159
13:00	5	23	36	0	0	5	11	0	8	27	0	0	27	2	2	0	146
13:15	10	13	17	0	1	2	3	0	0	23	0	0	25	2	1	0	97
13:30	4	19	22	0	0	3	7	1	0	17	0	0	20	0	4	0	96
13:45	4	11	23	0	0	1	7	0	1	27	0	0	25	2	1	0	102
14:00	12	18	12	0	2	1	5	0	2	17	0	1	25	1	4	0	99
14:15	4	28	19	0	0	4	3	2	2	20	1	0	19	0	8	0	108
14:30	7	20	24	0	0	8	7	1	6	24	1	1	21	2	3	0	123
14:45	4	19	15	0	0	2	7	1	2	38	1	0	21	0	5	0	114
15:00	7	33	41	0	0	7	10	4	5	36	3	11	32	2	5	0	181
15:15	13	52	35	0	1	2	13	7	7	33	3	4	30	1	4	0	194
15:30	14	40	22	0	0	7	11	0	2	28	1	0	31	2	6	0	164
15:45	9	27	23	0	1	2	9	2	4	23	2	0	30	3	5	0	138
16:00	14	35	26	0	0	1	8	0	4	18	2	0	27	6	2	0	143
16:15	5	36	30	0	1	1	11	2	5	18	1	4	31	2	3	0	144
16:30	10	31	19	0	0	1	5	0	3	18	1	0	41	3	11	0	143
16:45	4	37	26	0	0	4	11	0	5	27	1	0	29	2	8	0	154
17:00	8	27	38	0	1	5	4	0	2	24	2	0	45	13	10	0	179
17:15	16	39	17	0	0	7	8	0	6	25	0	0	22	3	4	0	147
17:30	7	22	24	2	0	4	5	2	2	27	1	0	29	1	6	0	128
17:45	9	34	24	0	0	3	9	1	0	27	1	0	33	1	3	0	144
18:00	9	24	15	0	0	0	9	1	5	20	1	0	14	3	2	0	102
18:15	8	26	9	0	0	3	7	1	2	25	0	1	15	1	2	0	98
18:30	10	29	19	0	0	1	11	0	5	22	0	0	15	0	2	0	114
18:45	6	21	15	0	0	3	12	1	5	24	0	0	21	1	4	0	112
Total	355	1141	1134	3	17	218	421	38	221	1251	47	35	1254	104	226	1	6389
Cars+	346	1120	1040	1	16	210	412	26	214	1211	43	27	1156	99	225	1	6092
SU Trucks	6	12	33	2	0	3	2	12	2	21	3	8	37	4	0	0	123
Buses	1	2	13	0	0	5	3	0	4	14	1	0	0	0	1	0	44
Semi Trucks	2	7	48	0	1	0	4	0	1	5	0	0	61	1	0	0	130
% SU	1.7	1.1	2.9	66.7	0.0	1.4	0.5	31.6	0.9	1.7	6.4	22.9	3.0	3.8	0.0	0.0	
Trucks	1.9				0.8				1.7				2.6				1.9
% Buses	0.3	0.2	1.1	0.0	0.0	2.3	0.7	0.0	1.8	1.1	2.1	0.0	0.0	0.0	0.4	0.0	
	0.6				1.2				1.3				0.1				0.7
% Semi	0.6	0.6	4.2	0.0	5.9	0.0	1.0	0.0	0.5	0.4	0.0	0.0	4.9	1.0	0.0	0.0	
Trucks	2.2				0.8				0.4				3.9				2.0

Location: Th 19 at Saratoga Street
Count Date: 5/23/2019
Counted By: LJ

TURNING MOVEMENT COUNT DATA

All Vehicles

	Saratoga St				TH 19				Saratoga St				TH 19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	1	5	0	0	1	13	2	0	1	7	2	1	2	23	1	0	58
6:15	3	0	0	0	0	13	0	0	2	6	1	0	1	24	1	0	51
6:30	0	1	1	0	0	24	1	0	0	10	4	0	2	30	5	0	78
6:45	6	6	1	0	2	19	10	1	3	17	7	0	6	39	1	0	117
7:00	5	4	1	0	4	36	4	2	2	7	7	0	3	31	5	0	109
7:15	3	9	4	1	4	36	2	4	3	13	4	1	3	63	12	2	156
7:30	11	30	13	0	8	71	1	6	8	20	12	1	7	99	13	0	293
7:45	5	20	3	2	8	82	10	3	21	39	20	0	9	123	11	0	351
8:00	3	9	7	1	14	44	4	1	4	17	7	5	3	78	9	2	199
8:15	5	9	4	0	1	36	2	0	1	10	5	12	3	37	5	1	118
8:30	1	5	2	0	1	32	3	2	3	9	3	3	3	42	2	0	106
8:45	6	10	7	0	3	27	5	0	4	6	2	1	3	47	2	0	122
9:00	6	3	3	0	4	24	1	2	1	8	2	0	3	42	1	0	98
9:15	4	8	3	0	4	35	2	0	3	12	0	1	1	36	6	0	114
9:30	9	3	2	0	1	32	4	1	7	3	4	0	2	46	1	0	114
9:45	4	4	5	0	4	39	3	0	4	13	8	2	2	45	2	0	133
10:00	6	7	5	0	3	38	4	0	6	9	7	0	0	44	5	0	134
10:15	4	11	2	1	5	41	3	0	1	10	3	3	0	44	5	0	129
10:30	5	3	4	0	2	32	4	0	5	6	6	1	4	41	8	1	120
10:45	5	20	5	0	0	30	3	1	5	11	6	2	1	40	8	0	134
11:00	10	5	8	0	4	39	4	0	7	10	5	2	2	36	3	0	133
11:15	5	11	5	0	6	40	7	0	6	10	8	0	4	58	4	0	164
11:30	4	9	5	0	5	41	9	0	3	13	6	1	3	37	7	0	142
11:45	4	21	3	1	6	49	7	0	12	15	9	3	6	59	4	1	195
12:00	6	22	19	0	15	70	8	2	7	12	10	5	4	56	7	0	236
12:15	8	16	9	2	9	55	7	3	9	11	7	1	4	49	8	3	192
12:30	12	21	6	2	9	68	7	2	12	16	10	2	5	61	9	0	236
12:45	8	15	8	0	7	63	9	0	5	16	9	4	8	61	7	0	216
13:00	4	11	5	0	5	65	6	10	4	22	10	5	5	62	3	0	202
13:15	9	15	5	1	5	44	4	0	5	11	3	2	3	51	0	1	155
13:30	2	15	9	0	8	39	8	1	5	19	6	1	3	42	3	1	159
13:45	10	13	3	1	0	37	6	1	4	14	5	1	4	56	3	1	155
14:00	6	10	4	0	3	32	7	1	4	5	6	1	3	42	3	2	125
14:15	6	11	7	1	4	41	7	0	6	9	5	0	6	37	4	2	143
14:30	7	9	3	0	2	50	9	1	7	3	8	1	3	43	7	0	151
14:45	9	9	5	1	4	44	6	0	3	11	4	0	3	62	7	0	167
15:00	6	21	12	1	9	77	6	1	16	20	7	3	3	72	9	0	258
15:15	7	15	11	3	6	69	7	16	9	25	10	7	8	75	8	1	250
15:30	4	22	13	0	3	56	4	2	6	16	6	2	1	63	8	1	202
15:45	4	24	4	2	5	51	5	2	7	14	6	3	4	51	9	0	184
16:00	4	16	8	0	5	74	5	1	8	10	15	1	4	50	1	0	200
16:15	6	17	4	0	5	65	5	1	11	15	11	2	4	54	9	0	206
16:30	9	27	9	0	8	59	6	4	5	16	10	2	5	55	6	0	215
16:45	9	29	6	1	11	51	4	2	17	16	15	2	4	67	10	1	239
17:00	12	32	8	0	4	72	13	2	10	21	14	5	2	57	9	1	254
17:15	7	23	3	0	17	66	9	2	6	17	6	0	2	50	10	0	216
17:30	2	42	8	2	12	44	9	3	3	17	9	1	1	62	7	0	216
17:45	1	16	3	0	9	55	7	0	11	11	2	1	3	56	10	1	184
18:00	6	7	4	1	8	39	5	0	8	17	3	1	4	35	6	1	142
18:15	6	10	8	0	3	40	13	0	3	6	4	0	0	41	7	0	141
18:30	3	14	6	0	6	46	4	0	6	6	3	2	4	40	3	0	141
18:45	5	26	5	0	6	37	4	2	8	26	14	6	7	50	5	0	193
Total	293	721	288	24	278	2382	285	82	317	683	356	100	180	2664	299	23	8746
Cars+	274	703	284	18	272	2273	280	55	303	670	350	93	172	2531	295	17	8407
SU Trucks	17	15	3	6	5	44	5	27	8	11	6	7	4	50	1	6	169
Buses	0	3	1	0	0	8	0	0	6	2	0	0	2	12	2	0	36
Semi Trucks	2	0	0	0	1	57	0	0	0	0	0	0	2	71	1	0	134
% SU	5.8	2.1	1.0	25.0	1.8	1.8	1.8	32.9	2.5	1.6	1.7	7.0	2.2	1.9	0.3	26.1	
Trucks	2.7				1.8				1.8				1.7				1.9
% Buses	0.0	0.4	0.3	0.0	0.0	0.3	0.0	0.0	1.9	0.3	0.0	0.0	1.1	0.5	0.7	0.0	
	0.3				0.3				0.6				0.5				0.4
% Semi	0.7	0.0	0.0	0.0	0.4	2.4	0.0	0.0	0.0	0.0	0.0	0.0	1.1	2.7	0.3	0.0	
Trucks	0.2				2.0				0.0				2.4				1.5

Location: TH 19 at Main Street
Count Date: 5/23/2019
Counted By: LJ

TURNING MOVEMENT COUNT DATA

All Vehicles

	Main St				TH 19				Main St				TH 19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	7	16	5	0	6	9	9	0	4	21	2	0	3	12	7	0	101
6:15	9	22	3	0	2	6	12	0	4	22	3	0	4	13	5	1	105
6:30	9	14	4	0	1	15	14	0	4	40	3	0	6	19	7	2	136
6:45	20	37	7	0	5	24	10	0	9	58	4	0	12	36	5	0	227
7:00	15	32	8	0	8	26	9	0	8	43	5	0	10	24	11	0	199
7:15	29	31	13	0	5	29	14	0	7	57	6	0	11	43	14	0	259
7:30	35	77	28	0	10	45	15	0	26	52	11	0	11	67	32	1	409
7:45	35	75	26	0	16	46	23	1	39	92	18	0	27	79	33	0	509
8:00	23	58	13	0	8	39	17	0	19	61	9	0	21	48	20	0	336
8:15	13	55	12	0	1	26	23	0	7	37	6	0	8	29	13	0	230
8:30	30	51	7	1	7	23	16	1	12	42	7	0	3	32	10	0	240
8:45	21	46	4	1	8	29	17	1	4	46	9	0	7	38	12	24	241
9:00	14	33	6	0	12	20	14	0	8	38	11	0	10	24	15	0	205
9:15	12	65	8	0	11	24	20	0	8	32	10	0	6	24	12	22	232
9:30	22	46	4	0	11	24	15	0	9	46	11	0	7	35	15	0	245
9:45	20	60	6	1	12	29	18	0	11	52	8	0	16	29	16	1	277
10:00	19	50	8	0	6	24	13	0	12	50	11	0	9	34	13	0	249
10:15	7	59	14	1	11	22	27	0	17	44	15	2	8	33	11	0	268
10:30	20	57	5	0	19	24	18	0	11	53	14	0	12	29	13	0	275
10:45	17	74	12	5	15	21	21	0	10	56	12	0	11	27	15	0	291
11:00	20	56	6	1	17	33	13	0	12	42	14	0	8	32	12	0	265
11:15	35	69	5	0	12	39	16	0	7	55	12	0	6	40	22	0	318
11:30	28	63	6	1	17	33	19	0	18	40	18	0	13	31	18	0	304
11:45	29	64	14	1	16	37	29	0	15	70	16	0	10	40	30	0	370
12:00	42	91	21	1	15	55	31	1	23	45	12	0	11	47	21	0	414
12:15	24	69	10	2	21	45	22	6	16	70	21	0	8	45	15	1	366
12:30	22	68	19	2	23	58	37	0	11	87	17	0	10	48	24	1	424
12:45	25	57	6	1	21	59	28	3	19	79	23	0	14	38	26	2	395
13:00	17	73	11	0	13	49	39	1	22	69	14	0	17	42	16	2	382
13:15	16	69	9	6	13	32	23	4	11	55	14	0	9	39	20	1	310
13:30	12	71	11	3	14	29	26	0	12	61	11	0	9	34	13	0	303
13:45	19	66	7	2	18	30	21	0	13	55	10	1	13	43	15	4	310
14:00	19	57	8	1	17	30	19	0	7	63	11	1	4	31	18	0	284
14:15	19	60	12	0	14	33	16	0	8	55	11	0	4	35	8	0	275
14:30	17	66	9	1	15	38	25	0	14	64	14	0	7	32	13	2	314
14:45	15	70	18	0	19	24	21	0	15	59	6	0	9	46	22	1	324
15:00	17	65	17	4	13	41	20	2	39	76	18	0	16	46	22	3	390
15:15	16	81	11	2	21	59	29	0	15	58	16	0	17	59	23	4	405
15:30	26	93	18	0	22	34	29	0	12	75	23	0	13	43	19	1	407
15:45	21	77	15	2	17	32	23	0	20	67	16	0	10	31	21	2	350
16:00	33	80	8	2	32	62	30	0	12	68	24	0	17	39	18	1	423
16:15	28	87	13	1	20	48	19	0	17	61	11	0	11	47	21	0	383
16:30	25	106	10	2	24	57	31	1	16	83	7	0	21	36	29	1	445
16:45	26	88	15	0	24	39	26	0	12	91	15	0	16	53	25	0	430
17:00	15	141	29	0	23	47	28	0	22	69	14	0	15	41	30	0	474
17:15	26	96	28	0	33	57	30	0	16	68	17	0	10	40	16	3	437
17:30	12	77	13	3	22	44	23	1	13	71	15	0	9	53	16	0	368
17:45	20	42	16	1	22	43	21	2	21	64	5	0	9	29	24	0	316
18:00	18	43	11	1	18	27	12	0	18	71	13	0	6	28	14	1	279
18:15	13	56	15	1	19	26	18	0	7	55	20	0	8	36	14	2	287
18:30	9	40	13	6	19	29	13	7	13	47	17	0	9	27	17	1	253
18:45	14	36	9	3	21	26	14	0	8	54	19	0	9	32	22	1	264
Total	1055	3235	606	59	789	1800	1076	31	713	2989	649	4	550	1938	903	85	16303
Cars+	1016	2996	598	52	777	1730	1025	30	669	2750	637	3	525	1863	830	78	15416
SU Trucks	19	77	7	7	9	28	26	1	18	77	9	1	21	29	36	7	356
Buses	2	4	0	0	2	4	0	0	6	4	3	0	2	0	10	0	37
Semi Trucks	18	158	1	0	1	38	25	0	20	158	0	0	2	46	27	0	494
% SU	1.8	2.4	1.2	11.9	1.1	1.6	2.4	3.2	2.5	2.6	1.4	25.0	3.8	1.5	4.0	8.2	
Trucks	2.1				1.7				2.4				2.5				2.2
% Buses	0.2	0.1	0.0	0.0	0.3	0.2	0.0	0.0	0.8	0.1	0.5	0.0	0.4	0.0	1.1	0.0	
	0.1				0.2				0.3				0.4				0.2
% Semi	1.7	4.9	0.2	0.0	0.1	2.1	2.3	0.0	2.8	5.3	0.0	0.0	0.4	2.4	3.0	0.0	
Trucks	3.6				1.7				4.1				2.2				3.0

Location: TH 19 at Lyon Street
Count Date: 5/23/2019
Counted By: LJ

TURNING MOVEMENT COUNT DATA

All Vehicles

	W Lyon St				TH 19				W Lyon St				TH 19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	1	0	6	0	0	17	0	0	0	0	2	0	0	21	0	0	47
6:15	1	1	0	0	0	20	1	0	0	0	0	0	4	21	0	0	48
6:30	2	0	1	0	0	29	3	0	0	0	0	0	3	28	0	0	66
6:45	2	0	2	0	0	37	3	0	0	0	1	0	1	58	0	0	104
7:00	5	0	5	0	0	39	3	0	0	1	0	0	2	42	0	0	97
7:15	7	1	1	0	2	48	1	0	1	2	1	0	1	77	0	0	142
7:30	16	0	11	0	0	60	5	0	1	1	0	0	5	102	0	1	201
7:45	13	2	7	1	0	79	8	0	2	2	0	1	10	117	3	0	243
8:00	5	0	8	1	0	54	7	0	0	2	0	0	7	78	0	0	161
8:15	3	0	2	0	0	47	3	2	0	1	1	0	1	41	3	0	102
8:30	4	1	1	1	0	49	5	0	0	2	0	0	3	67	0	0	132
8:45	7	0	5	0	1	45	2	0	1	1	0	0	5	63	0	1	130
9:00	4	1	7	0	0	40	6	0	0	1	0	0	4	43	1	0	107
9:15	7	1	4	0	0	47	5	0	2	2	0	0	6	39	0	0	113
9:30	6	0	9	0	0	40	4	0	0	2	1	0	8	56	2	0	128
9:45	8	1	12	0	0	49	3	1	0	1	3	0	6	50	1	0	134
10:00	18	1	4	0	0	42	9	0	0	2	0	0	4	54	1	0	135
10:15	8	3	10	2	2	52	4	1	0	0	1	0	11	46	0	0	137
10:30	13	1	13	0	1	44	9	2	3	3	0	0	8	50	1	1	146
10:45	8	1	6	0	2	46	7	3	0	3	0	0	2	53	1	0	129
11:00	12	4	10	1	2	53	6	1	0	0	1	0	6	59	1	0	154
11:15	14	0	14	0	0	61	5	3	1	3	3	0	1	83	1	0	186
11:30	10	2	8	0	1	58	8	1	1	1	1	0	10	63	4	0	167
11:45	14	6	8	0	3	73	12	0	0	5	2	0	8	69	2	4	202
12:00	20	2	10	1	2	89	8	1	1	1	2	0	5	99	0	0	239
12:15	16	1	18	0	1	69	6	1	0	1	1	0	9	77	3	1	202
12:30	17	0	17	0	0	100	13	0	2	1	5	0	9	78	0	1	242
12:45	15	1	13	0	1	101	21	3	0	3	1	0	8	70	1	0	235
13:00	11	0	16	2	1	77	10	1	0	2	1	0	7	64	3	0	192
13:15	13	2	11	3	0	56	6	1	1	1	4	0	10	56	1	0	161
13:30	12	0	14	0	0	56	6	2	0	1	3	0	7	51	2	0	152
13:45	9	2	10	1	0	60	8	0	1	0	0	3	7	64	1	2	162
14:00	15	1	7	0	2	57	6	0	2	2	1	1	10	51	1	0	155
14:15	8	2	9	1	1	50	7	3	1	4	1	0	5	54	0	0	142
14:30	17	1	7	2	1	69	11	1	1	1	1	0	8	56	0	0	173
14:45	10	2	10	0	0	46	7	0	3	0	1	0	6	54	0	1	139
15:00	6	2	11	1	1	68	9	2	1	0	2	0	10	70	2	1	182
15:15	7	1	16	0	0	88	16	2	0	2	3	0	11	71	1	0	216
15:30	6	3	13	0	0	73	16	0	2	3	2	1	8	88	0	0	214
15:45	8	2	7	2	3	66	10	1	0	1	1	0	8	59	0	0	165
16:00	13	2	24	2	3	85	14	3	2	2	1	0	4	89	2	0	241
16:15	15	5	13	2	2	75	12	0	0	2	0	0	6	77	1	0	208
16:30	16	0	17	1	3	96	8	0	0	1	1	1	7	61	2	0	212
16:45	10	0	12	0	7	72	15	0	0	3	4	0	10	80	1	0	214
17:00	19	2	17	2	4	84	15	1	0	3	3	1	4	62	0	1	213
17:15	16	0	21	0	1	94	11	0	0	1	4	0	10	69	4	0	231
17:30	10	1	15	1	1	71	4	0	0	2	1	0	8	68	2	0	183
17:45	10	0	15	1	2	67	7	1	0	4	3	0	3	52	0	1	163
18:00	4	4	10	0	3	45	10	0	1	3	2	0	8	47	0	0	137
18:15	8	2	6	2	0	54	15	0	1	0	1	0	11	53	2	1	153
18:30	8	1	15	4	2	45	9	0	0	1	2	0	7	46	0	0	136
18:45	6	2	15	2	2	44	8	0	2	3	0	0	8	58	0	0	148
Total	513	67	523	36	57	3086	407	37	33	83	68	8	330	3204	50	16	8421
Cars+	506	65	520	31	56	2963	405	32	29	69	66	6	323	3093	50	12	8145
SU Trucks	3	1	2	5	1	51	0	5	3	13	1	2	5	46	0	4	126
Buses	0	0	0	0	0	6	1	0	1	1	0	0	1	5	0	0	15
Semi Trucks	4	1	1	0	0	66	1	0	0	0	1	0	1	60	0	0	135
% SU	0.6	1.5	0.4	13.9	1.8	1.7	0.0	13.5	9.1	15.7	1.5	25.0	1.5	1.4	0.0	25.0	
Trucks	0.5				1.5				9.2				1.4				1.5
% Buses	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.0	3.0	1.2	0.0	0.0	0.3	0.2	0.0	0.0	
	0.0				0.2				1.1				0.2				0.2
% Semi	0.8	1.5	0.2	0.0	0.0	2.1	0.2	0.0	0.0	0.0	1.5	0.0	0.3	1.9	0.0	0.0	
Trucks	0.5				1.9				0.5				1.7				1.6

Location: TH 19 at Marshall Street
Count Date: 5/23/2019
Counted By: LJ

TURNING MOVEMENT COUNT DATA

All Vehicles

	Marshall St				TH 19				Marshall St				TH 19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	0	0	2	0	1	15	1	0	0	0	1	1	1	23	0	0	44
6:15	0	1	2	0	0	21	0	0	1	0	2	0	3	19	0	0	49
6:30	1	1	1	0	0	28	0	0	1	1	1	0	1	22	0	0	57
6:45	0	2	1	0	2	44	0	0	0	2	1	0	3	60	0	2	115
7:00	0	0	4	0	1	36	2	0	0	1	0	0	2	42	1	0	89
7:15	3	0	3	0	0	46	0	0	0	1	0	0	1	81	0	0	135
7:30	1	1	1	2	1	68	0	0	0	1	2	0	3	119	0	0	197
7:45	4	0	4	1	3	91	1	0	0	1	4	0	0	124	0	0	232
8:00	2	1	3	0	1	58	1	0	0	0	2	1	5	78	0	0	151
8:15	3	1	3	0	2	53	0	0	0	1	0	0	1	44	0	0	108
8:30	1	4	4	1	3	49	0	0	0	1	2	0	0	70	0	0	134
8:45	0	1	3	0	0	48	0	0	0	1	1	0	1	62	0	0	117
9:00	0	0	0	0	0	49	0	0	0	0	0	0	2	42	1	0	94
9:15	2	1	3	0	1	48	0	0	0	0	0	0	0	44	0	0	99
9:30	1	1	2	0	2	42	1	0	0	1	0	0	3	57	1	0	111
9:45	4	1	1	1	6	53	0	0	0	1	3	0	4	63	1	2	137
10:00	0	0	0	0	5	56	1	0	1	2	4	2	8	63	0	0	140
10:15	3	2	0	1	4	51	1	0	0	0	1	0	4	44	1	0	111
10:30	1	0	2	0	1	48	3	0	0	0	2	0	0	64	0	0	121
10:45	2	0	6	0	4	50	0	0	0	0	0	0	4	59	0	0	125
11:00	3	1	3	1	2	59	1	0	0	0	4	0	2	62	0	0	137
11:15	0	0	2	0	3	58	0	0	0	1	0	0	4	100	0	0	168
11:30	5	2	2	0	3	68	1	1	0	0	3	0	0	77	0	1	161
11:45	4	1	3	0	2	89	1	0	0	0	3	0	2	83	1	1	189
12:00	1	3	6	1	1	87	1	1	0	0	4	0	3	118	3	2	227
12:15	1	2	2	1	3	80	6	0	1	1	4	2	3	90	0	0	193
12:30	3	2	2	0	0	116	2	0	0	1	3	0	3	94	2	0	228
12:45	3	2	4	0	0	115	2	0	1	2	2	0	4	79	0	0	214
13:00	2	5	1	0	1	85	0	0	1	3	4	0	2	70	0	0	174
13:15	2	2	3	3	3	62	1	0	1	1	5	0	2	64	1	0	147
13:30	1	4	2	1	3	64	1	0	0	1	6	0	5	65	0	0	152
13:45	4	1	5	0	1	63	0	0	2	0	3	1	1	72	2	0	154
14:00	2	1	6	0	1	66	1	0	0	0	5	0	4	68	0	0	154
14:15	5	2	3	0	3	60	2	0	0	0	2	1	5	61	0	0	143
14:30	0	3	1	3	3	71	1	1	1	5	3	1	7	66	2	0	163
14:45	2	3	4	0	4	55	3	0	0	1	3	0	2	63	0	0	140
15:00	3	2	0	1	6	84	0	0	1	2	4	0	5	78	1	0	186
15:15	5	2	4	2	2	101	2	0	0	0	4	0	5	79	1	2	205
15:30	3	4	7	0	2	79	1	0	0	3	4	0	5	91	1	0	200
15:45	1	7	2	2	4	88	1	0	0	1	2	0	5	58	2	0	171
16:00	3	1	7	0	2	90	1	0	1	1	3	2	9	81	1	0	200
16:15	0	4	6	2	3	75	2	0	0	2	6	0	9	86	0	0	193
16:30	3	4	9	0	2	105	4	0	0	3	7	0	6	66	0	0	209
16:45	1	2	8	3	4	76	0	0	1	1	4	1	3	88	0	0	188
17:00	2	4	6	0	3	100	1	1	1	1	5	1	7	78	1	0	209
17:15	0	3	7	1	4	99	1	2	3	2	2	1	8	82	0	4	211
17:30	2	0	6	2	4	63	2	0	0	1	3	0	3	72	0	0	156
17:45	4	5	6	1	2	73	1	0	1	1	0	1	4	61	0	0	158
18:00	6	1	3	1	3	52	0	0	0	3	1	1	5	49	1	0	124
18:15	2	2	4	1	0	60	1	2	0	0	1	1	2	58	0	1	130
18:30	1	0	1	4	2	54	1	1	0	0	2	1	9	45	0	0	115
18:45	1	1	1	1	3	47	1	0	0	0	1	0	4	59	1	1	119
Total	103	93	171	37	116	3398	53	9	18	51	129	18	184	3543	25	16	7884
Cars+	96	92	167	29	113	3278	46	5	17	50	127	16	182	3427	23	10	7618
SU Trucks	6	0	2	8	3	53	7	4	0	0	2	2	1	49	2	6	125
Buses	1	1	2	0	0	3	0	0	0	1	0	0	1	4	0	0	13
Semi Trucks	0	0	0	0	0	64	0	0	1	0	0	0	0	63	0	0	128
% SU	5.8	0.0	1.2	21.6	2.6	1.6	13.2	44.4	0.0	0.0	1.6	11.1	0.5	1.4	8.0	37.5	
Trucks	2.2				1.8				1.0				1.4				1.6
% Buses	1.0	1.1	1.2	0.0	0.0	0.1	0.0	0.0	0.0	2.0	0.0	0.0	0.5	0.1	0.0	0.0	
	1.1				0.1				0.5				0.1				0.2
% Semi	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	5.6	0.0	0.0	0.0	0.0	1.8	0.0	0.0	
Trucks	0.0				1.8				0.5				1.7				1.6

Location: TH 19 at N 3rd Street
Count Date: 5/23/2019
Counted By: CA

TURNING MOVEMENT COUNT DATA

All Vehicles

	N 3rd St				TH 19				N/A				TH 19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	4	0	0	0	0	16	5	0	0	0	0	0	0	24	0	0	49
6:15	5	0	0	0	0	24	3	0	0	0	0	0	0	21	0	0	53
6:30	1	0	0	0	0	26	12	0	0	0	0	0	0	28	0	0	67
6:45	7	0	2	0	0	49	11	0	0	0	0	0	0	61	0	0	130
7:00	12	0	0	0	0	38	13	0	0	0	0	0	0	41	0	0	104
7:15	6	0	1	0	0	44	15	0	0	0	0	0	1	84	0	0	151
7:30	12	0	5	1	0	64	15	0	0	0	0	0	0	116	0	0	212
7:45	21	0	3	0	0	97	22	0	0	0	0	0	0	139	0	0	282
8:00	5	0	3	0	0	53	17	0	0	0	0	0	2	72	0	0	152
8:15	9	0	1	0	0	53	9	0	0	0	0	0	1	46	0	0	119
8:30	7	0	1	0	0	51	8	0	0	0	0	0	1	69	0	0	137
8:45	10	0	0	1	0	47	10	0	0	0	0	0	0	67	0	0	134
9:00	6	0	0	0	0	48	10	1	0	0	0	0	1	38	0	0	103
9:15	10	0	3	1	0	49	10	0	0	0	0	0	0	44	0	0	116
9:30	9	0	2	0	0	43	12	0	0	0	0	0	2	66	0	0	134
9:45	4	0	1	1	0	58	16	0	0	0	0	0	1	65	0	0	145
10:00	8	0	2	0	0	63	10	0	0	0	0	0	1	68	0	0	152
10:15	10	0	1	2	0	55	9	0	0	0	0	0	1	44	0	0	120
10:30	10	0	1	0	0	53	9	0	0	0	0	0	2	64	0	0	139
10:45	11	0	1	0	0	54	14	0	0	0	0	0	2	58	0	0	140
11:00	9	0	3	1	0	57	30	0	0	0	0	0	1	69	0	0	169
11:15	6	0	0	0	0	59	21	0	0	0	0	0	0	101	0	0	187
11:30	11	0	2	2	0	75	20	0	0	0	0	0	3	79	0	0	190
11:45	9	0	0	4	0	92	28	0	0	0	0	0	3	92	0	0	224
12:00	15	0	3	1	0	85	25	0	0	0	0	0	4	117	0	0	249
12:15	15	0	1	1	0	89	29	0	0	0	0	0	0	86	0	0	220
12:30	10	0	1	1	0	109	20	0	0	0	0	0	0	97	0	0	237
12:45	12	1	1	0	0	121	34	0	0	0	0	0	0	80	0	0	249
13:00	10	0	0	0	0	82	28	0	0	0	0	0	1	68	0	0	189
13:15	12	1	1	0	0	68	20	0	0	0	0	0	0	75	0	0	177
13:30	17	0	0	1	0	66	20	0	0	0	0	0	4	60	0	0	167
13:45	12	0	1	1	0	57	27	0	0	0	0	0	1	79	0	0	177
14:00	9	0	0	0	0	78	14	0	0	0	0	0	1	77	0	0	179
14:15	18	0	0	0	0	58	22	0	0	0	0	0	2	66	0	0	166
14:30	9	0	1	3	0	73	20	0	0	0	0	0	2	68	0	0	173
14:45	8	0	0	1	0	64	14	0	0	0	0	0	1	68	0	0	155
15:00	10	0	0	1	0	92	29	0	0	0	0	0	2	78	0	0	211
15:15	8	0	2	2	0	98	24	0	0	0	0	0	2	86	0	0	220
15:30	15	0	1	2	0	84	32	0	0	0	0	0	1	87	0	0	220
15:45	8	0	1	0	0	95	21	0	0	0	0	0	1	64	0	0	190
16:00	9	0	1	0	0	81	17	0	0	0	0	0	1	84	0	0	193
16:15	12	0	2	0	0	80	19	0	0	0	0	0	1	84	0	0	198
16:30	11	0	2	0	0	111	17	0	0	0	0	0	3	78	0	0	222
16:45	15	0	2	0	0	77	25	0	0	0	0	0	2	87	0	0	208
17:00	16	0	1	0	0	96	19	0	0	0	0	0	3	83	0	0	218
17:15	6	0	0	0	0	107	20	0	0	0	0	0	2	86	0	0	221
17:30	5	0	3	2	0	69	14	0	0	0	0	0	3	66	0	0	160
17:45	8	0	2	1	0	68	17	0	0	0	0	0	0	68	0	0	163
18:00	10	0	2	1	0	58	22	0	0	0	0	0	1	63	0	0	156
18:15	14	0	0	4	0	57	13	0	0	0	0	0	1	54	0	0	139
18:30	6	0	0	3	0	55	12	0	0	0	0	0	1	46	0	0	120
18:45	4	0	0	0	0	48	8	0	0	0	0	0	2	51	0	0	113
Total	506	2	60	38	0	3494	911	1	0	0	0	0	64	3662	0	0	8699
Cars+	499	2	58	35	0	3360	893	1	0	0	0	0	63	3526	0	0	8401
SU Trucks	3	0	2	3	0	66	13	0	0	0	0	0	1	58	0	0	143
Buses	2	0	0	0	0	3	4	0	0	0	0	0	0	5	0	0	14
Semi Trucks	2	0	0	0	0	65	1	0	0	0	0	0	0	73	0	0	141
% SU	0.6	0.0	3.3	7.9	0.0	1.9	1.4	0.0	0.0	0.0	0.0	0.0	1.6	1.6	0.0	0.0	
Trucks	0.9				1.8				0.0				1.6				1.6
% Buses	0.4	0.0	0.0	0.0	0.0	0.1	0.4	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	
	0.4				0.2				0.0				0.1				0.2
% Semi	0.4	0.0	0.0	0.0	0.0	1.9	0.1	0.0	0.0	0.0	0.0	0.0	0.0	2.0	0.0	0.0	
Trucks	0.4				1.5				0.0				2.0				1.6

Location: TH 19 at Bruce Street
Count Date: 5/23/2019
Counted By: LJ

TURNING MOVEMENT COUNT DATA

All Vehicles

	Bruce St				TH 19				Bruce St				TH 19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	5	9	2	0	1	10	6	0	4	3	5	0	7	20	3	0	75
6:15	8	9	4	0	5	19	1	0	4	7	6	0	1	19	1	1	84
6:30	6	2	4	0	6	25	9	0	6	6	4	0	2	25	2	0	97
6:45	13	8	1	1	11	44	4	0	7	2	7	0	3	52	5	0	157
7:00	13	8	6	1	8	36	7	0	3	6	18	0	2	51	3	2	161
7:15	12	18	6	0	13	44	7	0	7	7	24	1	5	74	10	0	227
7:30	22	29	6	0	17	76	12	1	8	21	40	0	12	114	10	0	367
7:45	20	24	16	0	21	92	13	0	21	25	26	0	7	141	17	1	423
8:00	13	13	9	0	9	59	9	0	11	19	15	0	7	79	9	0	252
8:15	10	6	7	0	13	40	16	0	6	8	21	0	8	43	5	0	183
8:30	12	8	9	0	13	40	9	0	9	5	17	0	3	73	6	0	204
8:45	13	10	7	1	17	46	7	0	4	8	13	1	7	67	6	0	205
9:00	12	10	2	0	7	52	8	0	10	6	10	0	4	42	5	0	168
9:15	9	7	10	0	12	47	10	0	5	9	18	0	6	47	6	1	186
9:30	8	9	2	2	15	44	8	0	6	11	13	0	4	60	9	0	189
9:45	15	9	6	0	11	55	9	0	7	13	28	0	8	78	6	1	245
10:00	13	7	6	1	22	60	13	0	5	13	17	0	4	61	10	0	231
10:15	9	7	5	1	21	47	14	1	5	12	16	0	4	60	4	1	204
10:30	9	7	5	0	19	51	9	0	6	8	29	1	2	57	7	2	209
10:45	12	10	9	0	16	55	14	1	6	18	27	0	9	56	6	0	238
11:00	13	18	7	1	15	73	6	0	11	9	20	0	7	70	6	0	255
11:15	14	8	6	0	16	64	15	0	7	20	31	0	5	93	13	0	292
11:30	18	22	9	0	15	72	20	0	6	11	31	0	4	85	10	1	303
11:45	25	15	10	0	25	91	14	1	16	27	42	0	9	85	5	0	364
12:00	30	16	12	1	24	86	22	1	9	13	31	0	4	117	10	0	374
12:15	29	15	12	0	22	102	22	0	8	8	29	2	8	97	13	0	365
12:30	26	20	22	0	32	87	18	1	5	18	40	0	17	71	11	0	367
12:45	20	10	16	1	22	112	12	0	13	14	17	3	9	85	10	1	340
13:00	26	10	14	0	15	84	15	1	8	22	24	0	5	70	10	1	303
13:15	17	5	7	0	16	82	12	1	4	14	18	0	7	72	7	0	261
13:30	17	12	16	1	16	63	9	0	9	26	20	0	15	53	12	0	268
13:45	16	17	8	0	13	61	12	0	12	19	23	0	16	64	7	1	268
14:00	15	16	10	2	10	70	12	0	6	20	23	0	3	80	6	0	271
14:15	11	14	9	0	19	63	12	0	8	21	22	1	8	65	10	0	262
14:30	8	12	9	2	21	67	17	0	12	11	16	0	4	55	7	1	239
14:45	22	11	11	0	12	57	12	0	10	19	25	0	6	68	10	1	263
15:00	15	18	14	0	6	90	27	0	13	21	25	0	7	81	12	0	329
15:15	11	13	6	2	44	112	20	0	10	23	26	1	16	80	16	0	377
15:30	20	18	11	2	17	85	16	0	14	21	19	0	17	73	11	4	322
15:45	16	26	13	0	8	91	12	1	13	18	28	0	9	53	6	0	293
16:00	17	17	6	0	18	79	21	0	7	8	25	0	11	77	10	3	296
16:15	16	17	4	1	14	82	17	1	11	15	21	2	10	75	20	0	302
16:30	20	12	15	1	11	100	16	0	9	19	24	0	8	63	9	0	306
16:45	13	22	13	0	19	70	20	0	11	24	23	0	13	78	11	4	317
17:00	19	26	15	1	27	101	19	0	13	22	30	1	9	77	9	3	367
17:15	27	16	19	0	23	98	12	3	8	27	26	0	9	64	5	0	334
17:30	19	26	13	2	19	61	17	3	7	20	23	0	9	79	7	0	300
17:45	17	17	6	0	25	72	16	0	5	26	38	0	5	62	9	0	298
18:00	12	14	8	0	14	67	15	0	9	17	23	0	6	56	4	1	245
18:15	9	18	13	2	22	65	15	2	4	14	18	0	12	64	8	0	262
18:30	7	12	8	1	9	61	10	1	3	19	15	0	9	44	4	1	201
18:45	13	17	8	0	14	55	10	1	4	17	26	0	8	36	4	1	212
Total	792	720	472	27	840	3465	678	20	425	790	1156	13	390	3512	422	32	13661
Cars+	777	694	456	24	831	3346	658	15	411	769	1144	12	382	3391	415	19	13274
SU Trucks	11	15	9	3	7	53	15	5	7	11	7	1	4	48	3	13	190
Buses	2	10	3	0	1	7	1	0	5	10	4	0	1	8	3	0	55
Semi Trucks	2	1	4	0	1	59	4	0	2	0	1	0	3	65	1	0	143
% SU	1.4	2.1	1.9	11.1	0.8	1.5	2.2	25.0	1.6	1.4	0.6	7.7	1.0	1.4	0.7	40.6	
Trucks	1.8				1.5				1.1				1.3				1.4
% Buses	0.3	1.4	0.6	0.0	0.1	0.2	0.1	0.0	1.2	1.3	0.3	0.0	0.3	0.2	0.7	0.0	
	0.8				0.2				0.8				0.3				0.4
% Semi	0.3	0.1	0.8	0.0	0.1	1.7	0.6	0.0	0.5	0.0	0.1	0.0	0.8	1.9	0.2	0.0	
Trucks	0.4				1.3				0.1				1.6				1.0

Location: TH 19 at Greeley Street
Count Date: 11/7/2019
Counted By: CAA

TURNING MOVEMENT COUNT DATA

All Vehicles

	Greeley St				TH 19				Greeley St				TH 19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	1	0	2	0	1	13	0	0	1	0	1	0	0	24	0	0	43
6:15	1	0	1	0	2	13	0	0	1	0	3	0	0	22	0	0	43
6:30	0	0	1	0	1	24	0	0	1	0	4	0	0	33	1	0	65
6:45	0	0	0	0	0	23	0	0	4	0	7	0	0	38	3	0	75
7:00	0	0	1	0	1	38	0	0	1	1	6	0	0	33	1	0	82
7:15	1	1	1	0	2	40	1	0	5	0	8	0	3	67	4	0	133
7:30	0	1	1	1	5	86	1	0	4	1	10	3	1	105	8	0	223
7:45	1	0	2	0	1	105	0	0	7	1	9	1	3	133	7	0	269
8:00	0	1	1	0	3	52	0	0	4	0	5	0	1	85	2	0	154
8:15	0	0	1	0	2	38	1	0	3	0	3	0	1	42	3	0	94
8:30	0	0	0	1	2	35	0	0	1	1	4	0	1	43	0	1	87
8:45	0	0	0	0	0	37	1	0	2	2	4	1	1	48	0	0	95
9:00	0	0	0	0	3	23	2	0	0	2	0	0	1	45	1	0	77
9:15	0	0	3	0	1	40	0	0	1	1	3	0	0	40	2	0	91
9:30	1	1	2	1	3	38	0	0	1	2	3	1	0	45	1	0	97
9:45	0	0	0	0	5	42	1	0	1	0	2	0	0	47	0	0	98
10:00	0	0	1	0	3	45	1	0	0	0	2	0	0	47	1	0	100
10:15	0	1	0	0	3	41	0	0	0	0	1	0	0	47	2	0	95
10:30	1	0	2	0	4	33	4	0	0	0	3	0	0	49	2	0	98
10:45	1	2	1	0	3	34	3	1	3	1	7	0	0	41	1	0	97
11:00	0	0	1	0	2	52	0	0	1	1	5	0	0	35	5	0	102
11:15	0	0	1	0	7	43	2	0	1	1	1	0	0	64	1	0	121
11:30	2	0	0	0	4	44	1	0	2	0	4	0	1	41	3	1	102
11:45	3	0	3	0	5	56	3	0	0	0	4	0	3	62	2	0	141
12:00	1	0	2	0	11	84	2	0	1	1	8	0	3	58	0	0	171
12:15	1	0	3	0	12	59	2	0	0	2	3	1	0	57	2	0	141
12:30	1	0	1	0	8	78	1	0	5	0	6	0	0	68	3	0	171
12:45	0	1	0	0	3	73	0	0	2	1	8	0	1	68	0	0	157
13:00	0	2	0	0	9	64	1	0	5	0	3	0	2	67	3	0	156
13:15	1	0	1	0	7	46	1	0	1	0	7	1	1	46	0	0	111
13:30	0	0	4	0	1	50	2	0	0	0	6	0	0	42	1	1	106
13:45	0	3	2	0	2	41	1	0	2	0	3	0	3	60	2	0	119
14:00	0	0	3	0	5	35	0	0	3	2	6	0	2	42	0	0	98
14:15	0	1	3	0	3	50	1	0	2	1	2	5	1	45	1	2	110
14:30	2	0	2	0	7	50	3	3	2	0	4	0	0	47	6	0	123
14:45	0	0	2	0	5	46	1	1	0	0	3	1	0	69	1	1	127
15:00	1	0	0	1	11	92	2	0	1	1	7	0	3	76	1	0	195
15:15	1	0	2	1	8	81	0	0	0	1	5	0	2	82	3	1	185
15:30	0	0	1	0	7	68	0	0	1	0	2	0	0	69	4	0	152
15:45	1	0	2	1	4	55	3	0	3	0	6	2	0	57	0	1	131
16:00	1	1	2	1	7	82	1	0	4	1	5	1	1	49	6	0	160
16:15	0	0	2	0	17	60	3	0	3	0	8	3	1	59	3	0	156
16:30	0	0	2	0	5	66	2	0	2	1	9	1	0	57	12	0	156
16:45	1	0	3	1	9	63	2	0	4	1	4	1	2	76	2	1	167
17:00	1	0	2	1	12	76	2	0	5	1	6	1	1	61	4	1	171
17:15	2	2	1	0	7	67	1	0	2	1	10	0	1	51	1	0	146
17:30	0	0	3	1	6	47	2	1	0	0	5	5	0	65	1	0	129
17:45	1	0	0	1	7	62	0	0	1	2	3	1	0	65	3	1	144
18:00	1	1	3	0	4	47	0	0	0	0	3	0	1	42	1	0	103
18:15	1	1	1	0	8	44	0	0	4	1	5	0	1	42	3	0	111
18:30	0	0	0	0	8	49	1	0	4	0	9	0	1	38	0	0	110
18:45	1	0	0	0	3	47	0	0	2	1	2	0	0	59	1	0	116
Total	30	19	72	11	259	2677	55	6	103	32	247	29	43	2853	114	11	6504
Cars+	29	18	68	8	254	2555	51	5	103	31	243	17	41	2726	98	10	6217
SU Trucks	0	0	3	0	3	52	2	0	0	0	2	0	1	53	1	0	117
Buses	1	1	0	0	1	13	2	0	0	1	2	0	1	0	15	0	37
Semi Trucks	0	0	1	3	1	57	0	1	0	0	0	12	0	74	0	1	133
% SU	0.0	0.0	4.2	0.0	1.2	1.9	3.6	0.0	0.0	0.0	0.8	0.0	2.3	1.9	0.9	0.0	
Trucks	2.5				1.9				0.5				1.8				1.8
% Buses	3.3	5.3	0.0	0.0	0.4	0.5	3.6	0.0	0.0	3.1	0.8	0.0	2.3	0.0	13.2	0.0	
	1.7				0.5				0.8				0.5				0.6
% Semi	0.0	0.0	1.4	27.3	0.4	2.1	0.0	16.7	0.0	0.0	0.0	41.4	0.0	2.6	0.0	9.1	
Trucks	0.8				1.9				0.0				2.5				2.0

Location: TH 19 at Marvin Schwan Memorial Drive
Count Date: 10/30/2019
Counted By: CAA

TURNING MOVEMENT COUNT DATA

All Vehicles

	Marvin Schwan Memorial Dr				TH 19				N/A				TH 19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	0	0	0	0	2	16	0	0	3	0	0	0	0	22	3	0	46
6:15	0	0	0	0	0	13	0	0	3	0	1	0	0	21	3	0	41
6:30	0	0	0	0	1	22	0	0	1	0	2	0	0	30	1	0	57
6:45	0	0	0	0	7	34	0	1	1	0	1	0	0	52	3	0	98
7:00	0	0	0	0	5	37	0	0	1	0	2	0	0	43	1	0	89
7:15	0	0	0	0	12	37	0	1	6	0	2	0	0	66	4	0	127
7:30	0	0	0	0	9	91	0	4	1	0	2	3	0	108	7	0	218
7:45	0	0	0	0	15	99	0	1	2	0	3	1	0	136	8	0	263
8:00	0	0	0	0	16	56	0	1	1	0	17	0	0	73	1	0	164
8:15	0	0	0	0	7	37	0	0	1	0	1	0	0	49	1	0	96
8:30	0	0	0	0	4	38	0	0	1	0	4	0	0	42	0	0	89
8:45	0	0	0	0	1	35	0	1	3	0	2	0	0	55	3	0	99
9:00	0	0	0	0	3	31	0	0	1	0	3	0	0	47	0	0	85
9:15	0	0	0	0	4	36	0	0	1	0	0	0	0	42	1	0	84
9:30	0	0	0	0	1	36	0	0	1	0	3	1	0	54	5	0	100
9:45	0	0	0	0	0	46	0	0	3	0	1	0	0	60	3	0	113
10:00	0	0	0	0	1	43	0	0	0	0	2	0	0	55	0	0	101
10:15	0	0	0	0	4	49	0	0	1	0	1	1	0	51	2	0	108
10:30	0	0	0	0	3	37	0	0	5	0	4	0	0	50	1	0	100
10:45	0	0	0	0	2	41	0	0	0	0	2	1	0	51	3	0	99
11:00	0	0	0	0	4	47	0	0	3	0	5	0	0	48	0	0	107
11:15	0	0	0	0	1	50	0	0	0	0	4	0	0	64	1	0	120
11:30	0	0	0	0	33	24	0	0	5	0	2	0	0	60	3	0	127
11:45	0	0	0	0	13	53	0	5	3	0	10	7	0	70	2	1	151
12:00	0	0	0	0	11	90	0	3	3	0	18	1	0	62	5	0	189
12:15	0	0	0	0	14	57	0	3	6	0	4	2	0	64	3	0	148
12:30	0	0	0	0	7	81	0	7	1	0	1	6	0	81	3	0	174
12:45	0	0	0	0	16	68	0	1	0	0	6	1	0	72	4	0	166
13:00	0	0	0	0	7	75	0	1	2	0	6	1	0	70	3	0	163
13:15	0	0	0	0	6	46	0	2	0	0	4	2	0	64	3	0	123
13:30	0	0	0	0	3	49	0	0	2	0	3	1	0	53	3	0	113
13:45	0	0	0	0	6	44	0	2	0	0	3	0	0	68	2	0	123
14:00	0	0	0	0	3	41	0	0	4	0	3	1	0	51	3	0	105
14:15	0	0	0	0	2	51	0	1	5	0	2	4	0	45	2	0	107
14:30	0	0	0	0	4	56	0	1	3	0	6	0	0	46	3	0	118
14:45	0	0	0	0	1	56	0	0	2	0	4	0	0	74	1	0	138
15:00	0	0	0	0	8	89	0	1	1	0	2	0	0	83	2	0	185
15:15	0	0	0	0	5	80	0	1	1	0	3	0	0	96	1	0	186
15:30	0	0	0	0	3	61	0	1	3	0	6	0	0	69	2	0	144
15:45	0	0	0	0	2	65	0	2	0	0	4	0	0	58	0	0	129
16:00	0	0	0	0	4	78	0	1	1	0	12	0	0	63	1	0	159
16:15	0	0	0	0	4	74	0	1	1	0	9	1	0	70	3	0	161
16:30	0	0	0	0	8	75	0	2	3	0	8	1	0	78	3	0	175
16:45	0	0	0	0	6	60	0	1	3	0	5	1	0	89	1	0	164
17:00	0	0	0	0	12	86	0	1	3	0	21	1	0	66	4	0	192
17:15	0	0	0	0	7	95	0	1	0	0	6	0	0	60	3	0	171
17:30	0	0	0	0	3	67	0	2	3	0	10	2	0	68	1	0	152
17:45	0	0	0	0	8	72	0	4	3	0	4	1	0	58	1	1	146
18:00	0	0	0	0	8	48	0	0	14	0	8	0	0	41	2	0	121
18:15	0	0	0	0	3	45	0	1	8	0	5	1	0	53	2	0	116
18:30	0	0	0	0	3	52	0	1	0	0	6	0	0	47	3	0	111
18:45	0	0	0	0	6	37	0	1	1	0	6	0	0	57	2	0	109
Total	0	0	0	0	318	2806	0	56	120	0	249	41	0	3155	122	2	6770
Cars+	0	0	0	0	310	2687	0	42	118	0	235	37	0	2983	116	1	6449
SU Trucks	0	0	0	0	0	53	0	0	0	0	0	0	0	86	3	0	142
Buses	0	0	0	0	7	8	0	0	1	0	14	0	0	11	3	0	44
Semi Trucks	0	0	0	0	1	58	0	14	1	0	0	4	0	75	0	1	135
% SU	0.0	0.0	0.0	0.0	0.0	1.9	0.0	0.0	0.0	0.0	0.0	0.0	0.0	2.7	2.5	0.0	
Trucks	0.0				1.7				0.0				2.7				2.1
% Buses	0.0	0.0	0.0	0.0	2.2	0.3	0.0	0.0	0.8	0.0	5.6	0.0	0.0	0.3	2.5	0.0	
	0.0				0.5				4.1				0.4				0.6
% Semi	0.0	0.0	0.0	0.0	0.3	2.1	0.0	25.0	0.8	0.0	0.0	9.8	0.0	2.4	0.0	50.0	
Trucks	0.0				1.9				0.3				2.3				2.0

Location: TH 19 at Redwood Street
Count Date: 11/6/2019
Counted By: CAA

TURNING MOVEMENT COUNT DATA

All Vehicles

	Redwood St				TH 19				Redwood St				TH 19				
	Southbound				Westbound				Northbound				Eastbound				
Start Time	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Left	Thru	Right	Peds	Int. Total
6:00	0	0	1	0	0	17	0	0	0	0	1	0	0	23	0	0	42
6:15	0	0	1	0	0	23	1	0	0	1	2	0	0	20	0	0	48
6:30	1	1	0	0	0	30	0	0	0	0	2	0	3	20	0	0	57
6:45	0	0	0	0	0	43	2	0	0	0	2	0	2	61	0	0	110
7:00	1	0	0	0	0	40	0	0	0	2	0	0	2	44	1	0	90
7:15	2	0	0	0	0	48	1	0	0	0	1	0	0	79	0	0	131
7:30	0	1	1	0	1	67	1	0	0	0	1	1	5	121	0	0	198
7:45	1	0	0	0	2	91	2	0	0	0	0	0	5	123	0	0	224
8:00	3	0	1	0	1	59	1	0	1	1	2	0	2	79	0	0	150
8:15	0	0	0	0	0	56	0	4	0	0	1	0	0	44	2	0	103
8:30	0	1	0	0	1	52	0	0	0	1	2	0	2	69	1	0	129
8:45	1	0	0	0	0	49	2	0	2	1	3	0	3	59	1	0	121
9:00	0	0	0	0	1	47	1	0	0	1	2	0	3	43	0	1	98
9:15	2	1	2	1	5	45	1	0	1	1	3	0	2	40	0	0	103
9:30	4	2	0	0	4	38	2	0	5	0	3	0	1	55	0	0	114
9:45	5	1	0	0	6	48	0	0	2	0	8	0	3	55	5	0	133
10:00	2	1	0	0	1	54	2	0	1	0	4	0	3	65	1	1	134
10:15	2	1	0	0	2	48	1	0	0	1	4	0	4	43	3	0	109
10:30	2	1	1	0	0	50	0	0	0	0	1	0	3	62	3	1	123
10:45	2	0	3	1	7	49	0	0	3	1	4	0	5	57	0	1	131
11:00	1	1	2	0	7	52	3	0	5	1	7	0	4	56	0	0	139
11:15	2	2	0	0	2	56	2	1	7	2	4	0	5	98	1	0	181
11:30	1	1	1	1	0	69	2	0	2	1	6	0	5	71	4	1	163
11:45	2	0	3	0	2	88	2	1	3	1	6	0	2	78	1	0	188
12:00	3	0	4	0	6	86	1	0	4	0	7	0	4	114	1	0	230
12:15	2	2	2	0	6	77	0	0	3	2	4	0	2	87	0	0	187
12:30	1	0	2	0	4	110	4	0	4	1	9	0	1	90	2	0	228
12:45	1	1	1	0	5	111	4	0	0	1	3	0	8	79	3	0	217
13:00	3	0	0	0	0	86	1	0	1	0	3	0	5	66	1	0	166
13:15	4	0	2	0	11	54	1	0	3	2	5	0	0	58	4	0	144
13:30	2	1	2	0	4	61	1	0	1	2	9	0	3	60	2	0	148
13:45	3	0	4	0	0	69	1	0	4	0	9	0	3	63	3	0	159
14:00	3	0	1	2	5	66	1	0	2	1	2	0	5	67	3	0	156
14:15	3	1	1	0	3	58	2	0	3	1	4	0	1	59	2	1	138
14:30	0	0	2	0	2	70	1	0	5	4	7	0	3	69	1	2	164
14:45	1	1	2	0	3	56	0	0	2	3	2	0	3	62	1	1	136
15:00	1	1	1	0	0	85	0	0	3	2	2	0	3	81	1	0	180
15:15	2	2	1	0	2	101	2	0	3	3	1	0	5	82	1	0	205
15:30	1	0	4	1	4	79	3	0	1	1	4	0	3	93	1	0	194
15:45	1	0	0	2	0	90	0	0	2	0	1	1	0	63	2	0	159
16:00	2	2	6	2	2	89	7	4	1	0	1	0	1	88	3	0	202
16:15	2	0	1	0	1	78	2	0	1	2	4	1	3	89	0	0	183
16:30	2	0	6	0	6	104	4	0	10	2	3	0	5	69	3	0	214
16:45	2	0	5	0	3	82	0	0	4	0	2	1	9	87	0	0	194
17:00	1	0	1	0	3	103	1	0	0	2	4	0	0	81	1	0	197
17:15	0	0	2	1	2	107	0	0	2	0	1	0	1	89	0	0	204
17:30	3	0	1	1	2	67	0	0	2	0	1	0	3	71	0	0	150
17:45	0	0	1	1	1	78	1	0	0	0	3	1	0	62	1	1	147
18:00	3	0	1	0	0	54	1	2	1	1	2	0	1	50	0	0	114
18:15	1	0	0	0	0	61	3	0	1	2	0	3	3	59	0	0	130
18:30	3	0	1	0	1	48	6	0	1	0	1	0	2	50	0	0	113
18:45	1	0	1	0	0	48	0	0	0	0	0	0	2	63	0	2	115
Total	85	25	71	13	118	3397	73	12	96	47	163	8	143	3516	59	12	7793
Cars+	84	19	70	13	118	3275	69	10	94	39	150	5	141	3398	59	12	7516
SU Trucks	0	0	1	0	0	52	3	0	0	0	1	0	0	51	0	0	108
Buses	1	6	0	0	0	5	1	0	2	7	12	0	1	4	0	0	39
Semi Trucks	0	0	0	0	0	65	0	2	0	1	0	3	1	63	0	0	130
% SU	0.0	0.0	1.4	0.0	0.0	1.5	4.1	0.0	0.0	0.0	0.6	0.0	0.0	1.5	0.0	0.0	
Trucks		0.6				1.5				0.3				1.4			1.4
% Buses	1.2	24.0	0.0	0.0	0.0	0.1	1.4	0.0	2.1	14.9	7.4	0.0	0.7	0.1	0.0	0.0	
		3.9				0.2				6.9				0.1			0.5
% Semi	0.0	0.0	0.0	0.0	0.0	1.9	0.0	16.7	0.0	2.1	0.0	37.5	0.7	1.8	0.0	0.0	
Trucks		0.0				1.8				0.3				1.7			1.7

Appendix E

TH 19 at Country Club Drive/S 2nd Street – Alternatives Cost Analysis

20-Year Costs

Table E1

Summary

ITEM	Reconstructed Minor Street Stop Control	Single-Lane Roundabout
Vehicle Delay Cost	$ 2,507,128	$ 1,675,122
Crash Cost	$ 903,995	$ 1,106,802
TOTAL OPERATING COSTS (2019 Dollars)	**$ 3,411,124**	**$ 2,781,924**
Major Structures	$ -	$ -
Surfacing	$ 257,090	$ 329,620
Subbase/Base	$ 39,173	$ 38,913
Grading/Drainage	$ 201,835	$ 222,976
Miscellaneous	$ 169,918	$ 280,781
Mobilization and TMP (15%)	$ 100,202	$ 130,840
Right of Way	$ 7,659	$ 9,174
RISK (15%)	$ 100,202	$ 130,840
ENGINEERING (20%)	$ 173,684	$ 226,794
TOTAL CONSTRUCTION COST (2019 Dollars)	**$ 1,049,763**	**$ 1,369,938**
Project Remaining Capital Value (RCV)	$ (161,677)	$ (184,637)
TOTAL CONSTRUCTION COST MINUS RCV (2019 Dollars)	**$ 888,086**	**$ 1,185,301**
TOTAL LIFETIME COST (2019 Dollars)	**$ 4,299,210**	**$ 3,967,225**

Note: Total lifetime cost includes total delay cost, crash cost, construction cost, and the remaining capital value after 20 years.

20-Year Costs

Table E2

Assumptions Used in the Benefit-Cost Study

Alternatives

Build Option 1	Reconstructed Minor Street Stop Control
Build Option 2	Single-Lane Roundabout

Analysis Timeframe

Existing Year	2019
Duration of Benefit Cost Analysis (years)	20
Year of Opening	2025
Design Year	2045
Days Per Year	365.25

Crash Costs

Estimating change in crashes	Fatal Type K	$	12,300,000
Mn/DOT Standard Values [1]	Injury Type A	$	680,000
	Injury B	$	210,000
	Injury C	$	110,000
	Property Damage Only	$	12,000

Operating Costs

Estimating change in travel costs (Vehicle Miles of Travel)			
	Automobile (per mile) [1]	$	0.30
	Heavy Vehicle (per mile) [1]	$	0.90

Time Costs

Estimating change in time costs (Vehicle Hours of Travel)			
	Automobile (per person-hour) [1]	$	20.30
	Heavy Commercial (per person-hour) [1]	$	32.00

Vehicle Occupancy

Automobile (Statewide- Overall) [2]	1.64
Percent automobiles [3]	95.00%
Percent heavy vehicles [3]	5.00%

Component Service Life (years) [1]

Engineering	0
Right-of-Way	100
Bridge	60
Mass Grading and Drainage	50
Base	40
Surface	25
Signal System	20

Depreciation Method	**Discount Rate (annual)**
Real Discount Rate	1.2%

NOTES:

(1) MnDOT Office of Transportation System Management recommended value (July 2019)

(2) 2017 National Household Travel Survey (NHTS), Minnesota data

(3) Existing Turning movement data; 5% trucks.

20-Year Costs

Table E3

Remaining Capital Values

Service Life	Remaining Capital Value Factor	Item (2019 Dollars)	Reconstructed Minor Street Stop Control	Single-Lane Roundabout
50	67.0%	Grading and Drainage	$ 201,835	$ 222,976
40	56.0%	Subbase/Base	$ 39,173	$ 38,913
25	22.0%	Surfacing	$ 257,090	$ 329,620
		Construction RCV	**$ 213,726**	**$ 243,702**
60	74.0%	Major Structures	$ -	$ -
		Major Structures RCV	**$ -**	**$ -**
100	88.0%	Right of Way	$ 7,659	$ 9,174
		R/W RCV	**$ 6,740**	**$ 8,073**
		Other Costs	$ 544,006	$ 769,255
		TOTAL PROJECT COST	$ 1,049,763	$ 1,369,938
		TOTAL RCV YR 2045	$ 220,466	$ 251,775
		REMAINING CAPITAL VALUE 2019	**$ 161,677**	**$ 184,637**

20-Year Costs

Table E4

Yearly VMT / VHT

Calculated Yearly VMT and Vehicle Delay Hours

ITEM	Reconstructed Minor Street Stop Control	Single-Lane Roundabout
2025 VMT	0	0
2045 VMT	0	0
2025 Vehicle Delay Hours	4,018	2,922
2045 Vehicle Delay Hours	5,136	3,199

Daily VMT and Vehicle Delay Hours [(1)(2)]

ITEM	Reconstructed Minor Street Stop Control	Single-Lane Roundabout
2019 VMT	0	0
2025 VMT	0	0
2045 VMT	0	0
2019 Vehicle Delay Hours	10.1	7.3
2025 Vehicle Delay Hours	11.0	8.0
2045 Vehicle Delay Hours	14.1	8.8

NOTES:

(1)Daily Vehicle Delay data is based on traffic simulation modeling delay (SimTraffic). Hourly volume scenarios were developed for the both intersection control alternatives; this included the AM, Mid-Day and PM peak hours. The results were spread across the 24-hour daily distribution based on hourly percentages of the existing daily traffic demands for the intersection.

(2) Because only vehicle delay was used, VMT was not calculated or analyzed for the different control options; the difference would be negligible

20-Year Costs

Table E5

Delay Time Benefits

	Vehicle Hours Traveled (VHT)		Annual Time Cost		Annual Time Cost(2019 Dollars)	
Year	**Reconstructed Minor Street Stop Control**	**Single-Lane Roundabout**	**Reconstructed Minor Street Stop Control**	**Single-Lane Roundabout**	**Reconstructed Minor Street Stop Control**	**Single-Lane Roundabout**
2025	**4,018**	**2,922**				
2026	4,074	2,936	$ 135,356.61	$ 97,550.09	$ 124,513	$ 89,735
2027	4,130	2,950	$ 137,213.84	$ 98,009.73	$ 124,725	$ 89,089
2028	4,185	2,963	$ 139,071.06	$ 98,469.36	$ 124,914	$ 88,446
2029	4,241	2,977	$ 140,928.29	$ 98,928.99	$ 125,081	$ 87,805
2030	4,297	2,991	$ 142,785.51	$ 99,388.62	$ 125,227	$ 87,167
2031	4,353	3,005	$ 144,642.74	$ 99,848.25	$ 125,352	$ 86,532
2032	4,409	3,019	$ 146,499.96	$ 100,307.88	$ 125,456	$ 85,899
2033	4,465	3,033	$ 148,357.19	$ 100,767.52	$ 125,540	$ 85,269
2034	4,521	3,046	$ 150,214.41	$ 101,227.15	$ 125,604	$ 84,643
2035	4,577	3,060	$ 152,071.64	$ 101,686.78	$ 125,649	$ 84,019
2036	4,633	3,074	$ 153,928.86	$ 102,146.41	$ 125,676	$ 83,398
2037	4,688	3,088	$ 155,786.09	$ 102,606.04	$ 125,684	$ 82,780
2038	4,744	3,102	$ 157,643.31	$ 103,065.67	$ 125,674	$ 82,165
2039	4,800	3,116	$ 159,500.54	$ 103,525.30	$ 125,647	$ 81,552
2040	4,856	3,129	$ 161,357.76	$ 103,984.94	$ 125,603	$ 80,943
2041	4,912	3,143	$ 163,214.99	$ 104,444.57	$ 125,542	$ 80,337
2042	4,968	3,157	$ 165,072.21	$ 104,904.20	$ 125,465	$ 79,734
2043	5,024	3,171	$ 166,929.44	$ 105,363.83	$ 125,372	$ 79,133
2044	5,080	3,185	$ 168,786.66	$ 105,823.46	$ 125,264	$ 78,536
2045	**5,136**	**3,199**	$ 170,643.89	$ 106,283.09	$ 125,140	$ 77,942
					$ 2,507,128	**$ 1,675,122**

20-Year Costs

Table E6

Crash Rates, Severity Rates and Annual Crash Cost by Facility Type

Time Frame	Scenario	Severity	Proportion of Crashes	AADT (Existing)	Crash Rate	Avg. Crashes/year	Cost/Crash	Cost/Year
2016-2018	Existing	K	0.0%	Average Entering AADT	Crashes per million entering vehicles	0.0	12,300,000	$ -
		A	0.0%			0.0	680,000	$ -
		B	11.1%			0.1	210,000	$ 19,950.00
		C	11.1%			0.1	110,000	$ 10,450.00
		N	77.8%			0.7	12,000	$ 7,999.92
		Total	**100.0%**	**7,890**	**0.30**	**0.9**	-	**$ 38,399.92**

Time Frame	Scenario	Severity	Proportion of Crashes	AADT (2020)	Crash Rate	Avg. Crashes/year	Cost/Crash	Cost/Year
2025	Replace In-Kind	K	0.0%	Average Entering AADT	Crashes per million entering vehicles	0.0	12,300,000	$ -
		A	0.0%			0.0	680,000	$ -
		B	11.1%			0.1	210,000	$ 21,000.00
		C	11.1%			0.1	110,000	$ 11,000.00
		N	77.8%			0.7	12,000	$ 8,400.00
		Total	**100%**	**7,970**	**0.30**	**0.9**	-	**$ 40,400.00**
2025	Reconstructed Minor Street Stop Control	K	0.3%	Average Entering AADT	Crashes per million entering vehicles	0.0	12,300,000	$ 23,857.76
		A	1.0%			0.0	680,000	$ 4,176.72
		B	7.5%			0.0	210,000	$ 9,504.31
		C	18.4%			0.1	110,000	$ 12,126.08
		N	72.7%			0.4	12,000	$ 5,237.07
		Total	**100%**	**7,970**	**0.19**	**0.6**	-	**$ 54,901.94**
2025	Single-Lane Roundabout	K	0.2%	Average Entering AADT	Crashes per million entering vehicles	0.0	12,300,000	$ 21,370.66
		A	0.8%			0.0	680,000	$ 4,725.87
		B	6.8%			0.1	210,000	$ 12,770.27
		C	16.8%			0.2	110,000	$ 16,627.41
		N	75.5%			0.7	12,000	$ 8,152.12
		Total	**100%**	**7,970**	**0.32**	**0.9**	-	**$ 63,646.33**

Time Frame	Scenario	Severity	Proportion of Crashes	AADT (2040)	Crash Rate	Avg. Crashes/year	Cost/Crash	Cost/Year
2045	Replace In-Kind	K	0.0%	Average Entering AADT	Crashes per million entering vehicles	0.0	12,300,000	$ -
		A	0.0%			0.0	680,000	$ -
		B	11.1%			0.1	210,000	$ 23,333.33
		C	11.1%			0.1	110,000	$ 12,222.22
		N	77.8%			0.8	12,000	$ 9,333.33
		Total	**100%**	**8,960**	**0.30**	**1.0**	-	**$ 44,888.89**
2045	Reconstructed Minor Street Stop Control	K	0.3%	Average Entering AADT	Crashes per million entering vehicles	0.0	12,300,000	$ 23,857.76
		A	1.0%			0.0	680,000	$ 4,176.72
		B	7.5%			0.0	210,000	$ 9,504.31
		C	18.4%			0.1	110,000	$ 12,126.08
		N	72.7%			0.4	12,000	$ 5,237.07
		Total	**100%**	**8,960**	**0.19**	**0.6**	-	**$ 54,901.94**
2045	Single-Lane Roundabout	K	0.2%	Average Entering AADT	Crashes per million entering vehicles	0.0	12,300,000	$ 23,745.17
		A	0.8%			0.0	680,000	$ 5,250.97
		B	6.8%			0.1	210,000	$ 14,189.19
		C	16.8%			0.2	110,000	$ 18,474.90
		N	75.5%			0.8	12,000	$ 9,057.92
		Total	**100%**	**8,960**	**0.32**	**1.0**	-	**$ 70,718.15**

20-Year Costs

Table E7

Crash Benefits

	Annual Crash Cost			Present Value Crash Benefit (2019 dollars)(2019 Dollars)		
Year	**Replace In-Kind**	**Reconstructed Minor Street Stop Control**	**Single-Lane Roundabout**	**Replace In-Kind**	**Reconstructed Minor Street Stop Control**	**Single-Lane Roundabout**
2025	**$ 40,400**	**$ 54,902**	**$ 63,646**			
2026	$ 40,624	$ 54,902	$ 64,000	$ 37,370	$ 50,504	$ 58,873
2027	$ 40,849	$ 54,902	$ 64,354	$ 37,131	$ 49,905	$ 58,496
2028	$ 41,073	$ 54,902	$ 64,707	$ 36,892	$ 49,313	$ 58,120
2029	$ 41,298	$ 54,902	$ 65,061	$ 36,654	$ 48,728	$ 57,745
2030	$ 41,522	$ 54,902	$ 65,414	$ 36,416	$ 48,151	$ 57,370
2031	$ 41,747	$ 54,902	$ 65,768	$ 36,179	$ 47,580	$ 56,996
2032	$ 41,971	$ 54,902	$ 66,121	$ 35,942	$ 47,015	$ 56,623
2033	$ 42,196	$ 54,902	$ 66,475	$ 35,706	$ 46,458	$ 56,251
2034	$ 42,420	$ 54,902	$ 66,829	$ 35,470	$ 45,907	$ 55,880
2035	$ 42,644	$ 54,902	$ 67,182	$ 35,235	$ 45,363	$ 55,509
2036	$ 42,869	$ 54,902	$ 67,536	$ 35,000	$ 44,825	$ 55,140
2037	$ 43,093	$ 54,902	$ 67,889	$ 34,766	$ 44,293	$ 54,771
2038	$ 43,318	$ 54,902	$ 68,243	$ 34,533	$ 43,768	$ 54,404
2039	$ 43,542	$ 54,902	$ 68,597	$ 34,300	$ 43,249	$ 54,037
2040	$ 43,767	$ 54,902	$ 68,950	$ 34,068	$ 42,736	$ 53,672
2041	$ 43,991	$ 54,902	$ 69,304	$ 33,837	$ 42,230	$ 53,307
2042	$ 44,216	$ 54,902	$ 69,657	$ 33,607	$ 41,729	$ 52,944
2043	$ 44,440	$ 54,902	$ 70,011	$ 33,377	$ 41,234	$ 52,582
2044	$ 44,664	$ 54,902	$ 70,365	$ 33,147	$ 40,745	$ 52,221
2045	**$ 44,889**	**$ 54,902**	**$ 70,718**	$ 32,919	$ 40,262	$ 51,861
Total				**$ 702,551**	**$ 903,995**	**$ 1,106,802**

Table E1
TH 19 Marshall
TH 19 at Country Club Drive/S 2nd Street Traffic Operations (SimTraffic)
AM / MD / PM Peak Hours

Intersection			Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Vehicle Queing Information (feet)													
																		Left Turn Lane				Through Lane (s)					Right Turn Lane				
				L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Thru [2] ---->	% Block Left [2] <----	Link Length (feet)	Avg. Queue (feet) [1]	Max Queue (feet) [1]	% Block Right [2] ---->	% Block Thru [2] <----	Storage (feet) [3]	Avg. Queue (feet) [1]	Max Queue (feet) [1]
Reconstructed Minor Street Stop Control	2019	AM	EB	135	7		142	14.0	B	5.3	A			13.6	B	6.2	A						264	56	147					
			WB	2	71	56	129	6.4	A	21.5	C	6.8	A	14.9	B								945	33	110	1 %		100	20	69
			NB		214	9	223			0.6	A	2.1	A	0.7	A								799		20					
			SB	15	67	159	241	4.5	A	1.6	A	2.3	A	2.2	A								1066	20	28			100	20	23
		Mid-Day	EB	112	23		135	8.2	A	8.4	A			8.2	A	3.5	A						264	44	101					
			WB	1	18	40	59	7.4	A	9.9	A	3.5	A	5.5	A								945	20	38			100	20	41
			NB		105	3	108			0.4	A	2.1	A	0.4	A															
			SB	32	131	126	289	3.4	A	1.9	A	1.9	A	2.1	A								1066	20	36			100		20
		PM	EB	137	21		158	8.2	A	5.1	A			7.8	A	3.7	A						264	49	104					
			WB	1	17	28	46	5.2	A	10.7	B	3.7	A	6.3	A								945	20	56			100	20	48
			NB		94	4	98			0.3	A	2.1	A	0.4	A								799		20					
			SB	38	134	100	272	3.4	A	1.9	A	1.8	A	2.1	A								1066	20	38			100		20
	2045	AM	EB	155	10		165	15.8	C	8.1	A			15.3	C	7.8	A						264	63	158					
			WB	5	80	65	150	5.9	A	32.2	D	8.5	A	21.1	C								945	44	170	4 %		100	22	**95**
			NB		240	10	250			0.8	A	2.0	A	0.8	A															
			SB	15	75	180	270	4.5	A	1.7	A	2.3	A	2.3	A								1066	20	32			100	20	20
		Mid-Day	EB	125	25		150	9.7	A	6.9	A			9.2	A	3.9	A						264	48	113					
			WB	5	20	45	70	8.0	A	11.1	B	4.1	A	6.4	A								945	20	42			100	20	40
			NB		120	5	125			0.4	A	2.0	A	0.5	A															
			SB	35	150	140	325	3.8	A	2.0	A	2.1	A	2.2	A								1066	20	36			100		20
		PM	EB	155	25		180	10.7	B	7.8	A			10.3	B	4.6	A						264	62	176					
			WB	5	20	30	55	6.2	A	11.2	B	3.9	A	6.8	A								945	20	58			100	20	49
			NB		105	5	110			0.4	A	2.2	A	0.5	A															
			SB	45	150	115	310	3.7	A	2.2	A	2.0	A	2.3	A								1066	20	44			100		20
Single-Lane Roundabout	2019	AM	EB	135	7		142	2.8	A	1.8	A			2.8	A	3.7	A						276	20	58					
			WB	2	71	56	129	2.9	A	4.8	A	3.5	A	4.2	A								946	20	57					
			NB		214	9	223			4.6	A	3.3	A	4.5	A								804	20	85					
			SB	15	67	159	241	3.5	A	2.6	A	3.4	A	3.2	A								1030	20	56					
		Mid-Day	EB	112	23		135	2.9	A	3.3	A			3.0	A	3.1	A						276	20	58					
			WB	1	18	40	59	0.0	A	3.7	A	2.9	A	3.1	A								946	20	49					
			NB		105	3	108			3.7	A	2.5	A	3.7	A								804	20	43					
			SB	32	131	126	289	3.0	A	3.1	A	3.0	A	3.0	A								1030	20	39					
		PM	EB	137	21		158	2.9	A	2.4	A			2.8	A	3.1	A						276	20	72					
			WB	1	17	28	46	0.0	A	4.0	A	2.8	A	3.2	A								946	20	52					
			NB		94	4	98			3.9	A	3.2	A	3.9	A								804	20	60					
			SB	38	134	100	272	3.0	A	3.0	A	3.1	A	3.0	A								1030	20	33					
	2045	AM	EB	155	10		165	2.9	A	2.4	A			2.9	A	3.9	A						276	20	66					
			WB	5	80	65	150	3.2	A	5.3	A	4.0	A	4.7	A								946	24	79					
			NB		240	10	250			4.9	A	3.5	A	4.8	A								804	25	102					
			SB	15	75	180	270	3.5	A	2.6	A	3.6	A	3.3	A								1030	20	68					
		Mid-Day	EB	125	25		150	3.0	A	3.0	A			3.0	A	3.3	A						276	20	70					
			WB	5	20	45	70	3.6	A	3.8	A	2.9	A	3.2	A								946	20	40					
			NB		120	5	125			3.9	A	2.8	A	3.9	A								804	20	47					
			SB	35	150	140	325	3.2	A	3.3	A	3.1	A	3.2	A								1030	20	42					
		PM	EB	155	25		180	3.2	A	2.8	A			3.1	A	3.3	A						276	22	90					
			WB	5	20	30	55	3.0	A	4.2	A	3.0	A	3.4	A								946	20	55					
			NB		105	5	110			4.0	A	3.5	A	4.0	A								804	20	69					
			SB	45	150	115	310	3.2	A	3.1	A	3.2	A	3.2	A								1030	20	47					

Note: WB is NB S 2nd St; SB is WB TH 19, NB is Country Club Dr, EB is EB TH 19

NOTES
1. If the reported queue is greater than zero (0), but less than 20 ft, a minimum of 20 ft is reported.
2. Block Percentage is proportion of analysis time (1 hour) the storage lane or through lane is blocked or blocking.
3. Multiple storage lanes of different length are averaged together to show the "Effective Storage Length" per lane.