

Traffic Impact Analysis

TH 246 and Jefferson Parkway

City of Northfield, Minnesota

SEH No. NFIEL 137211 4.00

December 15, 2016



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Traffic Impact Analysis
City of Northfield, Minnesota

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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
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Traffic Impact Analysis

TH 246 and Jefferson Parkway

Prepared for Northfield, Minnesota

1.0 Background

This report provides findings and recommendations related to a traffic impact analysis performed to evaluate the intersections surrounding and including the TH 246/Jefferson Parkway intersection. Currently, the intersection of TH 246/Jefferson Parkway is surrounded by three public schools (Northfield High School to the north, Bridgewater Elementary School & Northfield Middle School to the south). Multiple intersections experience traffic delays during both the AM and PM peak hours due to traffic and pedestrian peaking associated with the nearby schools.

2.0 Project Area Concerns

In addition to the traffic delays experienced at multiple intersections throughout the project area, multiple other project concerns exist. These project concerns have been brought up through the Project Management Team as well as from the general public. The following is a description of these concerns that this study will attempt to address.

2.1 Project Management Team

During the previous Project Management Team Meetings several issues have been identified throughout the project area. These concerns are as follows:

1. Currently at the Elementary School, the queue length from vehicles extends out of the parking lot and onto the street during the peak school dismissal period. A solution was suggested involving reversing Bridgewater Elementary School drop-off and pick-up traffic flow. This requires traffic to enter the elementary school site from TH 246 and exit onto Jefferson Parkway.
2. Intersection design recommendations need to account for farm vehicles and semi-trucks.

2.2 Public Input

A public open house was also conducted so that residents of Northfield could provide their concerns to the Project Management Team. The following are a few of the main concerns that residents had regarding the study area:

1. Pedestrian and bicycle crossings of TH 246.
2. Intersection control at TH 246/Jefferson Pkwy.
3. Traffic Speed on TH 246.
4. Keeping access closed from the Northfield Middle School to the west.
5. A crosswalk should be marked on TH 246 at the Northfield High School.

The detailed comments received from the open house can be seen in the Attached Appendix F.

3.0 Existing Conditions

Currently, TH 246 is a 2-lane Minor Arterial undivided highway. The posted speed limit immediately to the south of Jefferson Parkway is 35 mph changing to a 45 mph zone approximately 300 feet south of the study intersection and immediately north of Jefferson Parkway the speed limit is 35 mph.

Jefferson Parkway is a 2-lane Major Collector roadway with a center median and turn lanes. The posted speed limit on Jefferson Parkway is 30 mph.

3.1 Data Collection

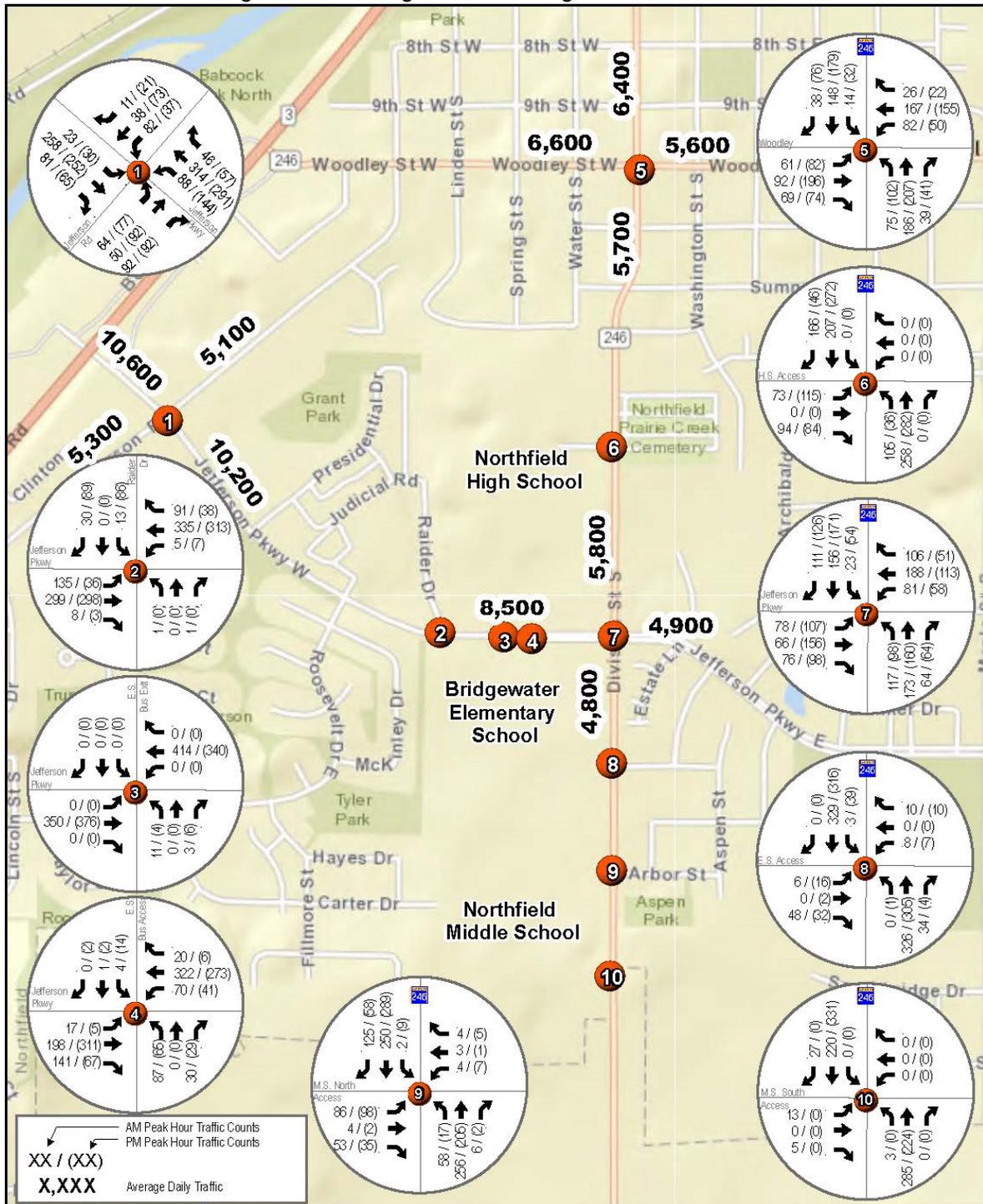
Existing turning movement counts were collected using video monitors during the month of May of 2016 at multiple intersections surrounding the three public schools in Northfield, MN. The study area including study intersections are shown in **Figure 1**.

Figure 1 – Study Area and Study Intersections



A thirteen hour traffic count was conducted at each study intersection from 6:00 AM to 7:00 PM. At the intersection of TH 246 at Jefferson Parkway three separate thirteen hour counts were conducted on the same week Tuesday-Thursday. For the purpose of analysis the average of the three days was used. The peak hours of the roadways were found to be from 7:30 AM – 8:30 AM & 2:45 PM – 3:45 PM. The existing traffic turning movement and ADT volumes can be seen in **Figure 2** below.

Figure 2 – Existing Traffic Turning Movement Counts



3.2 Existing Crash Analysis

Crash data from January 1st, 2013 through December 31st, 2015 were obtained from MnDOT's Crash Mapping Analysis Tool (MnCMAT). The type and severity of the crashes were reviewed and crash rates were calculated for each intersection. This crash information is summarized in Table 1.

Today, the intersections of Jefferson Parkway/Raider Drive, TH 246/Jefferson Pkwy, TH 246/Elementary School Access, and TH 246/Northern Middle School Access are above the statewide average rates for similar intersection types. However, all intersections are below the calculated critical rate indicating that a sustained crash problem does not exist at any study intersection.

More detailed crash information is shown in Tables A1 & A2 in the attached Appendix G.

Table 1
Crash History 2013-2015

Intersection	Fatal/Injury A & B	Injury C	Property Damage	Total Crashes	Crash Rate	Calculated Critical Crash Rate
Jefferson Pkwy/Jefferson Road	0	2	3	5	0.32	0.69
Jefferson Pkwy/Raider Drive	0	0	4	4	0.49	0.52
Jefferson Pkwy/Elementary School Bus Exit	0	0	0	0	0.00	0.53
Jefferson Pkwy/Elementary School Access	0	0	0	0	0.00	0.52
TH 246/Jefferson Pkwy	1	3	2	6	0.51	0.74
TH 246/Woodley Street	0	0	2	2	0.16	0.72
TH 246/High School Access	0	0	0	0	0.00	0.57
TH 246/Elementary School Access	0	1	0	1	0.20	0.63
TH 246/North Middle School Access	0	2	1	3	0.59	0.63
TH 246/South Middle School Access	0	0	0	0	0.00	0.64
Total	1	8	12	21		

4.0 Traffic Forecasting

The daily traffic forecasts for major roadway segments and peak hour turning movements for the study intersections were developed using the following steps:

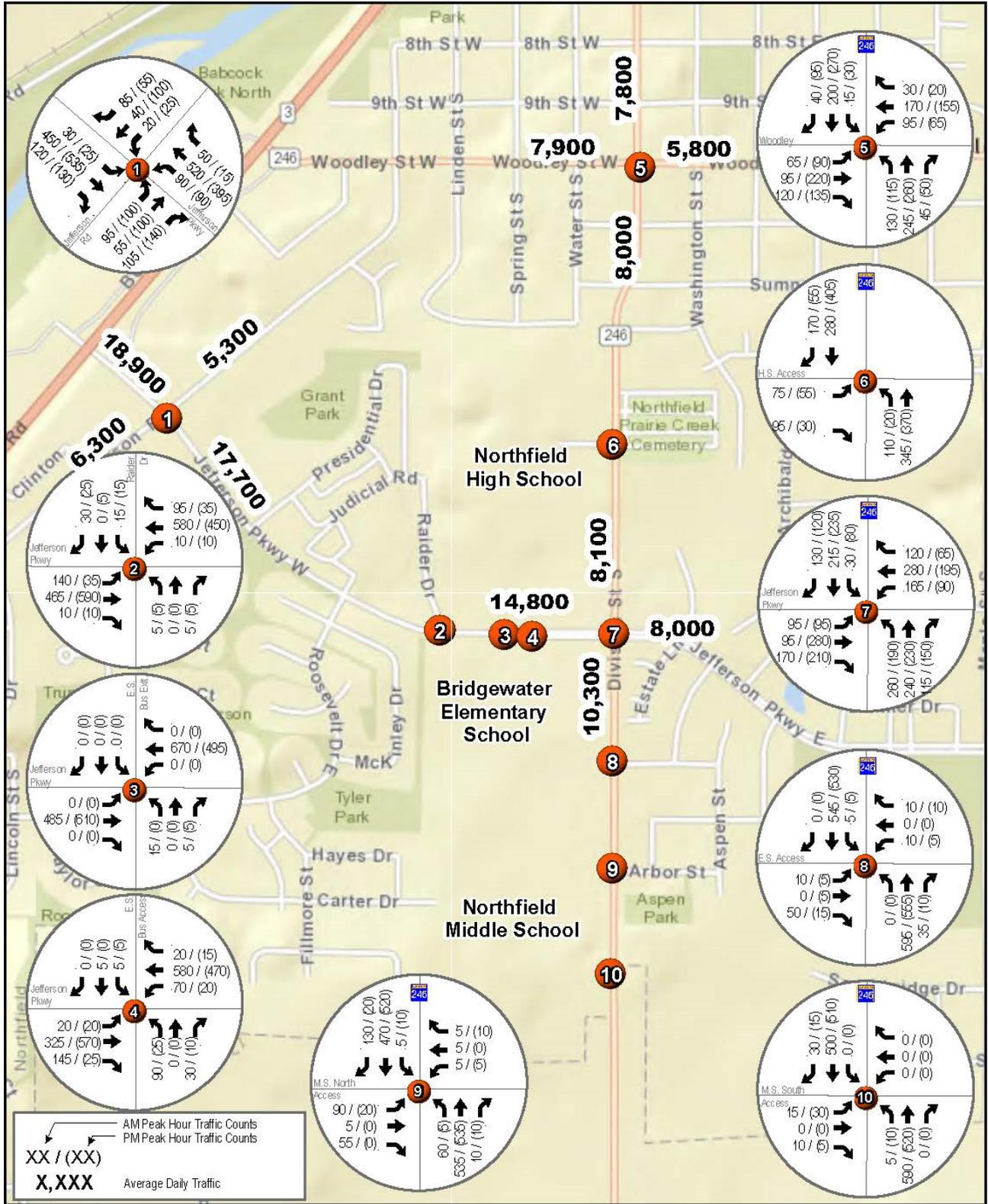
1. The original 2000 and 2030 City travel demand models, provided by the City of Northfield, were respectively updated to include the latest 2010 and 2040 socio-economic data for the entire metropolitan area, including seven core counties and twelve ring counties.
2. The updated 2010 and 2040 City models were run and their daily outputs for major roadway segments in the study area were adjusted to develop daily traffic forecasts based on the actual counts, base year model outputs and forecast model outputs.
3. The peak hour turning movements for the study intersections were developed based on the daily traffic growth and they were further adjusted to account for varying growth by approach.

Figure 2 illustrates the existing daily traffic on major roadway segments in the study area and peak hour turning movements for the study intersections.

Figure 3 illustrates the 2040 daily traffic forecasts on major roadway segments in the study area and peak hour turning movement traffic forecasts for the study intersections. The annual traffic growth rates are estimated to be:

- TH 246 north of Jefferson Parkway = 1.7%
- TH 246 south of Jefferson Parkway = 5.3%
- Jefferson Parkway west of TH 246 = 3.2%

Figure 3 – 2040 Future Traffic Turning Movement Counts



5.0 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 traffic signal control at an intersection. This MnMUTCD guidance is provided in the form of “warrants,” or criteria, for when all-way stop or traffic signal control may be justified. Though all-way stop or traffic 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 that particular type of control. An engineering study that considers factors, including warrants, should be performed to determine the “best” type of control at an intersection.

MnDOT guidelines suggest removing 100% of right turning traffic from the minor leg since this movement typically is able to enter the traffic stream with minimal conflicts. Therefore, a traffic signal would not be needed to reduce delay or improve safety for this right turn movement. In certain circumstances (i.e. high right turn volume, minimal mainline gaps etc.), MnDOT allows 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 TH 246 at Jefferson Parkway intersection should not include right turning traffic from the minor Jefferson Parkway approaches. For informational purposes the Warrant analysis was conducted three separate times, once with no right turns included in the analysis, once with 50% of the right turns included in the analysis, and once with all of the right turns included in the analysis.

The MnMUTCD states that “if the 85th-percentile approach speed of the major street traffic exceeds 40 mph, the minimum hourly vehicular volume warrants can be reduced by 70%.” In this case the speed limit was used in this analysis. The speed limit on TH 246 changes from 55 mph to 45 mph approximately 1,900 feet south of Jefferson Parkway and to 35 mph approximately 300 feet south of Jefferson Parkway. Due to the 35 mph, the All-Way Stop and Signal Warrant Analyses were evaluated without the warrant volume reduction.

Based on the 2016 traffic turning movement counts, the all-way stop warrant for TH 246 at Jefferson Parkway meets the volume threshold for 10 of the required 8 hours.

The study intersection does not meet any of the required Warrants to justify the installation of a traffic signal.

Based on MnDOT’s ICE guidelines, if development is imminent future anticipated volumes may be used. Therefore five year forecast traffic volumes were analyzed. Based on the 2021 forecast traffic demands, the intersection only meets Traffic Signal Warrant 1 – Eight Hour Vehicular Volume for 5 of the required 8 hours.

Table 2 provides the all-way stop warrant summary for the 2016 Existing Conditions. Table 3 provides the traffic signal warrant summary for 2016, 2021 and 2040 volume conditions.

The all-way stop warrant analysis sheets and the analysis traffic volumes are shown in Appendix A. The traffic signal warrant analysis sheets and the analysis traffic volumes are shown in Appendix B.

Table 2
All Way Stop Warrant Analysis

Forecast Year	Hours Required to be Met	TH 246 at Jefferson Parkway:
		Warrant Met (Hours Met)
2016	8	YES (10)

Table 3
Signal Warrant Analyses

Forecast Year	Hours Required to be Met	TH 246 at Jefferson Parkway:		
		0% Right Turns Included	50% Right Turns Included	100% Right Turns Included
		Warrant Met (Hours Met)		
2016	8-Hour	NO (3)	NO (3)	NO (3)
	4-Hour	NO (0)	NO (0)	NO (1)
	Peak Hour	NO (0)	NO (0)	NO (0)
2021	8-Hour	NO (5)	NO (5)	NO (5)
	4-Hour	NO (1)	NO (2)	YES (4)
	Peak Hour	NO (0)	NO (0)	NO (0)
2040	8-Hour	YES (8)	YES (8)	YES (8)
	4-Hour	YES (6)	YES (6)	YES (7)
	Peak Hour	YES (4)	YES (5)	YES (5)

6.0 Operational Analysis

Traffic operations analyses were conducted to determine the level of service (LOS), delay, and queuing information for the AM and PM peak hour conditions. LOS is a qualitative rating system used to describe the efficiency of traffic operations at an intersection. Six LOS 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).

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. 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 at a stop sign. Therefore the LOS thresholds for each LOS category are lower for unsignalized intersections than for signalized intersections.

The traffic operations analyses were performed using the Synchro/SimTraffic (version 7) software package for the signalized and unsignalized analysis. For signalized and

unsignalized intersections, Synchro uses the methods outlined in the 2010 Highway Capacity Manual (HCM). LOS for intersections is determined by the average control delay per vehicle. SimTraffic results were reported in this analysis for an average of five runs. For the roundabout analysis, the RODEL software package was used to help aid in design for the roundabouts and determine the operations of the study intersections.

Multiple intersections were modeled in this analysis due to the close proximity of the three public schools in the area and how the operations at the intersection of TH 246/Jefferson Parkway effect the surrounding intersection operations. The video that was collected at the study intersections was utilized for the analysis to ensure an accurate representation of the current conditions in the field.

The study intersections included in the traffic operations analysis are as follows:

- Jefferson Parkway at Jefferson Road
- Jefferson Parkway at Raider Drive
- Jefferson Parkway at Bridgewater Elementary School Bus Access
- Jefferson Parkway at Bridgewater Elementary School Access
- TH 246 at Woodley Street
- TH 246 at Northfield High School Access
- TH 246 at Jefferson Parkway
- TH 246 at Bridgewater Elementary School Access/Anderson Drive
- TH 246 at Northfield Middle School Access/Arbor Street
- TH 246 at Northfield Middle School Bus Access

The proposed intersection layouts can be found in Appendix D.

Six scenarios were analyzed as part of this study; the following is description of the six modeled scenarios:

- Scenario 1: 2016 Existing Conditions
- Scenario 2: 2016 Existing Conditions with Mitigations
 - Includes Scenario 1 Plus
 - Traffic Signal Control at the intersection of TH 246 at Jefferson Parkway
 - Left turn lanes for all approaches at the intersection of TH 246 at Jefferson Parkway
- Scenario 3: 2040 No Build Conditions
 - Includes Scenario 1 Plus:
 - Forecasted background growth
- Scenario 4: 2040 Build Conditions
 - Includes Scenario 2 Plus:
 - Forecasted background growth
 - Traffic Signal control at the intersection of Jefferson Parkway at Jefferson Road. Also includes three lanes of approach (left turn, thru, and right turn lanes) for all intersection approaches.

- Two outbound lanes for the Middle School Access, a thru-left turn lane and a dedicated right turn lane
- Scenario 4a: 2040 Build Conditions – Geometry Mitigations at Jefferson Parkway/Jefferson Road
 - Includes Scenario 4 Plus:
 - Geometric changes to the intersection of Jefferson Parkway at Jefferson Road
- Scenario 4b: 2040 Build Conditions – Roundabout Analysis
 - Includes Scenario 4 Plus:
 - The RODEL software package was used to identify roundabout control operations at the intersections of TH 246/Jefferson Parkway, Jefferson Parkway/Jefferson Road, and TH 246/northern Middle School Driveway
- Scenario 4c: 2040 Build Conditions – Mini Roundabout Analysis
 - Includes Scenario 4 Plus:
 - The RODEL software package was used to identify mini roundabout control operations at the intersections of TH 246/Jefferson Parkway, Jefferson Parkway/Jefferson Road, and TH 246/northern Middle School Driveway

A detailed planning level matrix has been developed to provide City staff with a variety of improvements throughout the study area along with costs and impacts of each option. The matrix, shown in the attached Appendix E, shows a comparison of Measures of Effectiveness (MOE) for each 2040 alternative scenario as well as traffic, pedestrian, and bicycle safety and construction costs.

6.1 Scenario 1: 2016 Existing Conditions

In 2016, all intersections operate at a LOS C or better in both the AM and PM peak hours. The intersection of TH 246 at Jefferson Parkway operates at a LOS C in the AM peak hour with the northbound approach operating at a LOS D with an approximate 350 foot maximum queue length. In the PM peak hour the intersection operates at a LOS A. The intersection of TH 246/Northfield Middle School Access operates at a LOS A in both peak hours. However the eastbound Middle School exit operates at a LOS D in the AM peak hour with maximum queue length of 235 feet. Table 4 below shows the operational results for some key study intersections. More detailed results as well as the results for the remaining study intersections are shown in Table A in Appendix C.

Table 4
2016 Existing Key Intersection SimTraffic MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	Jefferson Parkway at Jefferson Road	14.1 / B	12.3 / B	8.8 / A	8.7 / A	11.9 / B
	Jefferson Parkway at Raider Drive	6.4 / A	0.9 / A	9.5 / A	12.8 / B	4.2 / A
	TH 246 at Woodley Street	8.9 / A	13.0 / B	9.2 / A	11.4 / B	10.6 / B
	TH 246 at Jefferson Parkway	8.4 / A	16.6 / C	28.1 / D	13.6 / B	17.6 / C
	TH 246 at Northfield Middle School Access/Arbor Street	25.0 / D	8.6 / A	2.2 / A	0.8 / A	5.4 / A
PM Peak	Jefferson Parkway at Jefferson Road	13.5 / B	12.0 / B	10.6 / B	8.5 / A	11.8 / B
	Jefferson Parkway at Raider Drive	3.7 / A	0.6 / A	0.0 / A	11.8 / B	4.1 / A
	TH 246 at Woodley Street	14.8 / B	12.4 / B	9.4 / A	11.5 / B	11.9 / B
	TH 246 at Jefferson Parkway	8.2 / A	9.5 / A	10.0 / B	10.3 / B	9.5 / A
	TH 246 at Northfield Middle School Access/Arbor Street	7.0 / A	5.2 / A	0.5 / A	0.7 / A	1.9 / A

6.2 Scenario 2: 2016 Existing Conditions with Mitigations

Under this scenario the existing traffic volumes were modeled with the addition of a traffic signal with flashing yellow arrow left turn operation at the intersection of TH 246/Jefferson Parkway. In addition to the traffic signal, three lanes of approach (left, thru, and right turn lanes) for all intersection approaches were also modeled. The modeled layout of the intersection can be seen in the attached Appendix D.

With the addition of a traffic signal at TH 246/Jefferson all intersections operate at a LOS B or better in both peak hours. The overall intersection operation at TH 246/Jefferson Parkway improves from a LOS C to a LOS A in the AM peak hour and the northbound approach improves to a LOS A. The northbound approach at TH 246/Jefferson Pkwy maximum queue length is approximately 125 feet with the addition of the traffic signal. However with the improvement at the TH 246/Jefferson Parkway intersection more traffic is able to be served by the traffic signal and therefore hinders traffic from exiting the Middle School Access. Due to the improvement in operations at TH 246/Jefferson Parkway the exiting traffic at the Middle School Access operates at a LOS D in the AM peak hour. Table 5 below shows the operational results for some key study intersections. More detailed results as well as the results for the remaining study intersections are shown in Table B in Appendix C.

Table 5
2016 Existing Conditions with Mitigations Key Intersection SimTraffic MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	Jefferson Parkway at Jefferson Road	14.7 / B	12.8 / B	8.6 / A	9.1 / A	12.3 / B
	Jefferson Parkway at Raider Drive	6.4 / A	1.0 / A	5.9 / A	10.5 / B	4.2 / A
	TH 246 at Woodley Street	8.6 / A	12.7 / B	9.4 / A	10.9 / B	10.4 / B
	TH 246 at Jefferson Parkway	9.1 / A	9.8 / A	8.4 / A	8.3 / A	8.9 / A
	TH 246 at Northfield Middle School Access/Arbor Street	31.9 / D	9.8 / A	2.8 / A	0.9 / A	6.9 / A
PM Peak	Jefferson Parkway at Jefferson Road	12.6 / B	12.2 / B	13.2 / B	8.8 / A	12.2 / B
	Jefferson Parkway at Raider Drive	3.5 / A	0.7 / A	0.0 / A	10.9 / A	3.8 / A
	TH 246 at Woodley Street	13.0 / B	12.5 / B	9.6 / A	14.8 / B	12.2 / B
	TH 246 at Jefferson Parkway	9.5 / A	10.1 / B	7.6 / A	7.6 / A	8.6 / A
	TH 246 at Northfield Middle School Access/Arbor Street	7.8 / A	5.2 / A	0.7 / A	0.9 / A	2.2 / A

6.3 Scenario 3: 2040 No Build Conditions

In this scenario the existing geometry and traffic control was modeled under the 2040 forecast traffic volumes scenario. Multiple intersections operate at a LOS F in both the AM and PM peak hours. The intersection of TH 246/Jefferson Parkway has long queue lengths that impact the operations at multiple intersections to the south of the intersection. This includes the Middle School Access which operates poorly in both the AM and PM peak hours due to queue lengths that extend back through this intersection from TH 246/Jefferson Parkway. Table 6 below shows the operational results for some key study intersections. More detailed results as well as the results for the remaining study intersections are shown in Table C in Appendix C.

Table 6
2040 No Build Conditions Key Intersections SimTraffic MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	Jefferson Parkway at Jefferson Road	759.1 / F	52.2 / F	18.8 / C	12.9 / B	298.1 / F
	Jefferson Parkway at Raider Drive	5.7 / A	1.2 / A	30.0 / D	14.6 / B	4.2 / A
	TH 246 at Woodley Street	13.2 / B	17.9 / C	9.4 / A	46.2 / E	20.9 / C
	TH 246 at Jefferson Parkway	18.1 / C	123.8 / F	505.8 / F	166.1 / F	192.3 / F
	TH 246 at Northfield Middle School Access/Arbor Street	6699.2 / F	37.8 / E	1307.0 / F	0.9 / A	655.0 / F
PM Peak	Jefferson Parkway at Jefferson Road	1368.4 / F	28.7 / D	35.9 / E	13.5 / B	489.8 / F
	Jefferson Parkway at Raider Drive	4.5 / A	0.4 / A	13.8 / B	10.1 / B	3.0 / A
	TH 246 at Woodley Street	39.6 / E	16.3 / C	12.7 / B	26.2 / D	25.4 / D
	TH 246 at Jefferson Parkway	30.8 / D	131.0 / F	509.6 / F	214.4 / F	203.0 / F
	TH 246 at Northfield Middle School Access/Arbor Street	1641.4 / F	889.3 / F	388.1 / F	0.7 / A	205.8 / F

6.4 Scenario 4: 2040 Build Conditions

Under this scenario the intersections of TH 246/Jefferson Parkway & Jefferson Parkway/Jefferson Road have been signalized. In addition to the signalization of the intersections, the same lane geometry was used as in Scenario 2 for the intersection of TH 246/Jefferson Parkway. The Middle School Access also has the addition of two outbound lanes, a thru-left turn and a dedicated right turn lane. The intersection layouts for the TH 246/Jefferson Parkway & Jefferson Parkway/Jefferson Road are shown in the attached Appendix D.

Under the 2040 forecasted traffic volumes the signalized intersection of TH 246/Jefferson Parkway operates at a LOS B in the AM peak hour with a maximum queue length for the northbound left turn approach approximately 324 feet. The intersection in the PM peak hour operates at a LOS B with a maximum queue lengths for all approaches being between 50-225 feet.

The intersection of TH 246/Northfield Middle School Access operates at a LOS D in the AM peak hour and at a LOS A in the PM peak hour. However, operational issues still exist for the exiting (eastbound) vehicles in the AM peak hour. In the AM peak hour the eastbound approach operates at a LOS F with approximately 273.2 seconds of delay per vehicle and a maximum queue length of 1,014 feet.

With the addition of traffic signal control at the intersection of Jefferson Parkway/Jefferson Road the intersection operates at a LOS B in the AM peak hour and at a LOS C in the PM peak hour. In the AM peak hour the maximum eastbound queue length is approximately 496 feet which is nearly at the intersection of Jefferson Parkway/TH 3.

With no geometry or traffic control improvements the intersection of TH 246/Woodley Street operates at a LOS D in the AM peak hour and at a LOS E in the PM peak hour. In the PM peak hour, the worst movement is the northbound left turn approach which operates at a LOS F with approximately 68.4 seconds of delay per vehicle. The addition of a traffic signal or roundabout at this intersection would likely improve traffic operations.

Table 7 shows the operational results for some key study intersections. More detailed results as well as the results for the remaining study intersections are shown in Table D in Appendix C.

Table 7
2040 Build Conditions Key Intersections SimTraffic MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	Jefferson Parkway at Jefferson Road	18.6 / B	15.2 / B	21.5 / C	26.2 / C	18.3 / B
	Jefferson Parkway at Raider Drive	10.0 / B	1.4 / A	28.6 / D	43.6 / E	6.9 / A
	TH 246 at Woodley Street	14.1 / B	24.0 / C	38.8 / E	52.2 / SB	32.5 / D
	TH 246 at Jefferson Parkway	13.0 / B	18.5 / B	18.3 / B	14.9 / B	16.7 / B
	TH 246 at Northfield Middle School Access/Arbor Street	273.2 / F	25.6 / D	4.5 / A	1.2 / A	31.5 / D
PM Peak	Jefferson Parkway at Jefferson Road	29.7 / C	15.0 / B	57.4 / E	19.3 / B	29.7 / C
	Jefferson Parkway at Raider Drive	5.0 / A	0.8 / A	9.1 / A	10.0 / B	3.5 / A
	TH 246 at Woodley Street	45.4 / E	19.7 / C	50.8 / F	32.5 / D	39.7 / E
	TH 246 at Jefferson Parkway	12.5 / B	15.1 / B	11.6 / B	12.8 / B	12.8 / B
	TH 246 at Northfield Middle School Access/Arbor Street	15.6 / C	8.4 / A	1.6 / A	1.1 / A	1.7 / A

6.5 Scenario 4a: 2040 Build Conditions with Intersection Improvements at Jefferson Parkway/Jefferson Road

Due to the long eastbound queue lengths reported from SimTraffic at the intersection of Jefferson Parkway/Jefferson Road, geometry mitigations were tested in this scenario for the eastbound and westbound approaches. Both the eastbound and westbound approaches at Jefferson Parkway were widened to include a dedicated left turn lane, a through lane, and a through-right turn lane. With this geometry mitigation the intersection operates at a LOS B in the AM and PM peak hours. With the addition of the geometric changes the maximum eastbound queue length occurs in the AM peak hour peak hour and is approximately 303 feet. This maximum queue length extends through the MN TH 3 frontage road.

Table 8 below shows the operational results for the intersection of Jefferson Parkway/Jefferson Road. More detailed results as well as results for the remaining study intersections are shown in Table E in Appendix C.

Table 8
2040 Build Conditions Jefferson Parkway/Jefferson Road SimTraffic MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	Jefferson Parkway at Jefferson Road	16.3 / B	11.6 / B	12.0 / B	13.7 / B	13.5 / B
PM Peak	Jefferson Parkway at Jefferson Road	19.5 / B	11.9 / B	22.0 / C	12.0 / B	17.0 / B

6.6 Scenario 4b: 2040 Build Conditions with Roundabout Improvements

A roundabout analysis was conducted at three separate study intersections to improve operations. The RODEL software package was used to evaluate the following intersections under 2040 traffic conditions:

- TH 246 at Jefferson Parkway
- TH 246 at Northfield Middle School Access
- Jefferson Parkway at Jefferson Road

The intersection of TH 246/Jefferson Parkway operates at a LOS B in the AM peak hour and operates at a LOS A in the PM peak hour. The maximum northbound queue length occurs in the PM peak hour with an approximate length of 6.30 vehicles. Table 9 below shows the operational results for the intersection of TH 246/Jefferson Parkway.

Table 9
2040 Build Conditions TH 246 at Jefferson Parkway Roundabout RODEL MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	TH 246 at Jefferson Parkway	6.33 / A	14.76 / B	8.84 / A	9.28 / A	10.20 / B
PM Peak	TH 246 at Jefferson Parkway	10.80 / B	6.90 / A	11.22 / B	7.93 / A	9.57 / A

The intersection of TH 246 at the Northfield Middle School Access operates at a LOS A in both the AM and PM peak hours. The maximum eastbound Middle School exit queue occurs during the AM peak hours and is approximately 0.63 vehicles with an average delay of 4.82 seconds per vehicle. Table 10 below shows the operational results for the intersection of TH 246/Northfield Middle School Access. While operationally a roundabout would be effective, it is unlikely to be warranted.

Table 10
2040 Build Conditions TH 246 at Northfield Middle School Access Roundabout RODEL MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	TH 246 at Northfield Middle School Access	4.82 / A	4.65 / A	7.42 / A	7.17 / A	7.00 / A
PM Peak	TH 246 at Northfield Middle School Access	4.23 / A	4.27 / A	6.19 / A	6.07 / A	6.07 / A

With the addition of a roundabout, the intersection of Jefferson Parkway at Jefferson Road operates at a LOS A in both peak hours. The maximum eastbound queue length is 4.73 vehicles with an approximate delay of 8.45 seconds per vehicle in the AM peak hour. In the PM peak hour the maximum eastbound queue length is 7.76 vehicles with an approximate delay of 11.53 seconds of delay. Table 11 shows the operational results for the intersection of Jefferson Parkway at Jefferson Road.

Table 11
2040 Build Conditions Jefferson Parkway at Jefferson Road Roundabout RODEL MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	Jefferson Parkway at Jefferson Road	8.45 / A	9.57 / A	6.08 / A	5.77 / A	8.30 / A
PM Peak	Jefferson Parkway at Jefferson Road	11.53 / B	7.15 / A	7.57 / A	5.65 / A	8.85 / A

6.7 Scenario 4c: 2040 Build Conditions with Mini Roundabout Improvements

A mini roundabout analysis was conducted at three separate study intersections to improve operations. The RODEL software package was used to evaluate the following intersections under 2040 traffic conditions:

- TH 246 at Jefferson Parkway
- TH 246 at Northfield Middle School Access
- Jefferson Parkway at Jefferson Road

The intersection of TH 246/Jefferson Parkway operates at a LOS B in the AM peak hour and operates at a LOS A in the PM peak hour. The maximum northbound queue length occurs in the PM peak hour with an approximate length of 6.66 vehicles. Table 12 below shows the operational results for the intersection of TH 246/Jefferson Parkway.

Table 12
2040 Build Conditions TH 246 at Jefferson Parkway Mini Roundabout RODEL MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	TH 246 at Jefferson Parkway	6.47 / A	16.07 / C	9.00 / A	9.86 / A	10.78 / B
PM Peak	TH 246 at Jefferson Parkway	11.24 / B	7.12 / A	11.76 / B	8.20 / A	9.97 / A

The intersection of TH 246 at the Northfield Middle School Access operates at a LOS A in both the AM and PM peak hours. The maximum eastbound Middle School exit queue occurs during the AM peak hours and is approximately 0.65 vehicles with an average delay of 4.91 seconds per vehicle. Table 13 shows the operational results for the intersection of TH 246/Northfield Middle School Access.

Table 13

2040 Build Conditions TH 246 at Northfield Middle School Mini Roundabout RODEL SimTraffic MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	TH 246 at Northfield Middle School Access	4.91 / A	4.78 / A	7.47 / A	7.20 / A	7.04 / A
PM Peak	TH 246 at Northfield Middle School Access	4.31 / A	4.36 / A	6.20 / A	6.08 / A	6.08 / A

With the addition of the roundabout the intersection of Jefferson Parkway at Jefferson Road operates at a LOS A in both peak hours. The maximum eastbound queue length is 4.73 vehicles with an approximate delay of 8.45 seconds per vehicle in the AM peak hour. In the PM peak hour the maximum eastbound queue length is 7.76 vehicles with an approximate delay of 11.53 seconds of delay. Table 14 shows the operational results for the intersection of Jefferson Parkway at Jefferson Road.

Table 14

2040 Build Conditions Jefferson Parkway at Jefferson Road Mini Roundabout RODEL MOE's

Peak Hour	Intersection	Approach (Delay / LOS)				Intersection (Delay / LOS)
		EB	WB	NB	SB	
AM Peak	Jefferson Parkway at Jefferson Road	8.45 / A	9.57 / A	6.08 / A	5.77 / A	8.30 / A
PM Peak	Jefferson Parkway at Jefferson Road	11.53 / B	7.15 / A	7.57 / A	5.65 / A	8.85 / A

While mini roundabouts are less costly than a regular roundabout and can provide similar operational and safety benefits, they do have limitations and can present some concerns. Per the Federal Highway Administration, they should not be used where traffic speeds are greater than 35 mph. Also of note, is that they do not have a landscaped center island, thereby exposing drivers approaching at night to headlight glare from oncoming vehicles.

7.0 Pedestrian & Bicycle Safety

Pedestrian and bicycle safety is a concern throughout the study area due to the close proximity of the three public schools. The intersection of TH 246 at Jefferson Parkway has been identified as an intersection that needs to be studied for both operational and safety improvements in the City of Northfield's 2009 Safe Routes to School Plan. As identified in this plan, such pedestrian and bicycle improvements included installing a traffic signal, roundabout or grade-separated pedestrian crossing.

The MnDOT Bikeway Facility Design Manual was used to select an appropriate crossing treatment to cross TH 246. Several factors are used to determine a crossing treatment including the roadway speed and average daily traffic. The recommended treatment is then separated into two different classes of crossing safety; "good" or "satisfactory". It is recommended to choose the "good" crossing treatment if the path is used for trips to school, a large number of users are children, seniors, or disabled people, or if the crossing point is heavily used at times of peak bike and pedestrian use.

It is our understanding that the Mill Towns Trail is planned to parallel Jefferson Parkway and cross TH 246. It is recommended that the trail be constructed as an off-street trail. Based on the presence of the trail, a "good" crossing treatment should be selected. A roadway with a motor vehicle speed of 30 – 40 mph and having greater than 9,000 vehicle trips per day should consider a grade separated crossing treatment. Therefore a pedestrian tunnel at this intersection was chosen as a possible solution. A pedestrian tunnel at this intersection would provide a safe way for pedestrians and bicyclists to cross TH 246 all while removing any conflicts between pedestrians and bicycles with vehicle traffic.

Additionally, consideration should be given to marking a crossing of TH 246 at the high school. The public has presented evidence of this need through pictures and discussion. To allow for access to this crossing within the public right-of-way a sidewalk is needed on the east side of TH 246 from Marvin Lane south to the crossing. A layout showing the additional sidewalk on the east side of TH 246 as well as the improved high school crossing is shown in the attached Appendix D.

As previously mentioned, a detailed planning level matrix has been developed to provide City staff with a variety of improvements throughout the study area along with costs and impacts of each option. The matrix, shown in the attached Appendix E, shows the impacts of the particular alternative including operational performance, user safety, and construction costs.

8.0 Findings & Recommendations

The following items are recommendations at each study intersection to improve traffic flow and pedestrian and bicycle safety. For planning purposes they are broken down into near term which should be included in the more immediate planning process and long term which should be monitored over time and addressed as the need arises.

Near Term

TH 246 at Jefferson Parkway

- A signalized intersection with three approach lanes for all legs of the intersection, a single lane roundabout, or a single lane mini roundabout should be considered at this intersection.
 - Signal Cost = \$747,721
 - Roundabout Cost = \$1,640,262
 - Mini Roundabout Cost = \$1,006,873
- A grade separated pedestrian tunnel should be considered to help pedestrians and bicyclists safely cross TH 246 if the Mill Towns Trail is extended through this intersection. The Mill Towns Trail should be constructed as an off-street trail.
 - Tunnel Cost = \$697,770

Jefferson Parkway at Raider Drive

- Due to the queueing issues present under existing conditions for the eastbound Jefferson Parkway left turn lane at Raider Drive, the left turn lane should be lengthened to 300 feet. This length should contain the maximum queue length during peak AM and PM period.
 - Left Turn Lane Cost = \$38,624

Jefferson Parkway at Bridgewater Elementary School Access

- Due to the back-up of traffic during the PM peak school dismissal period, the reversal of traffic flow at Bridgewater Elementary School is recommended. This will help improve operations on Jefferson Parkway during peak school periods as well as the pick-up and drop-off process. The reversal would have traffic entering the school site from TH 246 and exiting the site onto Jefferson Parkway.

TH 246 at Northfield High School Access

- The addition of sidewalk on the east side of TH 246 from Marvin Lane to the proposed marked Northfield high school pedestrian crossing as well as signing improvements will likely help improve safety for students crossing TH 246.
 - Crosswalk and Sidewalk Cost = \$76,740

Long Term

Jefferson Parkway at Jefferson Road

- A roundabout should be considered at this intersection as it will improve operational and queueing issues identified under 2040 No Build Conditions and will also likely improve safety. The addition of a roundabout will also not require widening of the roadway for additional lanes.
 - Roundabout Cost = \$1,282,030

TH 246 at Woodley Street

- Due to the poor operations at this intersection under 2040 conditions a traffic signal or roundabout will likely improve operations at this intersection.

TH 246 south of Jefferson Parkway

- The City of Northfield should also consider planting trees along both sides of TH 246 south of Jefferson Parkway as outlined in the Northfield Corridor Improvement Plan. As the trees mature, they could have an impact on reducing vehicle speeds along TH 246. To compliment this, as roadway improvements are needed, consideration should be given to an urban cross section with curb and gutter.
 - Planting Cost = \$56,544

Appendix A

All-Way Stop Warrant Analyses



SHORT ELLIOTT HENDRICKSON INC.

3535 Vadnais Center Drive
Saint Paul, MN 55110

2016 - Northfield, MN - Highway 246 and Jefferson Parkway ALL WAY STOP WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway
COUNTY: Rice
REF. POINT: 0
DATE: 9/16/2016

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach Total
35	Major App1: TH 246 NB	2	2878
35	Major App3: TH 246 SB	2	2809
30	Minor App2: Jefferson Parkway EB	2	2801
30	Minor App4: Jefferson Parkway WB	1	2501

0.70 SPEED FACTOR USED? **No**

Minimum Volume Requirement
300 **200**

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MINOR APPROACH TOTAL	WARRANT MET
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	Σ (APP.2 + APP. 4)	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	77	67	121	209	188	NO / NO
7:00 - 8:00	313	252	182	345	565	527	YES / YES
8:00 - 9:00	265	184	192	253	449	445	YES / YES
9:00 - 10:00	155	134	144	151	289	295	NO / YES
10:00 - 11:00	129	140	137	121	269	258	NO / YES
11:00 - 12:00	161	163	176	129	324	305	YES / YES
12:00 - 13:00	167	168	188	141	335	329	YES / YES
13:00 - 14:00	151	173	190	141	324	331	YES / YES
14:00 - 15:00	194	274	265	161	468	426	YES / YES
15:00 - 16:00	323	290	303	234	613	537	YES / YES
16:00 - 17:00	302	310	307	213	612	520	YES / YES
17:00 - 18:00	331	353	357	241	684	598	YES / YES
18:00 - 19:00	255	291	293	250	546	543	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	2878	2809	2801	2501			

Hours met for warrant: **Met (Hr) 10** **Required (Hr) 8**

All-way Stop Warrant: **Satisfied**

REMARKS: **Intersection volumes are an average of Tuesday May 17th, 2016 & Thursday May 19th, 2016. Without Speed Reduction.**

Appendix B

Signal Warrant Analyses



SHORT ELLIOTT HENDRICKSON INC.

3535 Vadnais Center Drive
Saint Paul, MN 55104

2016 - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0

DATE: 9/16/2016

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	2878
35	Major App3: TH 246 SB	2	2809
30	Minor App2: Jefferson Parkway EB	2	2006
30	Minor App4: Jefferson Parkway WB	1	1900

41 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	MAJOR	MINOR	MINOR	MAJOR	MAX MINOR	WARRANT 1A - 8	WARRANT 1B - 8	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	APPROACH TOTAL Σ (APP.1 + APP. 3)	APPROACH (APP. 2 or 4)	hr MAJOR/MINOR	hr MAJOR/MINOR	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	77	34	89	209	89	NO / NO	NO / NO	NO / NO
7:00 - 8:00	313	252	106	252	565	252	NO / YES	NO / YES	NO / YES
8:00 - 9:00	265	184	138	192	449	192	NO / NO	NO / YES	NO / YES
9:00 - 10:00	155	134	110	114	289	114	NO / NO	NO / YES	NO / NO
10:00 - 11:00	129	140	108	94	269	108	NO / NO	NO / YES	NO / NO
11:00 - 12:00	161	163	135	99	324	135	NO / NO	NO / YES	NO / NO
12:00 - 13:00	167	168	150	106	335	150	NO / NO	NO / YES	NO / NO
13:00 - 14:00	151	173	145	112	324	145	NO / NO	NO / YES	NO / NO
14:00 - 15:00	194	274	190	121	468	190	NO / NO	NO / YES	NO / YES
15:00 - 16:00	323	290	218	181	613	218	YES / YES	NO / YES	NO / YES
16:00 - 17:00	302	310	213	154	612	213	YES / YES	NO / YES	NO / YES
17:00 - 18:00	331	353	262	189	684	262	YES / YES	NO / YES	NO / YES
18:00 - 19:00	255	291	197	197	546	197	NO / 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 2878 2809 2006 1900

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	3	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	3	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: **100% of Right Turns taken out of the analysis on minor approaches.**
Intersection volumes are an average of Tuesday May 17th, 2016 & Thursday May 19th, 2016.
Without Speed Reduction.



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

2016 - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0
 DATE: 9/16/2016

OPERATOR: JDA

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

85 th Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	2878
35	Major App3: TH 246 SB	2	2809
30	Minor App2: Jefferson Parkway EB	2	2006
30	Minor App4: Jefferson Parkway WB	1	1900

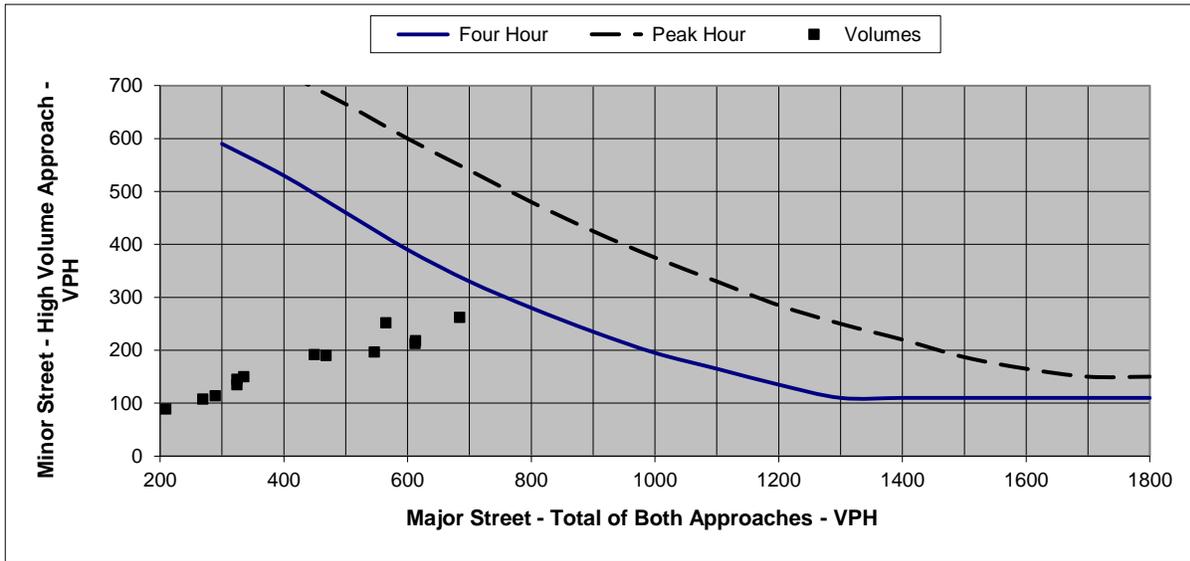


Figure 1. Four Hour and Peak Hour Warrant Analysis

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

HOUR	Actual Hourly Count		Warrants Met:	
	Sum Major App.	Max Minor App.	Warrant 2 Four Hour	Warrant 3 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	209	89	NO	NO
7:00 - 8:00	565	252	NO	NO
8:00 - 9:00	449	192	NO	NO
9:00 - 10:00	289	114	NO	NO
10:00 - 11:00	269	108	NO	NO
11:00 - 12:00	324	135	NO	NO
12:00 - 13:00	335	150	NO	NO
13:00 - 14:00	324	145	NO	NO
14:00 - 15:00	468	190	NO	NO
15:00 - 16:00	613	218	NO	NO
16:00 - 17:00	612	213	NO	NO
17:00 - 18:00	684	262	NO	NO
18:00 - 19:00	546	197	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.

3535 Vadnais Center Drive
Saint Paul, MN 55104

2016 - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0

DATE: 9/16/2016

OPERATOR: JDA

85 th % Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	2878
35	Major App3: TH 246 SB	2	2809
30	Minor App2: Jefferson Parkway EB	3	2418
30	Minor App4: Jefferson Parkway WB	2	2212

41 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	MAJOR	MINOR	MINOR	MAJOR	MAX MINOR	WARRANT 1A - 8	WARRANT 1B - 8	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	APP. 1 + APP. 3	(APP. 2 or 4)	hr	hr	B
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	77	51	106	209	106	NO / NO	NO / YES	NO / NO
7:00 - 8:00	313	252	145	299	565	299	NO / YES	NO / YES	NO / YES
8:00 - 9:00	265	184	166	223	449	223	NO / YES	NO / YES	NO / YES
9:00 - 10:00	155	134	128	133	289	133	NO / NO	NO / YES	NO / NO
10:00 - 11:00	129	140	124	108	269	124	NO / NO	NO / YES	NO / NO
11:00 - 12:00	161	163	157	115	324	157	NO / NO	NO / YES	NO / NO
12:00 - 13:00	167	168	171	125	335	171	NO / NO	NO / YES	NO / YES
13:00 - 14:00	151	173	168	127	324	168	NO / NO	NO / YES	NO / YES
14:00 - 15:00	194	274	229	142	468	229	NO / YES	NO / YES	NO / YES
15:00 - 16:00	323	290	261	209	613	261	YES / YES	NO / YES	NO / YES
16:00 - 17:00	302	310	260	185	612	260	YES / YES	NO / YES	NO / YES
17:00 - 18:00	331	353	311	216	684	311	YES / YES	NO / YES	NO / YES
18:00 - 19:00	255	291	247	224	546	247	NO / 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 2878 2809 2418 2212

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	3	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	3	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: **50% of Right Turns taken out of the analysis on minor approaches.**
Intersection volumes are an average of Tuesday May 17th, 2016 & Thursday May 19th, 2016.
Without Speed Reduction.



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

2016 - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0
 DATE: 9/16/2016

OPERATOR: JDA

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

85 th Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	2878
35	Major App3: TH 246 SB	2	2809
30	Minor App2: Jefferson Parkway EB	3	2418
30	Minor App4: Jefferson Parkway WB	2	2212

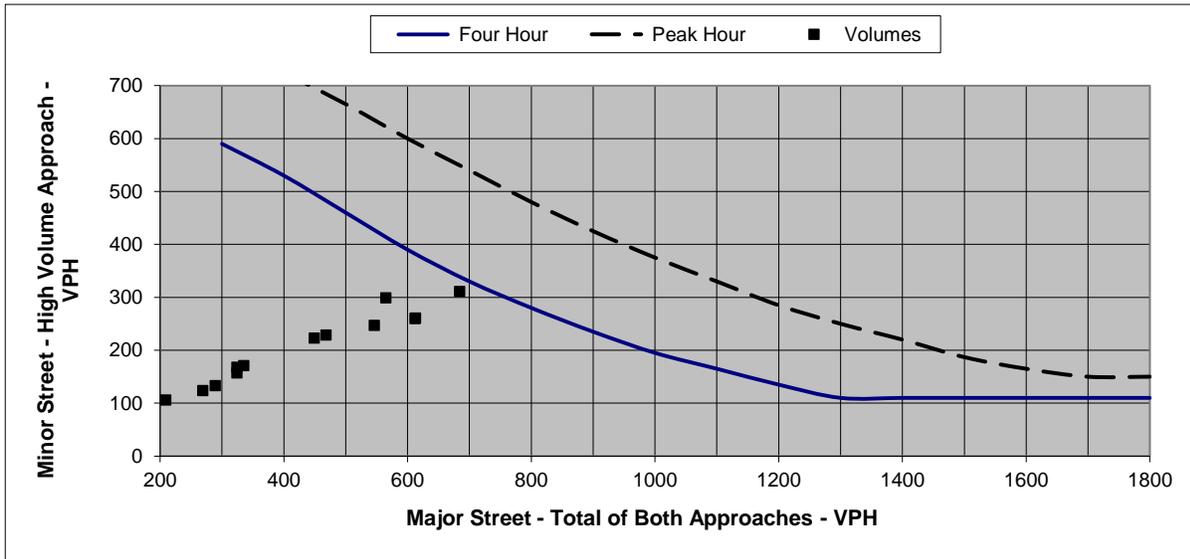


Figure 1. Four Hour and Peak Hour Warrant Analysis

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

HOUR	Actual Hourly Count		Warrants Met:	
	Sum Major App.	Max Minor App.	Warrant 2 Four Hour	Warrant 3 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	209	106	NO	NO
7:00 - 8:00	565	299	NO	NO
8:00 - 9:00	449	223	NO	NO
9:00 - 10:00	289	133	NO	NO
10:00 - 11:00	269	124	NO	NO
11:00 - 12:00	324	157	NO	NO
12:00 - 13:00	335	171	NO	NO
13:00 - 14:00	324	168	NO	NO
14:00 - 15:00	468	229	NO	NO
15:00 - 16:00	613	261	NO	NO
16:00 - 17:00	612	260	NO	NO
17:00 - 18:00	684	311	NO	NO
18:00 - 19:00	546	247	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.

3535 Vadnais Center Drive
Saint Paul, MN 55104

2016 - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0

DATE: 9/16/2016

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	2878
35	Major App3: TH 246 SB	2	2809
30	Minor App2: Jefferson Parkway EB	3	2801
30	Minor App4: Jefferson Parkway WB	2	2501

41 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	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP. 1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	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	77	67	121	209	121	NO / NO	NO / YES	NO / NO
7:00 - 8:00	313	252	182	345	565	345	NO / YES	NO / YES	NO / YES
8:00 - 9:00	265	184	192	253	449	253	NO / YES	NO / YES	NO / YES
9:00 - 10:00	155	134	144	151	289	151	NO / NO	NO / YES	NO / NO
10:00 - 11:00	129	140	137	121	269	137	NO / NO	NO / YES	NO / NO
11:00 - 12:00	161	163	176	129	324	176	NO / NO	NO / YES	NO / YES
12:00 - 13:00	167	168	188	141	335	188	NO / NO	NO / YES	NO / YES
13:00 - 14:00	151	173	190	141	324	190	NO / NO	NO / YES	NO / YES
14:00 - 15:00	194	274	265	161	468	265	NO / YES	NO / YES	NO / YES
15:00 - 16:00	323	290	303	234	613	303	YES / YES	NO / YES	NO / YES
16:00 - 17:00	302	310	307	213	612	307	YES / YES	NO / YES	NO / YES
17:00 - 18:00	331	353	357	241	684	357	YES / YES	NO / YES	NO / YES
18:00 - 19:00	255	291	293	250	546	293	NO / 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	2878	2809	2801	2501					

	Met (Hr)	Required (Hr)	WARRANT MET:
Warrant 1 Eight Hour Volumes	3	8	Not satisfied
Warrant 1A Minimum Vehicular Volume	3	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	1	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	5	8	Not satisfied

COMMENTS: **No Right Turns taken out of the analysis on minor approaches.**
Intersection volumes are an average of Tuesday May 17th, 2016 & Thursday May 19th, 2016.
Without Speed Reduction.



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

2016 - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0
 DATE: 9/16/2016

OPERATOR: JDA

85 th Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	2878
35	Major App3: TH 246 SB	2	2809
30	Minor App2: Jefferson Parkway EB	3	2801
30	Minor App4: Jefferson Parkway WB	2	2501

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

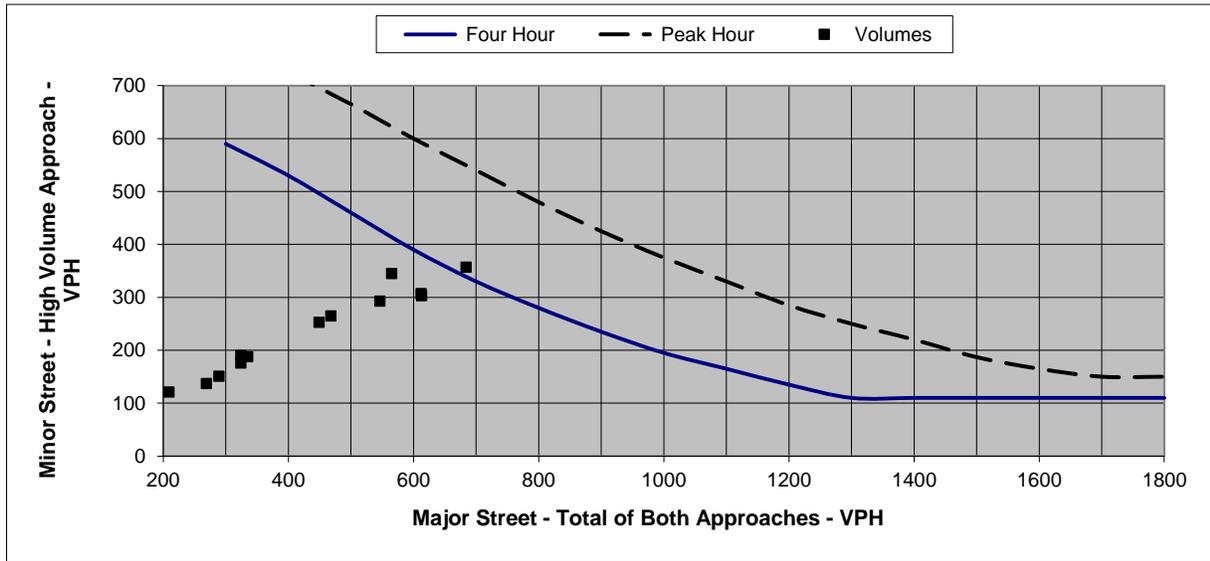


Figure 1. Four Hour and Peak Hour Warrant Analysis

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	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

HOUR	Actual Hourly Count		Warrants Met:	
	Sum Major App.	Max Minor App.	Warrant 2 Four Hour	Warrant 3 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	209	121	NO	NO
7:00 - 8:00	565	345	NO	NO
8:00 - 9:00	449	253	NO	NO
9:00 - 10:00	289	151	NO	NO
10:00 - 11:00	269	137	NO	NO
11:00 - 12:00	324	176	NO	NO
12:00 - 13:00	335	188	NO	NO
13:00 - 14:00	324	190	NO	NO
14:00 - 15:00	468	265	NO	NO
15:00 - 16:00	613	303	NO	NO
16:00 - 17:00	612	307	NO	NO
17:00 - 18:00	684	357	YES	NO
18:00 - 19:00	546	293	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.

3535 Vadnais Center Drive
Saint Paul, MN 55104

2021 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0

DATE: 9/16/2016

OPERATOR: CMJ

85 th % Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	3296
35	Major App3: TH 246 SB	2	3309
30	Minor App2: Jefferson Parkway EB	2	2324
30	Minor App4: Jefferson Parkway WB	1	2169

41 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	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8	WARRANT 1B - 8	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	hr MAJOR/MINOR	hr MAJOR/MINOR	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	156	95	41	101	251	101	NO / NO	NO / YES	NO / NO
7:00 - 8:00	416	347	129	300	763	300	YES / YES	NO / YES	YES / YES
8:00 - 9:00	252	177	156	208	429	208	NO / YES	NO / YES	NO / YES
9:00 - 10:00	160	151	110	111	311	111	NO / NO	NO / YES	NO / NO
10:00 - 11:00	152	168	120	116	320	120	NO / NO	NO / YES	NO / NO
11:00 - 12:00	180	187	162	117	367	162	NO / NO	NO / YES	NO / YES
12:00 - 13:00	211	204	177	121	415	177	NO / NO	NO / YES	NO / YES
13:00 - 14:00	181	210	172	130	391	172	NO / NO	NO / YES	NO / YES
14:00 - 15:00	218	326	224	140	544	224	NO / YES	NO / YES	NO / YES
15:00 - 16:00	379	333	263	202	712	263	YES / YES	NO / YES	NO / YES
16:00 - 17:00	359	355	253	182	714	253	YES / YES	NO / YES	NO / YES
17:00 - 18:00	349	397	301	206	746	301	YES / YES	NO / YES	YES / YES
18:00 - 19:00	283	359	216	235	642	235	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 3296 3309 2324 2169

	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
Warrant 2 Four Hour Volumes	1	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	6	8	Not satisfied

COMMENTS: **100% of Right Turns taken out of the analysis on minor approaches.**
Intersection volumes are 2021 Future Forecast Volumes
Without Speed Reduction.



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

2021 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0
 DATE: 9/16/2016

OPERATOR: CMJ

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

85 th Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	3296
35	Major App3: TH 246 SB	2	3309
30	Minor App2: Jefferson Parkway EB	2	2324
30	Minor App4: Jefferson Parkway WB	1	2169

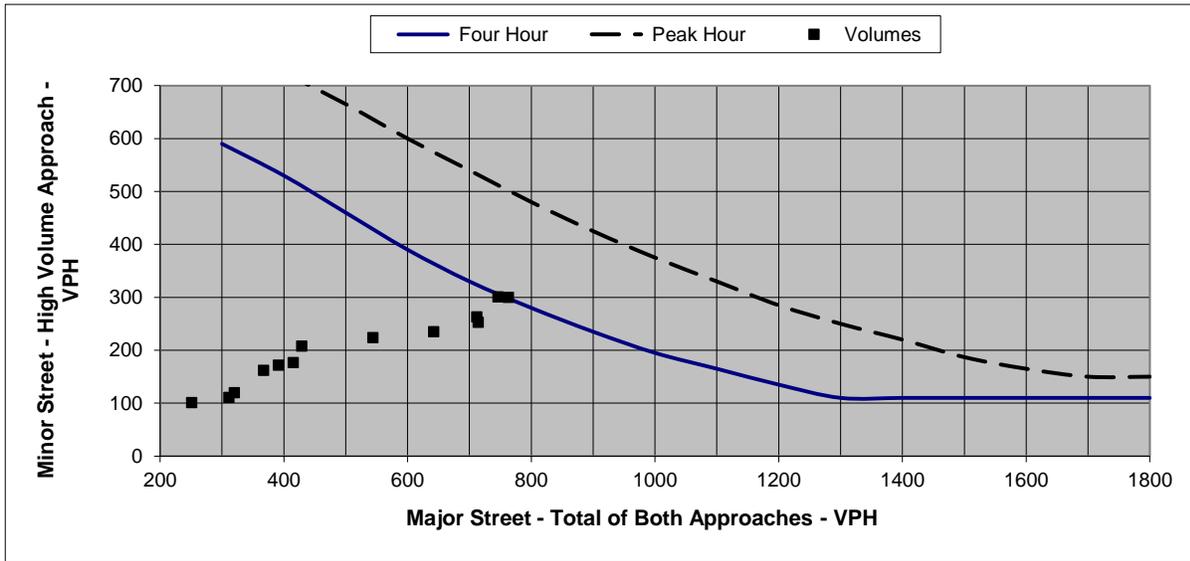


Figure 1. Four Hour and Peak Hour Warrant Analysis

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:	
HOUR	Sum Major App.	Max Minor App.	Warrant 2 Four Hour	Warrant 3 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	251	101	NO	NO
7:00 - 8:00	763	300	YES	NO
8:00 - 9:00	429	208	NO	NO
9:00 - 10:00	311	111	NO	NO
10:00 - 11:00	320	120	NO	NO
11:00 - 12:00	367	162	NO	NO
12:00 - 13:00	415	177	NO	NO
13:00 - 14:00	391	172	NO	NO
14:00 - 15:00	544	224	NO	NO
15:00 - 16:00	712	263	NO	NO
16:00 - 17:00	714	253	NO	NO
17:00 - 18:00	746	301	NO	NO
18:00 - 19:00	642	235	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.

3535 Vadnais Center Drive
Saint Paul, MN 55104

2021 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0

DATE: 9/16/2016

OPERATOR: CMJ

85 th % Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	3296
35	Major App3: TH 246 SB	2	3309
30	Minor App2: Jefferson Parkway EB	2	2803
30	Minor App4: Jefferson Parkway WB	1	2545

41 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	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	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	156	95	63	122	251	122	NO / NO	NO / YES	NO / NO
7:00 - 8:00	416	347	183	366	763	366	YES / YES	NO / YES	YES / YES
8:00 - 9:00	252	177	183	240	429	240	NO / YES	NO / YES	NO / YES
9:00 - 10:00	160	151	130	131	311	131	NO / NO	NO / YES	NO / NO
10:00 - 11:00	152	168	138	133	320	138	NO / NO	NO / YES	NO / NO
11:00 - 12:00	180	187	189	137	367	189	NO / NO	NO / YES	NO / YES
12:00 - 13:00	211	204	198	143	415	198	NO / NO	NO / YES	NO / YES
13:00 - 14:00	181	210	200	149	391	200	NO / YES	NO / YES	NO / YES
14:00 - 15:00	218	326	270	162	544	270	NO / YES	NO / YES	NO / YES
15:00 - 16:00	379	333	310	235	712	310	YES / YES	NO / YES	NO / YES
16:00 - 17:00	359	355	301	220	714	301	YES / YES	NO / YES	NO / YES
17:00 - 18:00	349	397	355	237	746	355	YES / YES	NO / YES	YES / YES
18:00 - 19:00	283	359	283	270	642	283	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 3296 3309 2803 2545

	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
Warrant 2 Four Hour Volumes	2	4	Not satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	6	8	Not satisfied

COMMENTS: 50% of Right Turns taken out of the analysis on minor approaches.
Intersection volumes are 2021 Future Forecast Volumes
Without Speed Reduction.



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

2021 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0
 DATE: 9/16/2016

OPERATOR: CMJ

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

85 th Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	3296
35	Major App3: TH 246 SB	2	3309
30	Minor App2: Jefferson Parkway EB	2	2803
30	Minor App4: Jefferson Parkway WB	1	2545

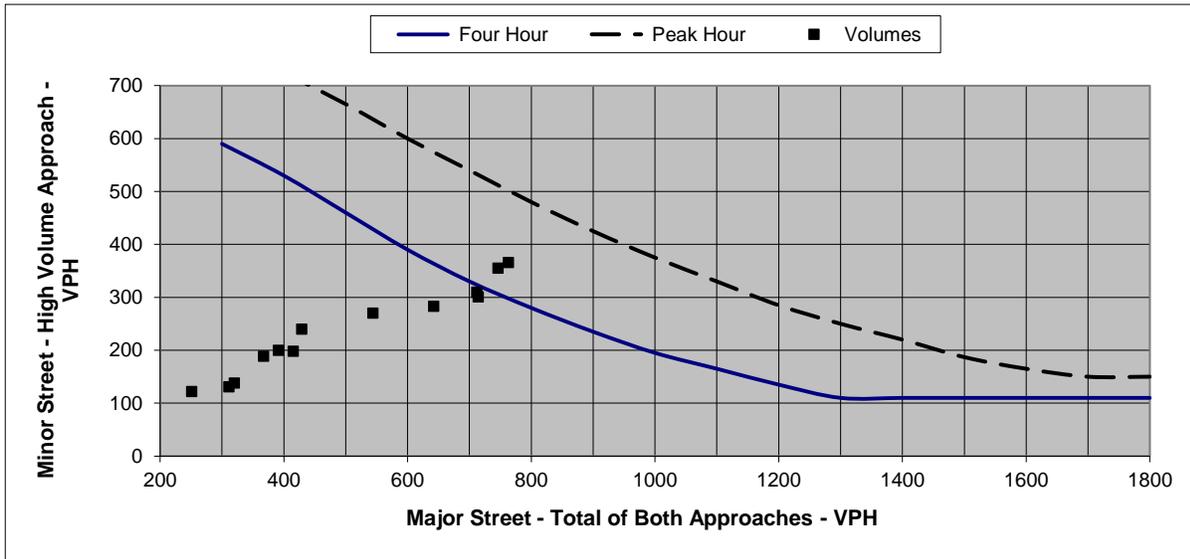


Figure 1. Four Hour and Peak Hour Warrant Analysis

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:	
HOUR	Sum Major App.	Max Minor App.	Warrant 2 Four Hour	Warrant 3 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	251	122	NO	NO
7:00 - 8:00	763	366	YES	NO
8:00 - 9:00	429	240	NO	NO
9:00 - 10:00	311	131	NO	NO
10:00 - 11:00	320	138	NO	NO
11:00 - 12:00	367	189	NO	NO
12:00 - 13:00	415	198	NO	NO
13:00 - 14:00	391	200	NO	NO
14:00 - 15:00	544	270	NO	NO
15:00 - 16:00	712	310	NO	NO
16:00 - 17:00	714	301	NO	NO
17:00 - 18:00	746	355	YES	NO
18:00 - 19:00	642	283	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.

3535 Vadnais Center Drive
Saint Paul, MN 55104

2021 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0

DATE: 9/16/2016

OPERATOR: CMJ

85 th % Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	3296
35	Major App3: TH 246 SB	2	3309
30	Minor App2: Jefferson Parkway EB	2	3260
30	Minor App4: Jefferson Parkway WB	1	2895

41 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	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	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	156	95	83	141	251	141	NO / NO	NO / YES	NO / NO
7:00 - 8:00	416	347	235	430	763	430	YES / YES	NO / YES	YES / YES
8:00 - 9:00	252	177	207	271	429	271	NO / YES	NO / YES	NO / YES
9:00 - 10:00	160	151	147	150	311	150	NO / NO	NO / YES	NO / NO
10:00 - 11:00	152	168	154	147	320	154	NO / NO	NO / YES	NO / NO
11:00 - 12:00	180	187	216	156	367	216	NO / YES	NO / YES	NO / YES
12:00 - 13:00	211	204	218	164	415	218	NO / YES	NO / YES	NO / YES
13:00 - 14:00	181	210	226	165	391	226	NO / YES	NO / YES	NO / YES
14:00 - 15:00	218	326	313	181	544	313	NO / YES	NO / YES	NO / YES
15:00 - 16:00	379	333	357	266	712	357	YES / YES	NO / YES	NO / YES
16:00 - 17:00	359	355	348	256	714	348	YES / YES	NO / YES	NO / YES
17:00 - 18:00	349	397	408	267	746	408	YES / YES	NO / YES	YES / YES
18:00 - 19:00	283	359	348	301	642	348	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 3296 3309 3260 2895

	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
Warrant 2 Four Hour Volumes	4	4	Satisfied
Warrant 3 Peak Hour Volumes	0	1	Not satisfied
Warrant 7 Crash Experience	6	8	Not satisfied

COMMENTS: **No Right Turns taken out of the analysis on minor approaches.**
Intersection volumes are 2021 Future Forecast Volumes
Without Speed Reduction.



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

2021 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0
 DATE: 9/16/2016

OPERATOR: CMJ

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

85 th Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	3296
35	Major App3: TH 246 SB	2	3309
30	Minor App2: Jefferson Parkway EB	2	3260
30	Minor App4: Jefferson Parkway WB	1	2895

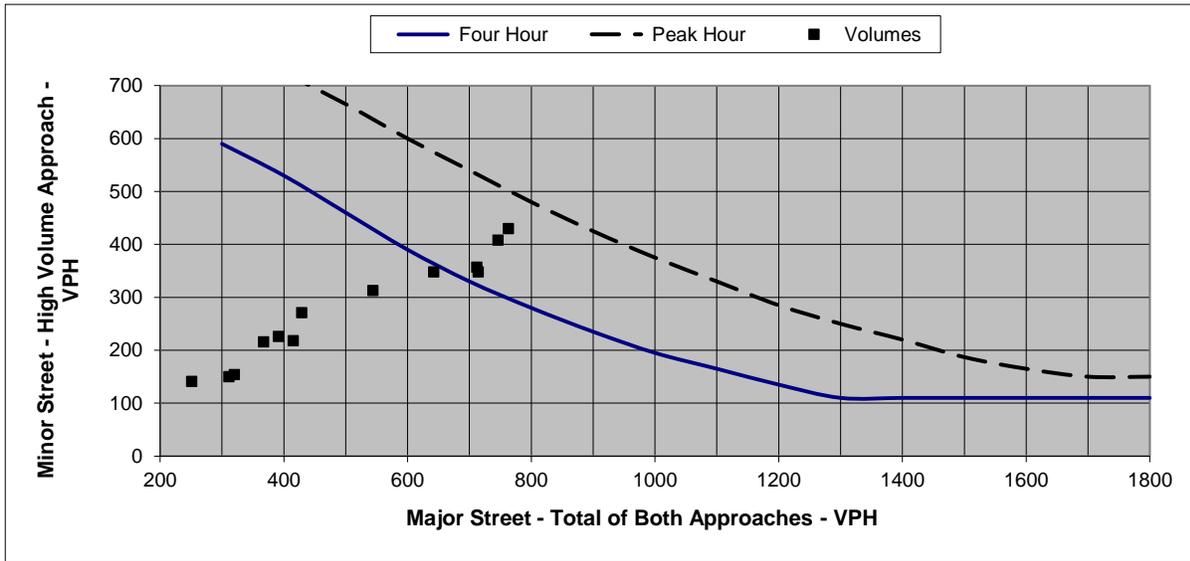


Figure 1. Four Hour and Peak Hour Warrant Analysis

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

HOUR	Actual Hourly Count		Warrants Met:	
	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	251	141	NO	NO
7:00 - 8:00	763	430	YES	NO
8:00 - 9:00	429	271	NO	NO
9:00 - 10:00	311	150	NO	NO
10:00 - 11:00	320	154	NO	NO
11:00 - 12:00	367	216	NO	NO
12:00 - 13:00	415	218	NO	NO
13:00 - 14:00	391	226	NO	NO
14:00 - 15:00	544	313	NO	NO
15:00 - 16:00	712	357	YES	NO
16:00 - 17:00	714	348	YES	NO
17:00 - 18:00	746	408	YES	NO
18:00 - 19:00	642	348	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.

3535 Vadnais Center Drive
Saint Paul, MN 55104

2040 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0

DATE: 9/16/2016

OPERATOR: CMJ

85 th % Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	4924
35	Major App3: TH 246 SB	2	4940
30	Minor App2: Jefferson Parkway EB	2	3477
30	Minor App4: Jefferson Parkway WB	1	3233

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

CORRECTABLE CRASHES: 4.1 Estimated based off of MnDOT
(12-month period) Statewide Averages.

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

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR	MAX MINOR	WARRANT 1A - 8	WARRANT 1B - 8	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	APPROACH TOTAL Σ (APP.1 + APP. 3)	APPROACH (APP. 2 or 4)	hr MAJOR/MINOR	hr MAJOR/MINOR	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	234	142	62	149	376	149	NO / NO	NO / YES	NO / NO
7:00 - 8:00	620	519	195	447	1139	447	YES / YES	YES / YES	YES / YES
8:00 - 9:00	378	267	234	309	645	309	YES / YES	NO / YES	NO / YES
9:00 - 10:00	237	224	165	165	461	165	NO / NO	NO / YES	NO / YES
10:00 - 11:00	227	250	179	173	477	179	NO / NO	NO / YES	NO / YES
11:00 - 12:00	269	280	243	174	549	243	NO / YES	NO / YES	NO / YES
12:00 - 13:00	316	306	263	180	622	263	YES / YES	NO / YES	NO / YES
13:00 - 14:00	271	314	256	195	585	256	NO / YES	NO / YES	NO / YES
14:00 - 15:00	327	486	333	207	813	333	YES / YES	NO / YES	YES / YES
15:00 - 16:00	565	497	393	302	1062	393	YES / YES	YES / YES	YES / YES
16:00 - 17:00	537	529	380	270	1066	380	YES / YES	YES / YES	YES / YES
17:00 - 18:00	519	591	451	309	1110	451	YES / YES	YES / YES	YES / YES
18:00 - 19:00	424	535	323	353	959	353	YES / YES	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 4924 4940 3477 3233

	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	5	8	Not satisfied
1A & 1B Combination of Warrants	6	8	Not satisfied
Warrant 2 Four Hour Volumes	6	4	Satisfied
Warrant 3 Peak Hour Volumes	4	1	Satisfied
Warrant 7 Crash Experience	10	8	Crashes Insufficient

COMMENTS: **100% of Right Turns taken out of the analysis on minor approaches.**
Intersection volumes are 2040 Future Forecast Volumes
Without Speed Reduction.



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2040 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0
DATE: 9/16/2016

OPERATOR: CMJ

85 th Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	4924
35	Major App3: TH 246 SB	2	4940
30	Minor App2: Jefferson Parkway EB	2	3477
30	Minor App4: Jefferson Parkway WB	1	3233

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

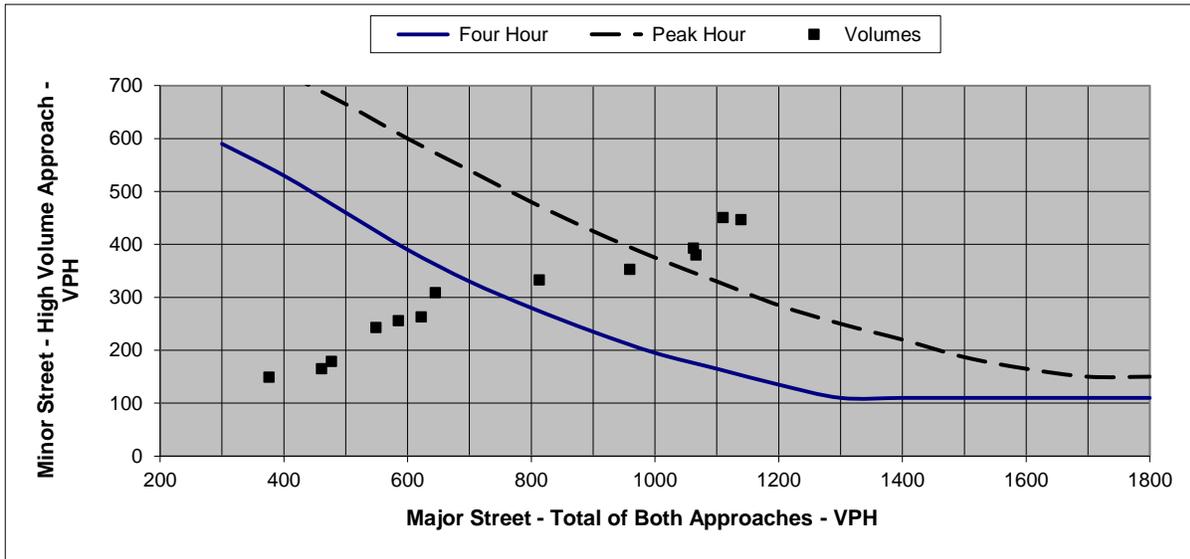


Figure 1. Four Hour and Peak Hour Warrant Analysis

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	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:	
HOUR	Sum Major App.	Max Minor App.	Warrant 2 Four Hour	Warrant 3 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	376	149	NO	NO
7:00 - 8:00	1139	447	YES	YES
8:00 - 9:00	645	309	NO	NO
9:00 - 10:00	461	165	NO	NO
10:00 - 11:00	477	179	NO	NO
11:00 - 12:00	549	243	NO	NO
12:00 - 13:00	622	263	NO	NO
13:00 - 14:00	585	256	NO	NO
14:00 - 15:00	813	333	YES	NO
15:00 - 16:00	1062	393	YES	YES
16:00 - 17:00	1066	380	YES	YES
17:00 - 18:00	1110	451	YES	YES
18:00 - 19:00	959	353	YES	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.

3535 Vadnais Center Drive
Saint Paul, MN 55104

2040 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0

DATE: 9/16/2016

OPERATOR: CMJ

85 th % Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	4924
35	Major App3: TH 246 SB	2	4940
30	Minor App2: Jefferson Parkway EB	2	4194
30	Minor App4: Jefferson Parkway WB	1	3791

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

CORRECTABLE CRASHES: 4.1 Estimated based off of MnDOT
(12-month period) Statewide Averages.

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

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR APPROACH TOTAL	MAX MINOR APPROACH	WARRANT 1A - 8 hr	WARRANT 1B - 8 hr	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	Σ (APP.1 + APP. 3)	(APP. 2 or 4)	MAJOR/MINOR	MAJOR/MINOR	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	234	142	95	180	376	180	NO / NO	NO / YES	NO / YES
7:00 - 8:00	620	519	275	546	1139	546	YES / YES	YES / YES	YES / YES
8:00 - 9:00	378	267	273	358	645	358	YES / YES	NO / YES	NO / YES
9:00 - 10:00	237	224	195	196	461	196	NO / NO	NO / YES	NO / YES
10:00 - 11:00	227	250	205	196	477	205	NO / YES	NO / YES	NO / YES
11:00 - 12:00	269	280	285	204	549	285	NO / YES	NO / YES	NO / YES
12:00 - 13:00	316	306	295	213	622	295	YES / YES	NO / YES	NO / YES
13:00 - 14:00	271	314	298	222	585	298	NO / YES	NO / YES	NO / YES
14:00 - 15:00	327	486	401	240	813	401	YES / YES	NO / YES	YES / YES
15:00 - 16:00	565	497	465	351	1062	465	YES / YES	YES / YES	YES / YES
16:00 - 17:00	537	529	452	327	1066	452	YES / YES	YES / YES	YES / YES
17:00 - 18:00	519	591	533	355	1110	533	YES / YES	YES / YES	YES / YES
18:00 - 19:00	424	535	422	403	959	422	YES / YES	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 4924 4940 4194 3791

	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	5	8	Not satisfied
1A & 1B Combination of Warrants	6	8	Not satisfied
Warrant 2 Four Hour Volumes	6	4	Satisfied
Warrant 3 Peak Hour Volumes	5	1	Satisfied
Warrant 7 Crash Experience	10	8	Crashes Insufficient

COMMENTS: 50% of Right Turns taken out of the analysis on minor approaches.
Intersection volumes are 2040 Future Forecast Volumes
Without Speed Reduction.



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
Minnetonka, MN 55343

2040 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0
DATE: 9/16/2016

OPERATOR: CMJ

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

85 th Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	4924
35	Major App3: TH 246 SB	2	4940
30	Minor App2: Jefferson Parkway EB	2	4194
30	Minor App4: Jefferson Parkway WB	1	3791

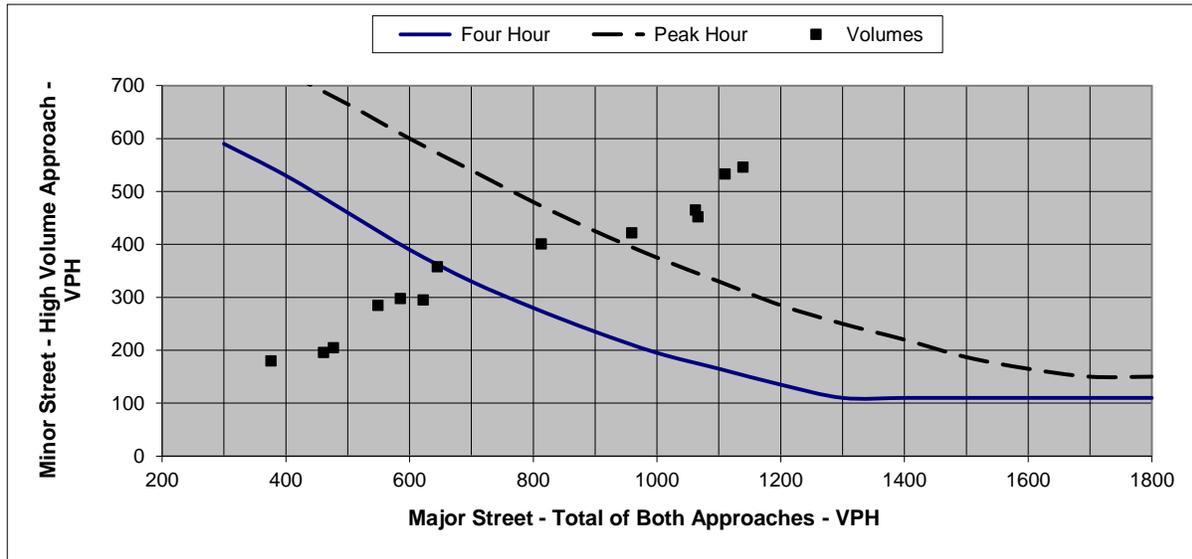


Figure 1. Four Hour and Peak Hour Warrant Analysis

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:	
HOUR	Sum Major App.	Max Minor App.	Warrant 2 Four Hour	Warrant 3 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	376	180	NO	NO
7:00 - 8:00	1139	546	YES	YES
8:00 - 9:00	645	358	NO	NO
9:00 - 10:00	461	196	NO	NO
10:00 - 11:00	477	205	NO	NO
11:00 - 12:00	549	285	NO	NO
12:00 - 13:00	622	295	NO	NO
13:00 - 14:00	585	298	NO	NO
14:00 - 15:00	813	401	YES	NO
15:00 - 16:00	1062	465	YES	YES
16:00 - 17:00	1066	452	YES	YES
17:00 - 18:00	1110	533	YES	YES
18:00 - 19:00	959	422	YES	YES
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.

3535 Vadnais Center Drive
Saint Paul, MN 55104

2040 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0

DATE: 9/16/2016

OPERATOR: CMJ

85 th % Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	4924
35	Major App3: TH 246 SB	2	4940
30	Minor App2: Jefferson Parkway EB	2	4879
30	Minor App4: Jefferson Parkway WB	1	4324

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

CORRECTABLE CRASHES: 4.1 Estimated based off of MnDOT
(12-month period) Statewide Averages.

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

HOUR	MAJOR	MAJOR	MINOR	MINOR	MAJOR	MAX MINOR	WARRANT 1A - 8	WARRANT 1B - 8	WARRANT 1A & B
	APP. 1	APP. 3	APP. 2	APP. 4	APPROACH TOTAL Σ (APP.1 + APP. 3)	APPROACH (APP. 2 or 4)	hr MAJOR/MINOR	hr MAJOR/MINOR	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	234	142	125	209	376	209	NO / YES	NO / YES	NO / YES
7:00 - 8:00	620	519	353	641	1139	641	YES / YES	YES / YES	YES / YES
8:00 - 9:00	378	267	311	403	645	403	YES / YES	NO / YES	NO / YES
9:00 - 10:00	237	224	222	224	461	224	NO / YES	NO / YES	NO / YES
10:00 - 11:00	227	250	230	219	477	230	NO / YES	NO / YES	NO / YES
11:00 - 12:00	269	280	323	233	549	323	NO / YES	NO / YES	NO / YES
12:00 - 13:00	316	306	325	244	622	325	YES / YES	NO / YES	NO / YES
13:00 - 14:00	271	314	337	248	585	337	NO / YES	NO / YES	NO / YES
14:00 - 15:00	327	486	467	270	813	467	YES / YES	NO / YES	YES / YES
15:00 - 16:00	565	497	533	399	1062	533	YES / YES	YES / YES	YES / YES
16:00 - 17:00	537	529	521	382	1066	521	YES / YES	YES / YES	YES / YES
17:00 - 18:00	519	591	612	399	1110	612	YES / YES	YES / YES	YES / YES
18:00 - 19:00	424	535	520	453	959	520	YES / YES	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 4924 4940 4879 4324

	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	5	8	Not satisfied
1A & 1B Combination of Warrants	6	8	Not satisfied
Warrant 2 Four Hour Volumes	7	4	Satisfied
Warrant 3 Peak Hour Volumes	5	1	Satisfied
Warrant 7 Crash Experience	10	8	Crashes Insufficient

COMMENTS: **No Right Turns taken out of the analysis on minor approaches.**
Intersection volumes are 2040 Future Forecast Volumes
Without Speed Reduction.



SHORT ELLIOTT HENDRICKSON INC.

10901 Red Circle Drive, Suite 200
 Minnetonka, MN 55343

2040 Future - Northfield, MN - Highway 246 and Jefferson Parkway SIGNAL WARRANT ANALYSIS

LOCATION: Northfield, MN - Highway 246 and Jefferson Parkway

COUNTY: Rice

REF. POINT: 0
 DATE: 9/16/2016

OPERATOR: CMJ

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

85 th Speed	Approach Description	Lanes	Approach
35	Major App1: TH 246 NB	2	4924
35	Major App3: TH 246 SB	2	4940
30	Minor App2: Jefferson Parkway EB	2	4879
30	Minor App4: Jefferson Parkway WB	1	4324

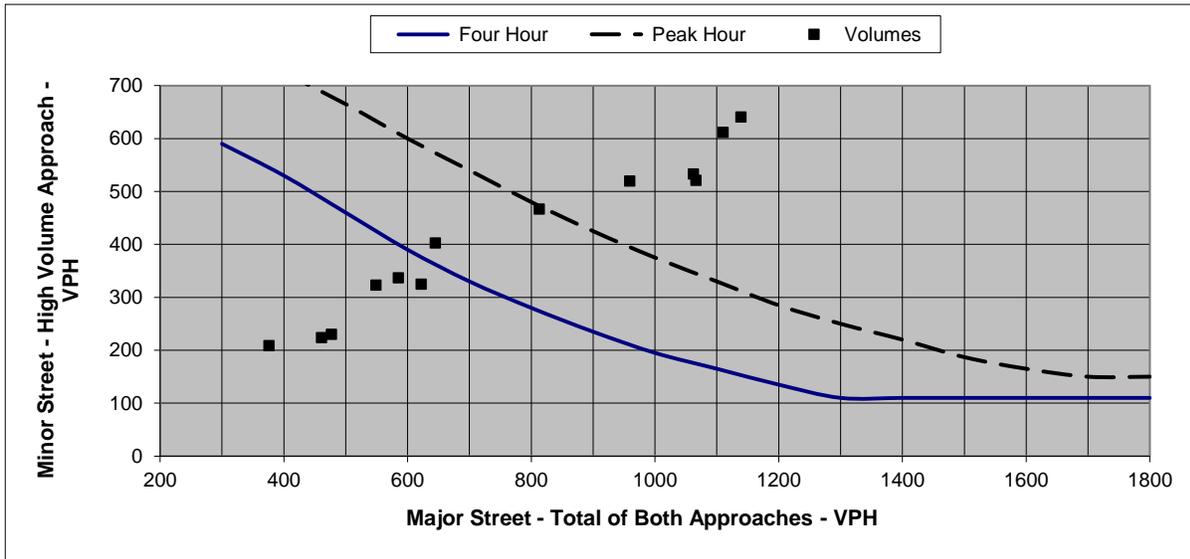


Figure 1. Four Hour and Peak Hour Warrant Analysis

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:	
HOUR	Sum Major App.	Max Minor App.	Warrant 2 Four Hour	Warrant 3 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	376	209	NO	NO
7:00 - 8:00	1139	641	YES	YES
8:00 - 9:00	645	403	YES	NO
9:00 - 10:00	461	224	NO	NO
10:00 - 11:00	477	230	NO	NO
11:00 - 12:00	549	323	NO	NO
12:00 - 13:00	622	325	NO	NO
13:00 - 14:00	585	337	NO	NO
14:00 - 15:00	813	467	YES	NO
15:00 - 16:00	1062	533	YES	YES
16:00 - 17:00	1066	521	YES	YES
17:00 - 18:00	1110	612	YES	YES
18:00 - 19:00	959	520	YES	YES
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

Appendix C

Detailed Intersection SimTraffic MOE Tables

Table A
Scenario 1: Existing Conditions
2016
Northfield, MN

Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Queuing Information (feet)										
		L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Through			Left Turn			Right Turn				
															Storage	Avg.	Max	Link Length	Avg.	Max	Storage	Avg.	Max			
AM Peak Hour	Jefferson Parkway at Jefferson Road	NB	64	50	92	206	8.5	A	10.1	B	8.2	A	8.8	A	11.9	B	1737	60	145	0			0			
		SB	82	38	11	131	9.7	A	8.2	A	5.4	A	8.7	A			1693	45	93	0			0			
		EB	23	258	81	362	10.8	B	15.8	C	9.6	A	14.1	B			843	89	259	200	13	40	0			
		WB	88	314	46	448	9.7	A	13.3	B	10.9	B	12.3	B			2378	80	244	215	38	132	0			
	Jefferson Parkway at Raider Drive	NB	1	0	1	2	16.8	C	0.0	A	2.1	A	9.5	A	4.2	A	500	3	40	0			0			
		SB	13	0	30	43	24.6	C	0.0	A	7.9	A	12.8	B			1288	14	81	0			235	16	65	
		EB	135	299	8	442	13.8	B	3.5	A	3.1	A	6.4	A			2378	2	55	195	32	162	0			
		WB	5	335	91	431	2.0	A	0.8	A	1.0	A	0.9	A			371	3	27	200	2	32	0			
	Jefferson Parkway at Elementary Bus Access	NB	11	0	3	14	9.7	A	0.0	A	3.8	A	8.2	A	0.6	A	500	14	73	0			0			
		SB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0			
		EB	0	350	0	350	0.0	A	0.6	A	0.0	A	0.6	A			0			0			0			
		WB	0	414	0	414	0.0	A	0.3	A	0.0	A	0.3	A			0			0			0			
Jefferson Parkway at Elementary School Access	NB	87	0	30	117	10.9	B	0.0	A	7.8	A	10.0	B	3.0	A	672	34	79	0			150	20	50		
	SB	4	1	0	5	8.5	A	18.2	C	0.0	A	10.9	B			635	3	35	0			0				
	EB	17	198	141	356	4.8	A	1.2	A	0.5	A	1.1	A			142	1	18	100	8	40	0				
	WB	70	322	20	412	5.5	A	2.0	A	1.9	A	2.6	A			0			190	15	49	0				
TH 246 at Woodley Street	NB	75	186	39	300	9.9	A	9.4	A	6.3	A	9.2	A	10.6	B	943	67	184	0			100	27	108		
	SB	14	148	38	200	9.7	A	12.6	B	7.1	A	11.4	B			1276	63	173	0			0				
	EB	61	92	69	222	8.3	A	10.1	B	7.7	A	8.9	A			2291	59	120	0			0				
	WB	82	167	26	275	13.6	B	13.5	B	7.6	A	13.0	B			3620	67	151	0			0				
TH 246 at High School Access	NB	105	258	0	363	5.7	A	3.3	A	0.0	A	4.0	A	5.4	A	1236	17	81	0			0				
	SB	0	207	166	373	0.0	A	1.0	A	3.6	A	2.2	A			876		4	0			230	4	44		
	EB	73	0	94	167	21.7	C	0.0	A	10.3	B	15.4	C			500			500	38	112	350	31	98		
	WB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0				
TH 246 at Jefferson Parkway	NB	117	173	64	354	30.7	D	34.9	D	4.8	A	28.1	D	17.6	C	800	123	352	0			300	37	134		
	SB	23	156	111	290	16.3	C	16.0	C	8.7	A	13.6	B			1236	73	202	0			150	32	93		
	EB	78	66	76	220	10.6	B	7.8	A	7.0	A	8.4	A			491	27	67	200	33	98	200	26	82		
	WB	81	188	106	375	19.6	C	21.7	C	6.3	A	16.6	C			410	90	253	0			410	34	136		
TH 246 at Elementary School Access/Anderson Drive	NB	0	326	34	360	0.0	A	1.7	A	1.0	A	1.6	A	2.2	A	645			0			215				
	SB	3	329	0	332	4.9	A	2.1	A	0.0	A	2.1	A			800	1	25	0			0				
	EB	6	0	48	54	7.8	A	0.0	A	4.3	A	4.7	A			500	22	58	0			0				
	WB	8	0	10	18	11.7	B	0.0	A	4.6	A	7.4	A			735	10	36	0			0				
TH 246 at Middle School Access/Arbor Street	NB	58	256	6	320	4.0	A	1.8	A	0.0	A	2.2	A	5.4	A	620	21	100	0			185				
	SB	2	250	125	377	0.6	A	0.8	A	0.9	A	0.8	A			679			0			350	2	40		
	EB	86	4	53	143	27.3	D	34.2	D	20.9	C	25.0	D			500	57	235	0			0				
	WB	4	3	4	11	8.6	A	16.5	C	2.3	A	8.6	A			606	6	22	0			0				
TH 246 at Middle School Bus Driveway	NB	3	285	0	288	2.5	A	0.5	A	0.0	A	0.5	A	0.6	A	819	1	28	0			0				
	SB	0	220	27	247	0.0	A	0.2	A	0.2	A	0.2	A			620			0			330		4		
	EB	13	0	5	18	7.6	A	0.0	A	4.9	A	6.7	A			500			500	8	47	100	6	50		
	WB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0				
PM Peak Hour	Jefferson Parkway at Jefferson Road	NB	77	92	92	261	11.1	B	12.4	B	8.4	A	10.6	B	11.8	B	1737	65	175	0			0			
		SB	37	73	21	131	8.2	A	9.6	A	4.9	A	8.5	A			1693	43	76	0			0			
		EB	30	252	65	347	11.1	B	14.4	B	10.8	B	13.5	B			843	81	231	200	15	47	0			
		WB	144	291	57	492	11.9	B	12.5	B	9.7	A	12.0	B			2378	75	157	215	46	114	0			
	Jefferson Parkway at Raider Drive	NB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A	4.1	A	500			0			0			
		SB	86	0	89	175	14.5	B	0.0	A	9.0	A	11.8	B			1288	39	108	0			235	35	77	
		EB	36	298	3	337	7.4	A	3.3	A	4.1	A	3.7	A			2378			195	10	39	0			
		WB	7	313	38	358	2.5	A	0.6	A	0.2	A	0.6	A			371		9	200	1	34	0			
	Jefferson Parkway at Elementary Bus Access	NB	4	0	6	10	11.0	B	0.0	A	3.3	A	6.8	A	0.6	A	500	11	55	0			0			
		SB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0			
		EB	0	376	0	376	0.0	A	0.7	A	0.0	A	0.7	A			0			0			0			
		WB	0	340	0	340	0.0	A	0.3	A	0.0	A	0.3	A			0			0			0			
Jefferson Parkway at Elementary School Access	NB	65	0	29	94	10.8	B	0.0	A	8.8	A	10.1	B	2.4	A	672	29	82	0			150	16	44		
	SB	14	2	2	18	10.9	B	10.6	B	4.6	A	9.9	A			635	12	52	0			0				
	EB	5	311	67	383	2.4	A	0.8	A	0.3	A	0.7	A			142		4	100	1	25	0				
	WB	41	273	6	320	5.1	A	1.6	A	1.8	A	2.0	A			0			190	11	41	0				
TH 246 at Woodley Street	NB	102	207	41	350	10.9	B	9.3	A	6.7	A	9.4	A	11.9	B	943	72	150	0			100	29	93		
	SB	32	179	76	287	11.9	B	12.4	B	9.0	A	11.5	B			1276	71	180	0			0				
	EB	82	196	74	352	14.6	B	15.7	C	12.9	B	14.8	B			2291	93	232	0			0				
	WB	50	155	22	227	13.4	B	12.5	B	10.0	B	12.4	B			3620	61	123	0			0				
TH 246 at High School Access	NB	36	282	0	318	4.7	A	2.6	A	0.0	A	2.8	A	4.4	A	1236	10	58	0			0				
	SB	0	272	46	318	0.0	A	0.7	A	1.9	A	0.9	A			876		4	0			230				
	EB	115	0	84	199	15.2	C	0.0	A	9.5	A	12.7	B			500			500	45	177	350	30	81		
	WB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0				
TH 246 at Jefferson Parkway	NB	98	160	64	322	11.4	B	11.3	B	4.1	A	10.0	B	9.5	A	800	64	146	0			300	21	55		
	SB	54	171	126	351	11.3	B	13.1	B	5.7	A	10.3	B			1236	61	144	0			150	30	65		
	EB	107																								

Table C
Scenario 3: No Build
2040
Northfield, MN

Intersection		Approach	Demand Volumes				Delay (s/veh)				LOS By Approach		LOS By Intersection		Queuing Information (feet)												
			L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Through			Left Turn			Right Turn				
																Storage	Avg.	Max	Link Length	Avg.	Max	Storage	Avg.	Max	Storage	Avg.	Max
AM Peak Hour	Jefferson Parkway at Jefferson Road	NB	105	55	95	255	15.4	C	16.7	C	21.7	C	18.8	C	298.1	F	1737	87	263	0			0				
		SB	85	40	20	145	14.5	B	11.4	B	7.8	A	12.9	B			1693	57	139	0			0				
		EB	30	450	120	600	785.9	F	754.4	F	781.1	F	759.1	F			843	863	899	200	81	225	0				
		WB	90	520	50	660	36.0	E	54.8	F	55.4	F	52.2	F			2378	368	883	215	126	240	0				
	Jefferson Parkway at Raider Drive	NB	5	0	5	10	44.1	E	0.0	A	8.9	A	30.0	D	4.2	A	500	18	94	0			0				
		SB	15	0	30	45	29.3	D	0.0	A	8.1	A	14.6	B			1288	15	65	0			235	18	72		
		EB	140	465	10	615	11.5	B	4.4	A	5.1	A	5.7	A			0		195	34	106	0					
		WB	10	580	95	685	3.4	A	1.3	A	0.7	A	1.2	A			371	3	36	200	4	42	0				
	Jefferson Parkway at Elementary Bus Access	NB	15	0	5	20	26.9	D	0.0	A	10.0	B	23.3	C	1.1	A	500	16	94	0			0				
		SB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0		0	0			0				
		EB	0	485	0	485	0.0	A	0.9	A	0.0	A	0.9	A			0		0	0			0				
		WB	0	670	0	670	0.0	A	0.5	A	0.0	A	0.5	A			0		0	0			0				
	Jefferson Parkway at Elementary School Access	NB	90	0	30	120	29.6	D	0.0	A	10.6	B	24.5	C	4.1	A	672	51	171	0			150	22	56		
		SB	5	5	0	10	14.5	B	22.0	C	0.0	A	18.3	C			635	8	44	0			0				
		EB	20	325	145	490	4.6	A	1.4	A	0.6	A	1.3	A			142	1	18	100	9	41	0				
		WB	70	580	20	670	7.0	A	2.1	A	1.9	A	2.5	A			491			190	14	47	0				
	TH 246 at Woodley Street	NB	130	245	45	420	9.6	A	10.2	B	5.0	A	9.4	A	20.9	C	943	65	149	0	9.4	0	100	27	85		
		SB	15	200	40	255	31.8	D	51.1	F	27.3	D	46.2	E			1276	149	536	0			0				
		EB	65	95	120	280	11.6	B	13.6	B	13.6	B	13.2	B			2291	80	196	0			0				
		WB	95	170	30	295	23.2	C	16.5	C	10.3	B	17.9	C			3620	85	223	0			0				
TH 246 at High School Access	NB	110	345	0	455	5.1	A	3.0	A	0.0	A	3.6	A	5.5	A	1236	22	76	0			0					
	SB	0	280	170	450	0.0	A	1.4	A	3.0	A	2.0	A			876	2	30	0			230	1	22			
	EB	75	0	95	170	18.3	C	0.0	A	17.9	C	18.1	C			500			500	37	123	350	37	172			
	WB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0					
TH 246 at Jefferson Parkway	NB	260	240	115	615	482.9	F	587.8	F	371.8	F	505.8	F	192.3	F	800			0			0					
	SB	30	215	130	375	218.8	F	169.1	F	148.5	F	166.1	F			1236			0			0					
	EB	95	95	170	360	14.0	B	11.6	B	18.1	C	15.2	C			491			0			0					
	WB	165	280	120	565	149.2	F	149.2	F	39.0	E	123.8	F			410			0			410					
TH 246 at Elementary School Access/Anderson Drive Poor LOS due to long backup from TH 246/Jefferson Parkway Intersection	NB	0	595	35	630	0.0	A	446.5	F	329.1	F	439.6	F	175.5	F	645			0			215					
	SB	5	545	0	550	5.6	A	2.2	A	0.0	A	2.2	A			800			0			0					
	EB	10	0	50	60	287.7	F	0.0	A	122.7	F	150.8	F			500			0			0					
	WB	10	0	10	20	195.2	F	0.0	A	425.1	F	310.2	F			735			0			0					
TH 246 at Middle School Access/Arbor Street Poor LOS due to long backup from TH 246/Jefferson Parkway Intersection	NB	60	535	10	605	1048.5	F	1323.4	F	2399.7	F	1307.0	F	655.0	F	620			0			185					
	SB	5	470	130	605	3.6	A	0.9	A	0.7	A	0.9	A			679			0			0					
	EB	90	5	55	150	6383.5	F	4927.0	F	7653.6	F	6699.2	F			500			0			0					
	WB	5	5	5	15	14.4	B	18.9	C	94.4	C	37.8	E			606			0			0					
TH 246 at Middle School Bus Driveway	NB	5	590	0	595	3.4	A	2.9	A	0.0	A	3.1	A	2.7	A	819			0			0					
	SB	0	500	30	530	0.0	A	0.6	A	0.2	A	0.6	A			620			0			0					
	EB	15	0	10	25	13.3	B	0.0	A	7.2	A	7.8	A			500			500			0					
	WB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0					
PM Peak Hour	Jefferson Parkway at Jefferson Road	NB	140	100	100	340	37.8	E	37.2	E	33.1	D	35.9	E	489.8	F	1737	145	395	0			0				
		SB	55	100	25	180	12.5	B	14.7	B	11.1	B	13.5	B			1693	61	126	0			0				
		EB	25	535	130	690	1129.6	F	1372.6	F	1398.7	F	1368.4	F			843	864	899	200	92	224	0				
		WB	90	395	15	500	16.2	C	31.2	D	33.5	D	28.7	D			2378	164	476	215	74	239	0				
	Jefferson Parkway at Raider Drive	NB	5	0	5	10	18.9	C	0.0	A	7.6	A	13.8	B	3.0	A	500	8	48	0			0				
		SB	15	5	25	45	14.3	B	14.2	B	7.2	A	10.1	B			1288	13	43	0			235	18	50		
		EB	35	590	10	635	8.5	A	4.4	A	4.2	A	4.5	A			0		195	9	44	0					
		WB	10	450	35	495	4.9	A	0.4	A	0.3	A	0.4	A			371		4	200	4	47	0				
	Jefferson Parkway at Elementary Bus Access	NB	0	0	5	5	0.0	A	0.0	A	6.3	A	6.3	A	0.6	A	500	5	49	0			0				
		SB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0		0	0			0				
		EB	0	610	0	610	0.0	A	0.8	A	0.0	A	0.8	A			0		0	0			0				
		WB	0	495	0	495	0.0	A	0.4	A	0.0	A	0.4	A			0		0	0			0				
	Jefferson Parkway at Elementary School Access	NB	25	0	10	35	16.6	C	0.0	A	10.4	B	14.5	B	1.8	A	672	21	60	0			150	10	35		
		SB	5	0	0	5	17.9	C	0.0	A	0.0	A	17.9	C			635	5	31	0			0				
		EB	20	570	25	615	3.5	A	0.7	A	0.2	A	0.7	A			142	1	26	100	5	31	0				
		WB	20	470	15	505	6.5	A	2.0	A	1.5	A	2.1	A			491			190	5	25	0				
	TH 246 at Woodley Street	NB	115	260	50	425	14.4	B	12.9	B	7.3	A	12.7	B	25.4	D	943	81	170	0			100	29	108		
		SB	30	270	95	395	26.0	D	26.8	D	24.4	C	26.2	D			1276	146	314	0			0				
		EB	90	220	135	445	38.2	E	41.9	E	37.2	E	39.6	E			2291	213	522	0			0				
		WB	65	155	20	240	16.0	C	16.8	C	13.0	B	16.3	C			3620	69	140	0			0				
TH 246 at High School Access	NB	20	370	0	390	5.1	A	2.5	A	0.0	A	2.6	A	3.8	A	1236	3	39	0			0					
	SB	0	405	55	460	0.0	A	3.2	A	2.1	A	3.1	A			876	17	118	0			230					
	EB	55	0	30	85	10.9	B	0.0	A	16.4	C	12.8	B			500			500	30	83	350	22	61			
	WB																										

Table E
Scenario 4a: Mitigations (Intersection Improvements at Jefferson Parkway/Jefferson Road)
2040
Northfield, MN

Intersection	Approach	Demand Volumes				Delay (s/veh)						LOS By Approach		LOS By Intersection		Queuing Information (feet)										
		L	T	R	Total	L	LOS	T	LOS	R	LOS	Delay (S/Veh)	LOS	Delay (S/Veh)	LOS	Through			Left Turn			Right Turn				
																Storage	Avg.	Max	Link Length	Avg.	Max	Storage	Avg.	Max		
AM Peak Hour	Jefferson Parkway at Jefferson Road (Signal)	NB	105	55	95	255	14.0	B	13.6	B	8.7	A	12.0	B	13.5	B	1737	76	205	0			0			
		SB	85	40	20	145	17.0	B	11.4	B	4.6	A	13.7	B			1693	56	142	0			0			
		EB	30	450	120	600	12.0	B	19.4	B	5.1	A	16.3	B			550	130	344	200	22	153	0			
		WB	90	520	50	660	12.6	B	12.2	B	3.4	A	11.6	B			435	125	282	215	40	169	0			
	Jefferson Parkway at Raider Drive	NB	5	0	5	10	53.5	F	0.0	A	11.6	B	32.6	D	5.3	A	500	18	100	0			0			
		SB	15	0	30	45	73.4	F	0.0	A	9.7	A	32.7	D			500	24	110	0			235	15	52	
		EB	140	465	10	615	20.5	C	3.6	A	2.5	A	7.2	A			660	15	275	195	44	214	0			
		WB	10	580	95	685	5.1	A	1.5	A	1.2	A	1.5	A			371	4	44	200	5	54	0			
	Jefferson Parkway at Elementary Bus Access	NB	15	0	5	20	15.5	C	0.0	A	5.6	A	13.3	B	2.0	A	500	13	71	0			0			
		SB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0			
		EB	0	485	0	485	0.0	A	3.7	A	0.0	A	3.7	A			371	20	217	0			0			
		WB	0	670	0	670	0.0	A	0.5	A	0.0	A	0.5	A			142			0			0			
Jefferson Parkway at Elementary School Access	NB	90	0	30	120	28.4	D	0.0	A	22.3	C	26.9	D	5.5	A	672	51	147	0			150	23	74		
	SB	5	5	0	10	9.1	A	44.3	E	0.0	A	26.7	D			635	8	44	0			0				
	EB	20	325	145	490	6.3	A	4.6	A	2.6	A	4.1	A			142	13	114	100	10	44	0				
	WB	70	580	20	670	8.6	A	1.9	A	1.9	A	2.6	A			491		2	190	21	72	0				
TH 246 at Woodley Street	NB	130	245	45	420	25.2	D	24.5	C	17.2	C	24.0	C	20.9	C	943	145	477	0			100	49	125		
	SB	15	200	40	255	22.4	C	31.0	D	18.9	C	28.7	D			1276	109	345	0			0				
	EB	65	95	120	280	11.7	B	13.2	B	12.0	B	12.3	B			2291	77	184	0			0				
	WB	95	170	30	295	21.1	C	16.7	C	12.1	B	17.7	C			3620	82	217	0			0				
TH 246 at High School Access	NB	110	345	0	455	6.6	A	3.9	A	0.0	A	4.6	A	6.2	A	1236	32	137	0			0				
	SB	0	280	170	450	0.0	A	1.0	A	2.8	A	1.7	A			876		4	0			230	2	44		
	EB	75	0	95	170	39.3	E	0.0	A	11.2	B	23.2	C			500			500	44	152	350	29	102		
	WB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0				
TH 246 at Jefferson Parkway (Signal)	NB	260	240	115	615	68.6	E	36.3	D	27.0	C	47.8	D	47.0	D	800	246	667	300	166	312	0				
	SB	30	215	130	375	59.8	E	36.6	D	45.4	D	40.9	D			1236	228	613	150	34	174	0				
	EB	95	95	170	360	114.5	F	26.6	C	15.5	B	43.0	D			491	100	446	200	104	295	200	65	183		
	WB	165	280	120	565	51.0	D	54.1	D	53.7	D	53.1	D			410	277	439	190	146	289	410				
TH 246 at Elementary School Access/Anderson Drive	NB	0	595	35	630	0.0	A	10.0	B	6.0	A	9.8	A	6.9	A	645	57	266	0			215	11	75		
	SB	5	545	0	550	5.8	A	2.7	A	0.0	A	2.7	A			800	3	87	0			0				
	EB	10	0	50	60	14.3	B	0.0	A	7.0	A	8.3	A			500	27	81	0			0				
	WB	10	0	10	20	30.6	D	0.0	A	36.5	E	33.9	D			735	10	39	0			0				
TH 246 at Middle School Access/Arbor Street	NB	60	580	10	650	9.6	A	4.7	A	1.0	A	5.0	A	11.0	B	620	43	235	0			185	4	112		
	SB	5	470	130	605	3.5	A	1.0	A	1.2	A	1.1	A			679	3	36	0			350	3	48		
	EB	45	5	0	50	219.3	F	229.5	F	0.0	A	220.8	F			500	87	298	0			0				
	WB	5	5	5	15	46.9	E	75.2	F	3.3	A	44.1	E			606	13	48	0			0				
TH 246 at Middle School Bus Driveway	NB	5	590	0	595	5.2	A	1.8	A	0.0	A	1.8	A	7.8	A	819	6	97	0			0				
	SB	0	445	30	475	0.0	A	1.0	A	0.3	A	1.0	A			620	1	15	0			330				
	EB	60	0	65	125	87.3	F	0.0	A	44.7	E	66.2	F			500			500	108	501	100	44	125		
	WB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0				
PM Peak Hour	Jefferson Parkway at Jefferson Road (Signal)	NB	140	100	100	340	23.7	C	23.1	C	18.6	B	22.0	C	17.0	B	1737	129	421	0			0			
		SB	55	100	25	180	14.2	B	12.0	B	6.4	A	12.0	B			1693	60	137	0			0			
		EB	25	535	130	690	13.6	B	22.7	C	7.5	A	19.5	B			550	161	304	200	20	192	200			
		WB	90	395	15	500	15.8	B	11.4	B	2.2	A	11.9	B			435	101	194	215	43	82	215			
	Jefferson Parkway at Raider Drive	NB	5	0	5	10	24.3	C	0.0	A	9.0	A	18.6	C	2.9	A	500	13	84	0			0			
		SB	15	5	25	45	18.0	C	17.8	C	7.4	A	11.5	B			500	16	85	0			235	20	60	
		EB	35	590	10	635	7.6	A	3.4	A	3.0	A	3.6	A			660		6	195	9	46	0			
		WB	10	450	35	495	4.1	A	0.8	A	0.5	A	0.8	A			371			200	4	35	0			
	Jefferson Parkway at Elementary Bus Access	NB	0	0	5	5	0.0	A	0.0	A	5.2	A	5.2	A	0.7	A	500	4	41	0			0			
		SB	0	0	0	0	0.0	A	0.0	A	0.0	A	0.0	A			0			0			0			
		EB	0	610	0	610	0.0	A	1.0	A	0.0	A	1.0	A			371			0			0			
		WB	0	495	0	495	0.0	A	0.3	A	0.0	A	0.3	A			142			0			0			
Jefferson Parkway at Elementary School Access	NB	25	0	10	35	15.3	C	0.0	A	10.8	B	13.5	B	1.7	A	672	20	57	0			150	12	36		
	SB	5	0	0	5	13.0	B	0.0	A	0.0	A	13.0	B			635	5	34	0			0				
	EB	20	570	25	615	3.8	A	0.9	A	0.2	A	0.9	A			142			100	7	31	0				
	WB	20	470	15	505	5.7	A	1.5	A	1.3	A	1.7	A			491			190	7	38	0				
TH 246 at Woodley Street	NB	115	260	50	425	46.3	E	31.7	D	19.4	C	33.8	D	34.7	D	943	177	494	0			100	59	125		
	SB	30	270	95	395	24.3	C	26.5	D	22.2	C	25.3	D			1276	140	342	0			0				
	EB	90	220	135	445	50.9	F	55.4	F	51.4	F	53.3	F			2291	258	526	0			0				
	WB	65	155	20	240	16.9	C	18.1	C	12.8	B	17.4	C			3620	74	169	0			0				
TH 246 at High School Access	NB	20	370	0	390	5.3	A	2.4	A	0.0	A	2.6	A	2.3	A	1236	9	57	0			0				
	SB	0	405	55	460	0.0	A	0.7	A	1.9	A	0.8	A			876			0			230				
	EB	55	0	30	85	10.9	B	0.0	A	8.0	A	9.9	A			500			500	30	80	350	18	59		
	WB	0	0	0	0	0.0	A	0.0	A</																	

Appendix D

Intersection Layouts & Cost Estimates

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 PHONE: 651490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	137211	Traffic Signal T.H. 246 / Jefferson Parkway	LAYOUT No. 1
	DATE: 10/6/2016		



 PHONE: 651490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	137211	Roundabout T.H. 246 / Jefferson Parkway	LAYOUT No. 2a
	DATE: 10/6/2016		



 PHONE: 651490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	137211	Mini Roundabout T.H. 246 / Jefferson Parkway	LAYOUT No. 2b
	DATE: 10/6/2016		

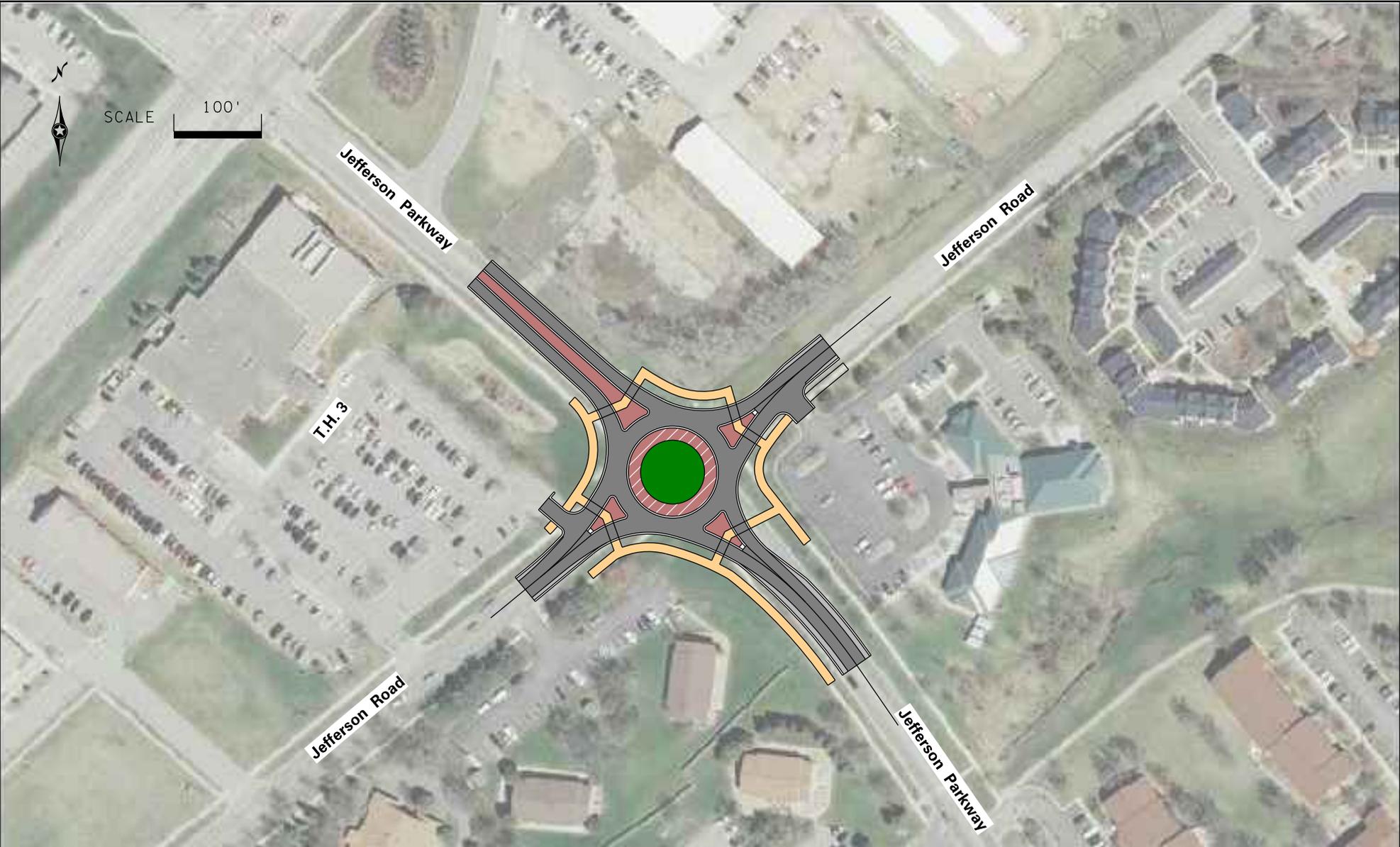


 PHONE: 651490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	137211	Roundabout T.H. 246 /Middle School Access Rd./ Arbor St.	LAYOUT No. 3a
	DATE: 10/6/2016		



 PHONE: 651490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	137211	Mini Roundabout T.H. 246 /Middle School Access Rd./ Arbor St.	LAYOUT No. 3b
	DATE: 10/6/2016		

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 PHONE: 651490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	137211	Roundabout Jefferson Parkway /Jefferson Rd.	LAYOUT No. 4a
	DATE: 10/6/2016		

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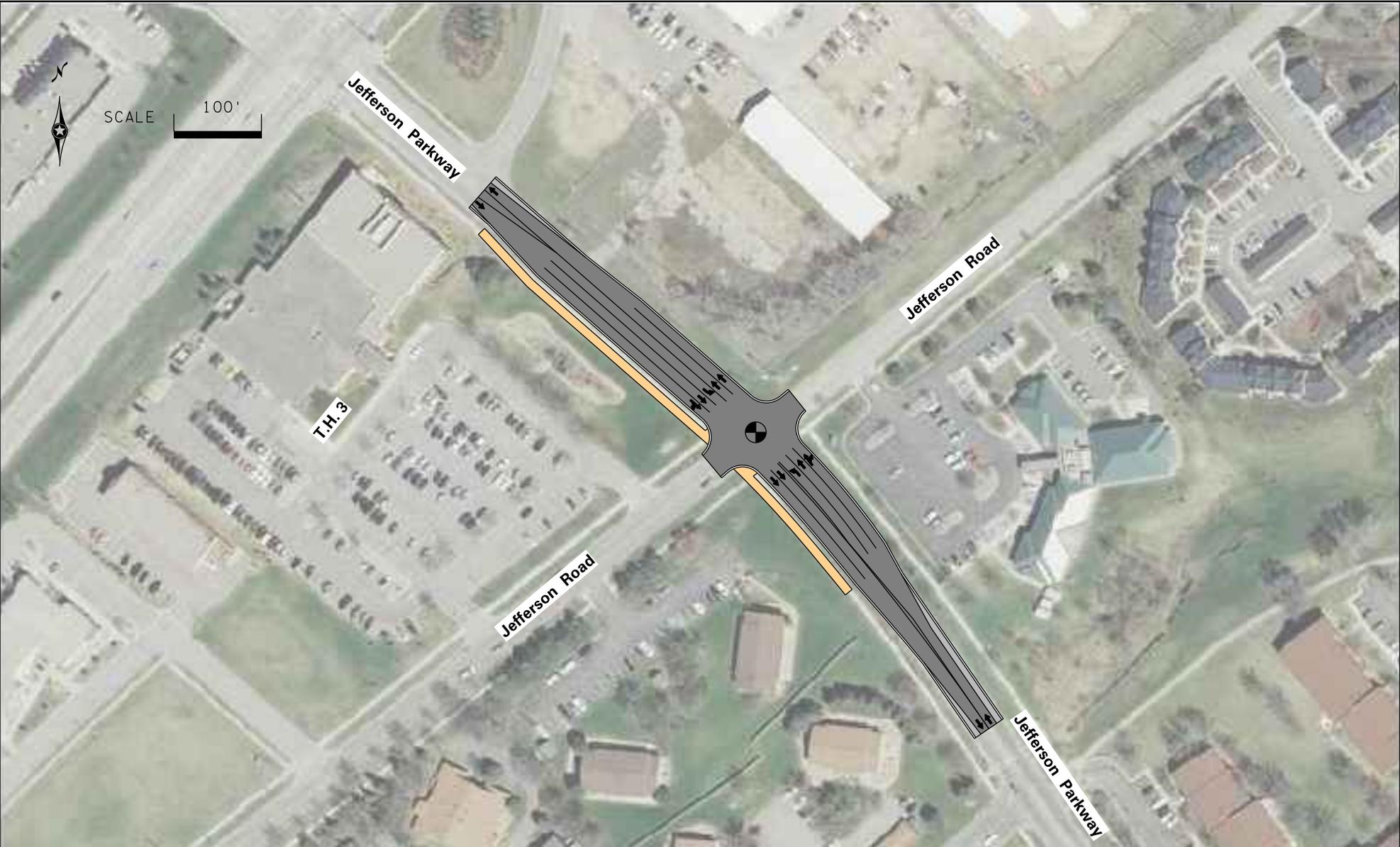


SCALE 100'



 PHONE: 651490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	137211	Mini Roundabout Jefferson Parkway /Jefferson Rd.	LAYOUT No. 4b
	DATE: 10/6/2016		

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 PHONE: (651)490-2000 3535 VADNAIS CENTER DR. ST. PAUL, MN 55110	137211	Traffic Signal Jefferson Parkway /Jefferson Rd.	LAYOUT No. 5
	DATE: 10/6/2016		

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Marvin Lane

TH 246

SCALE 100'



PHONE: 651490-2000
 3535 VADNAIS CENTER DR.
 ST. PAUL, MN 55110

137211

DATE:
10/6/2016

High School Crosswalk and Sidewalk
 TH 246

LAYOUT
No. 7

Construction Cost Estimate

RAB - TH 246/Jefferson Pkwy.				
Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	\$70.00	2,229	\$ 156,024
4" Concrete Walk	sq ft	\$6.00	13,925	\$ 83,550
8" Concrete pavement	sq yd	\$80.00	425	\$ 34,018
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	1,279	\$ 30,702
Subgrade Excavation (1)	cu yd	\$7.00	1,814	\$ 12,697
Common Excavation	cu yd	\$7.00	2,559	\$ 17,910
Common Borrow	cu yd	\$5.00	3,838	\$ 19,189
Select Granular Borrow	cu yd	\$18.00	1,814	\$ 32,649
Mill Pavement	sq yd	\$10.00	2,950	\$ 29,496
Curb and Gutter Design B624	lin ft	\$18.00	4,040	\$ 72,720
(a) Subtotal Paving and Grading				\$ 488,954
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		10.0%		\$ 48,895
Minor City Utilities		5.0%		\$ 24,448
Signing, Striping, Traffic Control		10.0%		\$ 48,895
Erosion Control and Turf Establishment		10.0%		\$ 48,895
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ 171,134
DRAINAGE				
Storm Sewer		25.0%		\$ 122,239
(c) Subtotal Drainage				\$ 122,239
STRUCTURES/SIGNALS/MISC. COST				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Roundabout Lighting		\$7,000	12	\$ 84,000
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	1	\$ 40,000
Intersection ADA	each	\$ 6,000.00	16	\$ 96,000
Signal System - RRFB	each	\$ 25,000.00	4	\$ 100,000
(d) Subtotal Structural				\$ 320,000
(a+b+c+d) Subtotal Construction				\$ 1,102,327
Risk & Contingency		20.0%		\$ 220,465
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 44,093
(e) Subtotal Miscellaneous				\$ 264,558
(a+b+c+d+e) Total Construction				\$ 1,366,885
Administrative & Engineering		20.0%		\$ 273,377
RW Cost				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 1,640,262

Construction Cost Estimate

Signal - TH 246/Jefferson Pkwy.				
Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	\$70.00	1,386	\$ 97,053
4" Concrete Walk	sq ft	\$6.00	0	\$ -
8" Concrete pavement	sq yd	\$80.00	0	\$ -
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	222	\$ 5,324
Subgrade Excavation (1)	cu yd	\$7.00	444	\$ 3,106
Common Excavation	cu yd	\$7.00	444	\$ 3,106
Common Borrow	cu yd	\$5.00	666	\$ 3,328
Select Granular Borrow	cu yd	\$18.00	444	\$ 7,987
Mill Pavement	sq yd	\$10.00	5,518	\$ 55,176
Curb and Gutter Design B624	lin ft	\$18.00	1,064	\$ 19,152
(a) Subtotal Paving and Grading				\$ 194,231
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		0.0%		\$ -
Minor City Utilities		0.0%		\$ -
Signing, Striping, Traffic Control		25.0%		\$ 48,558
Erosion Control and Turf Establishment		5.0%		\$ 9,712
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ 58,269
DRAINAGE				
Storm Sewer		0.0%		\$ -
(c) Subtotal Drainage				\$ -
STRUCTURES/SIGNALS/MISC. COST				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Roundabout Lighting		\$7,000	0	\$ -
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	0	\$ -
Intersection ADA	each	\$ 6,000.00	0	\$ -
Signal System	each	\$ 250,000.00	1	\$ 250,000
(d) Subtotal Structural				\$ 250,000
(a+b+c+d) Subtotal Construction				\$ 502,501
Risk & Contingency		20.0%		\$ 100,500
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 20,100
(e) Subtotal Miscellaneous				\$ 120,600
(a+b+c+d+e) Total Construction				\$ 623,101
Administrative & Engineering		20.0%		\$ 124,620
RW Cost				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 747,721

Construction Cost Estimate

MINI RAB - TH 246/Jefferson Pkwy.				
Item Description	Units	Unit Cost	Quantity	Total
<u>PAVING AND GRADING (P & G) COSTS</u>				
Bituminous Pavement (1)	ton	\$70.00	1,361	\$ 95,272
4" Concrete Walk	sq ft	\$6.00	2,039	\$ 12,234
8" Concrete pavement	sq yd	\$80.00	185	\$ 14,773
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	621	\$ 14,908
Subgrade Excavation (1)	cu yd	\$7.00	886	\$ 6,200
Common Excavation	cu yd	\$7.00	1,242	\$ 8,696
Common Borrow	cu yd	\$5.00	1,864	\$ 9,318
Select Granular Borrow	cu yd	\$18.00	886	\$ 15,943
Mill Pavement	sq yd	\$10.00	1,988	\$ 19,882
Curb and Gutter Design B624	lin ft	\$18.00	2,816	\$ 50,688
(a) Subtotal Paving and Grading				\$ 247,914
<u>UTILITIES, REMOVALS, DRAINAGE, ETC.</u>				
Removals/Clear and Grub		10.0%		\$ 24,791
Minor City Utilities		5.0%		\$ 12,396
Signing, Striping, Traffic Control		10.0%		\$ 24,791
Erosion Control and Turf Establishment		10.0%		\$ 24,791
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ 86,770
<u>DRAINAGE</u>				
Storm Sewer		25.0%		\$ 61,978
(c) Subtotal Drainage				\$ 61,978
<u>STRUCTURES/SIGNALS/MISC. COST</u>				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Roundabout Lighting		\$7,000	12	\$ 84,000
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	0	\$ -
Intersection ADA	each	\$ 6,000.00	16	\$ 96,000
Signal System - RRFB	each	\$ 25,000.00	4	\$ 100,000
(d) Subtotal Structural				\$ 280,000
(a+b+c+d) Subtotal Construction				\$ 676,662
Risk & Contingency		20.0%		\$ 135,332
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 27,066
(e) Subtotal Miscellaneous				\$ 162,399
(a+b+c+d+e) Total Construction				\$ 839,060
Administrative & Engineering		20.0%		\$ 167,812
<u>RW Cost</u>				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 1,006,873

Construction Cost Estimate

RAB - TH 246/Arbor St				
Item Description	Units	Unit Cost	Quantity	Total
<u>PAVING AND GRADING (P & G) COSTS</u>				
Bituminous Pavement (1)	ton	\$70.00	2,214	\$ 154,973
4" Concrete Walk	sq ft	\$6.00	4,310	\$ 25,860
8" Concrete pavement	sq yd	\$80.00	401	\$ 32,062
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	1,313	\$ 31,520
Subgrade Excavation (1)	cu yd	\$7.00	2,023	\$ 14,164
Common Excavation	cu yd	\$7.00	2,627	\$ 18,387
Common Borrow	cu yd	\$5.00	3,940	\$ 19,700
Select Granular Borrow	cu yd	\$18.00	2,023	\$ 36,421
Mill Pavement	sq yd	\$10.00	0	\$ -
Curb and Gutter Design B624	lin ft	\$18.00	2,735	\$ 49,230
(a) Subtotal Paving and Grading				\$ 382,317
<u>UTILITIES, REMOVALS, DRAINAGE, ETC.</u>				
Removals/Clear and Grub		10.0%		\$ 38,232
Minor City Utilities		5.0%		\$ 19,116
Signing, Striping, Traffic Control		10.0%		\$ 38,232
Erosion Control and Turf Establishment		10.0%		\$ 38,232
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ 133,811
<u>DRAINAGE</u>				
Storm Sewer		25.0%		\$ 95,579
(c) Subtotal Drainage				\$ 95,579
<u>STRUCTURES/SIGNALS/MISC. COST</u>				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Roundabout Lighting		\$7,000	10	\$ 70,000
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	1	\$ 40,000
Intersection ADA	each	\$ 6,000.00	16	\$ 96,000
Signal System - RRFB	each	\$ 25,000.00	4	\$ 100,000
(d) Subtotal Structural				\$ 306,000
(a+b+c+d) Subtotal Construction				\$ 917,707
Risk & Contingency		20.0%		\$ 183,541
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 36,708
(e) Subtotal Miscellaneous				\$ 220,250
(a+b+c+d+e) Total Construction				\$ 1,137,957
Administrative & Engineering		20.0%		\$ 227,591
<u>RW Cost</u>				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 1,365,548

Construction Cost Estimate

MINI RAB - TH 246/Arbor St				
Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	\$70.00	835	\$ 58,416
4" Concrete Walk	sq ft	\$6.00	1,214	\$ 7,284
8" Concrete pavement	sq yd	\$80.00	185	\$ 14,773
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	341	\$ 8,172
Subgrade Excavation (1)	cu yd	\$7.00	451	\$ 3,159
Common Excavation	cu yd	\$7.00	681	\$ 4,767
Common Borrow	cu yd	\$5.00	1,022	\$ 5,108
Select Granular Borrow	cu yd	\$18.00	451	\$ 8,123
Mill Pavement	sq yd	\$10.00	1,813	\$ 18,128
Curb and Gutter Design B624	lin ft	\$18.00	1,126	\$ 20,268
(a) Subtotal Paving and Grading				\$ 148,198
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		10.0%		\$ 14,820
Minor City Utilities		5.0%		\$ 7,410
Signing, Striping, Traffic Control		10.0%		\$ 14,820
Erosion Control and Turf Establishment		10.0%		\$ 14,820
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ 51,869
DRAINAGE				
Storm Sewer		25.0%		\$ 37,049
(c) Subtotal Drainage				\$ 37,049
STRUCTURES/SIGNALS/MISC. COST				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Roundabout Lighting		\$7,000	10	\$ 70,000
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	0	\$ -
Intersection ADA	each	\$ 6,000.00	16	\$ 96,000
Signal System - RRFB	each	\$ 25,000.00	4	\$ 100,000
(d) Subtotal Structural				\$ 266,000
(a+b+c+d) Subtotal Construction				\$ 503,116
Risk & Contingency		20.0%		\$ 100,623
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 20,125
(e) Subtotal Miscellaneous				\$ 120,748
(a+b+c+d+e) Total Construction				\$ 623,864
Administrative & Engineering		20.0%		\$ 124,773
RW Cost				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 748,637

Construction Cost Estimate

RAB - Jefferson Pkwy / Jefferson Rd				
Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	\$70.00	1,545	\$ 108,138
4" Concrete Walk	sq ft	\$6.00	7,293	\$ 43,758
8" Concrete pavement	sq yd	\$80.00	425	\$ 34,018
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	1,024	\$ 24,567
Subgrade Excavation (1)	cu yd	\$7.00	1,556	\$ 10,895
Common Excavation	cu yd	\$7.00	2,047	\$ 14,331
Common Borrow	cu yd	\$5.00	3,071	\$ 15,354
Select Granular Borrow	cu yd	\$18.00	1,556	\$ 28,015
Mill Pavement	sq yd	\$10.00	0	\$ -
Curb and Gutter Design B624	lin ft	\$18.00	3,300	\$ 59,400
(a) Subtotal Paving and Grading				\$ 338,476
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		10.0%		\$ 33,848
Minor City Utilities		5.0%		\$ 16,924
Signing, Striping, Traffic Control		10.0%		\$ 33,848
Erosion Control and Turf Establishment		10.0%		\$ 33,848
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ 118,467
DRAINAGE				
Storm Sewer		25.0%		\$ 84,619
(c) Subtotal Drainage				\$ 84,619
STRUCTURES/SIGNALS/MISC. COST				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Roundabout Lighting		\$7,000	12	\$ 84,000
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	1	\$ 40,000
Intersection ADA	each	\$ 6,000.00	16	\$ 96,000
Signal System - RRFB	each	\$ 25,000.00	4	\$ 100,000
(d) Subtotal Structural				\$ 320,000
(a+b+c+d) Subtotal Construction				\$ 861,561
Risk & Contingency		20.0%		\$ 172,312
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 34,462
(e) Subtotal Miscellaneous				\$ 206,775
(a+b+c+d+e) Total Construction				\$ 1,068,336
Administrative & Engineering		20.0%		\$ 213,667
RW Cost				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 1,282,003

Construction Cost Estimate

MINI RAB - Jefferson Pkwy / Jefferson Rd				
Item Description	Units	Unit Cost	Quantity	Total
<u>PAVING AND GRADING (P & G) COSTS</u>				
Bituminous Pavement (1)	ton	\$70.00	854	\$ 59,757
4" Concrete Walk	sq ft	\$6.00	1,274	\$ 7,644
8" Concrete pavement	sq yd	\$80.00	185	\$ 14,773
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	416	\$ 9,992
Subgrade Excavation (1)	cu yd	\$7.00	633	\$ 4,433
Common Excavation	cu yd	\$7.00	833	\$ 5,829
Common Borrow	cu yd	\$5.00	1,249	\$ 6,245
Select Granular Borrow	cu yd	\$18.00	633	\$ 11,398
Mill Pavement	sq yd	\$10.00	969	\$ 9,687
Curb and Gutter Design B624	lin ft	\$18.00	1,896	\$ 34,128
(a) Subtotal Paving and Grading				\$ 163,886
<u>UTILITIES, REMOVALS, DRAINAGE, ETC.</u>				
Removals/Clear and Grub		10.0%		\$ 16,389
Minor City Utilities		5.0%		\$ 8,194
Signing, Striping, Traffic Control		10.0%		\$ 16,389
Erosion Control and Turf Establishment		10.0%		\$ 16,389
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ 57,360
<u>DRAINAGE</u>				
Storm Sewer		25.0%		\$ 40,971
(c) Subtotal Drainage				\$ 40,971
<u>STRUCTURES/SIGNALS/MISC. COST</u>				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Roundabout Lighting		\$7,000	12	\$ 84,000
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	0	\$ -
Intersection ADA	each	\$ 6,000.00	16	\$ 96,000
Signal System - RRFB	each	\$ 25,000.00	4	\$ 100,000
(d) Subtotal Structural				\$ 280,000
(a+b+c+d) Subtotal Construction				\$ 542,217
Risk & Contingency		20.0%		\$ 108,443
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 21,689
(e) Subtotal Miscellaneous				\$ 130,132
(a+b+c+d+e) Total Construction				\$ 672,349
Administrative & Engineering		20.0%		\$ 134,470
<u>RW Cost</u>				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 806,819

Construction Cost Estimate

Signal - Jefferson Pkwy / Jefferson Rd				
Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	\$70.00	1,820	\$ 127,424
4" Concrete Walk	sq ft	\$6.00	0	\$ -
8" Concrete pavement	sq yd	\$80.00	0	\$ -
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	929	\$ 22,294
Subgrade Excavation (1)	cu yd	\$7.00	1,654	\$ 11,579
Common Excavation	cu yd	\$7.00	1,858	\$ 13,005
Common Borrow	cu yd	\$5.00	2,787	\$ 13,934
Select Granular Borrow	cu yd	\$18.00	1,654	\$ 29,774
Mill Pavement	sq yd	\$10.00	0	\$ -
Curb and Gutter Design B624	lin ft	\$18.00	1,706	\$ 30,708
(a) Subtotal Paving and Grading				\$ 248,717
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		10.0%		\$ 24,872
Minor City Utilities		5.0%		\$ 12,436
Signing, Striping, Traffic Control		10.0%		\$ 24,872
Erosion Control and Turf Establishment		10.0%		\$ 24,872
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ 87,051
DRAINAGE				
Storm Sewer		25.0%		\$ 62,179
(c) Subtotal Drainage				\$ 62,179
STRUCTURES/SIGNALS/MISC. COST				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Roundabout Lighting		\$7,000	0	\$ -
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	0	\$ -
Intersection ADA	each	\$ 6,000.00	4	\$ 24,000
Signal System	each	\$ 250,000.00	1	\$ 250,000
(d) Subtotal Structural				\$ 274,000
(a+b+c+d) Subtotal Construction				\$ 671,947
Risk & Contingency		20.0%		\$ 134,389
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 26,878
(e) Subtotal Miscellaneous				\$ 161,267
(a+b+c+d+e) Total Construction				\$ 833,214
Administrative & Engineering		20.0%		\$ 166,643
RW Cost				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 999,857

Construction Cost Estimate

High School Sidewalk				
Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	\$70.00	0	\$ -
4" Concrete Walk	sq ft	\$6.00	3,038	\$ 18,228
8" Concrete pavement	sq yd	\$80.00	0	\$ -
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	56	\$ 1,350
Subgrade Excavation (1)	cu yd	\$7.00	0	\$ -
Common Excavation	cu yd	\$7.00	113	\$ 788
Common Borrow	cu yd	\$5.00	169	\$ 844
Select Granular Borrow	cu yd	\$18.00	0	\$ -
Mill Pavement	sq yd	\$10.00	0	\$ -
Curb and Gutter Design B624	lin ft	\$18.00	0	\$ -
(a) Subtotal Paving and Grading				\$ 21,210
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		10.0%		\$ 2,121
Minor City Utilities		0.0%		\$ -
Signing, Striping, Traffic Control		10.0%		\$ 2,121
Erosion Control and Turf Establishment		10.0%		\$ 2,121
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ 6,363
DRAINAGE				
Storm Sewer		0.0%		\$ -
(c) Subtotal Drainage				\$ -
STRUCTURES/SIGNALS/MISC. COST				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Roundabout Lighting		\$7,000	0	\$ -
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	0	\$ -
Intersection ADA	each	\$ 6,000.00	4	\$ 24,000
Signal System	each	\$ 250,000.00	0	\$ -
(d) Subtotal Structural				\$ 24,000
(a+b+c+d) Subtotal Construction				\$ 51,573
Risk & Contingency		20.0%		\$ 10,315
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 2,063
(e) Subtotal Miscellaneous				\$ 12,377
(a+b+c+d+e) Total Construction				\$ 63,950
Administrative & Engineering		20.0%		\$ 12,790
RW Cost				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 76,740

Construction Cost Estimate

Raider Dr. LTL				
Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	\$70.00	65	\$ 4,561
4" Concrete Walk	sq ft	\$6.00	827	\$ 4,962
8" Concrete pavement	sq yd	\$80.00	0	\$ -
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	47	\$ 1,136
Subgrade Excavation (1)	cu yd	\$7.00	95	\$ 663
Common Excavation	cu yd	\$7.00	95	\$ 663
Common Borrow	cu yd	\$5.00	142	\$ 710
Select Granular Borrow	cu yd	\$18.00	95	\$ 1,705
Mill Pavement	sq yd	\$10.00	0	\$ -
Curb and Gutter Design B624	lin ft	\$18.00	230	\$ 4,140
(a) Subtotal Paving and Grading				\$ 18,541
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		10.0%		\$ 1,854
Minor City Utilities		10.0%		\$ 1,854
Signing, Striping, Traffic Control		10.0%		\$ 1,854
Erosion Control and Turf Establishment		10.0%		\$ 1,854
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ 7,416
DRAINAGE				
Storm Sewer		0.0%		\$ -
(c) Subtotal Drainage				\$ -
STRUCTURES/SIGNALS/MISC. COST				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
Roundabout Lighting		\$7,000	0	\$ -
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	0	\$ -
Intersection ADA	each	\$ 6,000.00	0	\$ -
Signal System	each	\$ 250,000.00	0	\$ -
(d) Subtotal Structural				\$ -
(a+b+c+d) Subtotal Construction				\$ 25,957
Risk & Contingency		20.0%		\$ 5,191
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 1,038
(e) Subtotal Miscellaneous				\$ 6,230
(a+b+c+d+e) Total Construction				\$ 32,187
Administrative & Engineering		20.0%		\$ 6,437
RW Cost				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 38,624

Construction Cost Estimate

TH 246 Trees				
Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Bituminous Pavement (1)	ton	\$70.00	0	\$ -
4" Concrete Walk	sq ft	\$6.00	0	\$ -
8" Concrete pavement	sq yd	\$80.00	0	\$ -
Concrete pavement	sq yd	\$70.00	0	\$ -
Class 2 Aggregate Shoulder (1)	cu yd	\$45.00	0	\$ -
Class 5 Aggregate Base (1)	cu yd	\$24.00	0	\$ -
Subgrade Excavation (1)	cu yd	\$7.00	0	\$ -
Common Excavation	cu yd	\$7.00	0	\$ -
Common Borrow	cu yd	\$5.00	0	\$ -
Select Granular Borrow	cu yd	\$18.00	0	\$ -
Mill Pavement	sq yd	\$10.00	0	\$ -
Curb and Gutter Design B624	lin ft	\$18.00	0	\$ -
(a) Subtotal Paving and Grading				\$ -
UTILITIES, REMOVALS, DRAINAGE, ETC.				
Removals/Clear and Grub		10.0%		\$ -
Minor City Utilities		10.0%		\$ -
Signing, Striping, Traffic Control		10.0%		\$ -
Erosion Control and Turf Establishment		10.0%		\$ -
(b) Subtotal Utilities, Removals, Drainage, Etc.				\$ -
DRAINAGE				
Storm Sewer		0.0%		\$ -
(c) Subtotal Drainage				\$ -
STRUCTURES/SIGNALS/MISC. COST				
Bridge removal	sqft	\$15	0	\$ -
Bridge rehab	lump sum	\$1,100,000	0	\$ -
Bridge	sqft	\$150	0	\$ -
Bridge	sqft	\$220	0	\$ -
Retaining Wall	sqft	\$100	0	\$ -
3" cal deciduous tree - b&b @ 40' spacing	each	\$500	76	\$ 38,000
Roundabout Lighting		\$7,000	0	\$ -
Interchange Lighting		\$480,000	0.0	\$ -
Roundabout Landscaping		\$40,000	0	\$ -
Intersection ADA	each	\$ 6,000.00	0	\$ -
Signal System	each	\$ 250,000.00	0	\$ -
(d) Subtotal Structural				\$ 38,000
(a+b+c+d) Subtotal Construction				\$ 38,000
Risk & Contingency		20.0%		\$ 7,600
TMP		0.0%		\$ -
Mobilization		4.0%		\$ 1,520
(e) Subtotal Miscellaneous				\$ 9,120
(a+b+c+d+e) Total Construction				\$ 47,120
Administrative & Engineering		20.0%		\$ 9,424
RW Cost				
		\$2,000,000	0%	\$ -
Total RW				\$ -
Total Estimated Cost				\$ 56,544

Construction Cost Estimate

TH 246/Jefferson Pkwy Pedestrian Tunnel				
Item Description	Units	Unit Cost	Quantity	Total
PAVING AND GRADING (P & G) COSTS				
Approach Grading, Utility Relocation, and street reconstruction	sq yd	\$1.00	100,000	\$ 100,000
(a) Subtotal Paving and Grading				\$ 100,000
STRUCTURES/SIGNALS/MISC. COST				
Trail Underpass (75' long 16'w x 10'h Box Culvert)	Lin. Ft.	\$1,550	75	\$ 116,250
Structure Excavation	lump sum	\$1	50,000	\$ 50,000
CIP Concrete Headwall on Spread FTG (Headwalls at 90 degrees to underpass at each end)	each	\$100,000	2	\$ 200,000
(b) Subtotal Structural				\$ 366,250
(a+b) Subtotal Construction				\$ 466,250
Risk & Contingency		20.0%		\$ 93,250
TMP		0.0%		\$ -
Mobilization		5.0%		\$ 23,313
(c) Subtotal Miscellaneous				\$ 116,563
(a+b+c) Total Construction				\$ 582,813
Administrative & Engineering		20%		\$ 114,957.43
Total Estimated Cost				\$ 697,770

Appendix E

2040 Alternative Comparison Matrix

Northfield Study Intersections' Improvements
2040 Alternative Comparison Matrix DRAFT

Alternative	Performance										Evaluation Criterion				Cost			
	AM Peak Hour					PM Peak Hour					User Safety				Cost			
	Approach	LOS By Approach		LOS By Intersection	Intersection LOS AM Peak Hour	Approach	LOS By Approach		LOS By Intersection	Intersection LOS PM Peak Hour	Influence on Speeds	Estimated Number of Crashes Annually**	Crash Types and Severity Commentary	Pedestrian/Bike Safety	Construction (\$)	Admin & Engineering (\$)	Total Project (\$)	
		Delay (s/veh)	LOS				Delay (s/veh)	LOS										Delay (s/veh)
TH 246 at Jefferson Parkway	All Way Stop	NB	505.8	F	192.3	F	NB	509.6	F	203.0	F	All vehicles must stop; Speeds may increase on adjacent segments	2.6	32 Intersection Conflict Points. Rear End & Right Angle Crashes	Conflicts from 4 directions & confusing when traffic is busy. Drivers may roll through intersection failing to notice pedestrians.			
		SB	166.1	F			SB	214.4	F									
		EB	15.2	C			EB	30.8	D									
		WB	123.8	F			WB	131.0	F									
	Traffic Signal (3 lanes of Approach for all legs)	NB	18.3	B	16.7	B	NB	11.6	B	12.8	B	Speeds through signal on green not affected except as influenced by stopped or slowed vehicles.	3.9	32 Intersection Conflict Points. Rear End & Right Angle Crashes	Delay due to waiting for "walk" light. Conflicts from 3 directions	\$ 623,101	\$ 124,620	\$ 747,721
		SB	14.9	B			SB	12.8	B									
		EB	13	B			EB	12.5	B									
		WB	18.5	B			WB	15.1	B									
	Single Lane Roundabout	NB	8.84	A	10.20	B	NB	11.22	B	9.60	A	All traffic is slowed to 15 mph	3.6	8 Intersection Conflict Points; Low speed crashes; Typically Rear Ends & Sideswipe. By converting from two-way stop control to a roundabout controlled intersection, a location can experience 82% reduction in severe (injury/fatal) crashes and a 44% reduction in overall crashes.* By converting from a signalized intersection to a roundabout, a location can experience a 78% reduction in severe (injury/fatal) crashes and a 48% reduction in overall crashes.* There have been no fatalities or serious injuries for peds or bikes at any roundabout in MN in the last 10 years.	Bikes/Pedestrians cross one lane at a time with conflicts from only one direction at a time. Much lower ped fatality rate due to lower speeds	\$ 1,366,885	\$ 273,377	\$ 1,640,262
		SB	9.28	A			SB	7.93	A									
		EB	6.33	A			EB	10.80	B									
		WB	14.76	B			WB	6.90	A									
	Single Lane Mini Roundabout	NB	9.00	A	10.78	B	NB	11.76	B	9.97	A					\$ 839,060	\$ 167,812	\$ 1,006,872
		SB	9.86	A			SB	8.20	A									
		EB	6.47	A			EB	11.24	B									
		WB	16.07	C			WB	7.12	A									
Underground Tunnel Crossing													Bikes/Pedestrians cross TH 246 underground. With grade separation, no conflicts are present.	\$ 581,475	\$ 116,295	\$ 697,770		
Jefferson Parkway at Jefferson Road	All-Way Stop	NB	18.8	C	298.1	F	NB	35.9	E	489.8	F	All vehicles must stop; Speeds may increase on adjacent segments	3.0	32 Intersection Conflict Points. Rear End & Right Angle Crashes				
		SB	12.9	B			SB	13.5	B									
		EB	759.1	F			EB	1,368.4	F									
		WB	52.2	F			WB	28.7	D									
	Traffic Signal w/ Two Thru Lanes	NB	11.1	B	13.3	B	NB	22.0	C	17.0	B	Speeds through signal on green not affected except as influenced by stopped or slowed vehicles.	4.6	32 Intersection Conflict Points. Rear End & Right Angle Crashes		\$ 833,214	\$ 166,643	\$ 999,857
		SB	13.9	B			SB	12.0	B									
		EB	16.3	B			EB	19.5	B									
		WB	11.4	B			WB	11.9	B									
	Single Lane Roundabout	NB	6.08	A	8.30	A	NB	7.57	A	8.90	A	All traffic is slowed to 15 mph	4.2	8 Intersection Conflict Points; Low speed crashes; Typically Rear Ends & Sideswipe. By converting from two-way stop control to a roundabout controlled intersection, a location can experience 82% reduction in severe (injury/fatal) crashes and a 44% reduction in overall crashes.* By converting from a signalized intersection to a roundabout, a location can experience a 78% reduction in severe (injury/fatal) crashes and a 48% reduction in overall crashes.* There have been no fatalities or serious injuries for peds or bikes at any roundabout in MN in the last 10 years.	\$ 1,068,336	\$ 213,667	\$ 1,282,003	
		SB	5.77	A			SB	5.65	A									
		EB	8.45	A			EB	11.53	B									
		WB	9.57	A			WB	7.15	A									
	Single Lane Mini Roundabout	NB	6.26	A	8.46	A	NB	7.89	A	9.08	A				\$ 672,349	\$ 134,470	\$ 806,819	
		SB	5.98	A			SB	5.83	A									
		EB	8.59	A			EB	11.83	A									
		WB	9.73	A			WB	7.27	B									
TH 246 at Middle School Driveway	Two-Way Stop	NB	1307	F	655.0	F	NB	388.1	F	205.8	F	Thru traffic speed is not reduced.	0.7	Major Type of crash that occurs is two-vehicle angle crash where driver on stop approach pulls out without adequate gap.				
		SB	0.9	A			SB	0.7	A									
		EB	6699.2	F			EB	1,641.4	F									
		WB	37.8	E			WB	889.3	F									
	Single Lane Roundabout	NB	7.42	A	7.00	A	NB	6.19	A	6.10	A	All traffic is slowed to 15 mph	1.8	8 Intersection Conflict Points; Low speed crashes; Typically Rear Ends & Sideswipe. By converting from two-way stop control to a roundabout controlled intersection, a location can experience 82% reduction in severe (injury/fatal) crashes and a 44% reduction in overall crashes.* By converting from a signalized intersection to a roundabout, a location can experience a 78% reduction in severe (injury/fatal) crashes and a 48% reduction in overall crashes.* There have been no fatalities or serious injuries for peds or bikes at any roundabout in MN in the last 10 years.	\$ 1,137,957	\$ 227,591	\$ 1,365,548	
		SB	7.17	A			SB	6.07	A									
		EB	4.82	A			EB	4.23	A									
		WB	4.65	A			WB	4.27	A									
	Single Lane Mini Roundabout	NB	7.47	A	7.04	A	NB	6.20	A	6.08	A				\$ 623,864	\$ 124,773	\$ 748,637	
		SB	7.20	A			SB	6.08	A									
		EB	4.91	A			EB	4.31	A									
		WB	4.78	A			WB	4.36	A									
	Northfield High School Pedestrian Crossing													Establish a marked crossing	\$ 63,950	\$ 12,790	\$ 76,740	
	TH 246 Tree Planting Jefferson Parkway to Arbor Street													Potential to lower speed	\$ 47,120	\$ 9,424	\$ 56,544	
	Jefferson Parkway at Raider Drive Eastbound Left Turn Lane Extension														\$ 32,187	\$ 6,437	\$ 38,624	

Notes:
*Source: FHWA-SA-12-005 "Proven Safety Countermeasures - Roundabouts"
**Based on MnDOT's statewide average crash rates for similar facilities

Appendix F

Northfield Categorized Comment Summary

Highway 246 & Jefferson Parkway Intersection Improvement - Categorized Comment Summary Spreadsheet

6/15/2016

Comment Format	Comment	Comment Category	Location	Email/Contact
Aerial Notes	In front of elementary school not a good place to extend bike trail	Pedestrians/Bikes	Elementary School	
Aerial Notes	One way (in or out) traffic at elementary access to Jefferson Parkway	Access	Elementary School	
Aerial Notes	One way (in or out) traffic at elementary access to Highway 246	Access	Elementary School	
Aerial Notes	Reverse pick up/drop off directions for elementary school	Access	Elementary School	
Aerial Notes	Can't get out of Anderson Dr in the AM	Traffic	Elementary School	
Aerial Notes	Pedestrian crossing on Highway 246 by elementary school access would be hazardous	Pedestrians/Bikes	Elementary School	
Newspaper Article	Jefferson parkway isnt wide enough in front of Bridewater Elementary	Roadway Section	Elementary School	George Kinney
Aerial Notes	Bike path/road by the tennis courts at the high school	Pedestrians/Bikes	High School	
Aerial Notes	Trail to school by the tennis courts at the high school	Pedestrians/Bikes	High School	
Aerial Notes	Pedestrian crossing on Highway 246 in front of the funeral home	Pedestrians/Bikes	High School	
Aerial Notes	Sidewalk along the driveway into the high school	Pedestrians/Bikes	High School	
Aerial Notes	Frontage road along Highway 246	Access	High School	
Aerial Notes	Path in front of the home along Highway 246 near the high school	Pedestrians/Bikes	High School	
Aerial Notes	Bike path in the driveway and parking lot of the school	Pedestrians/Bikes	High School	
Aerial Notes	High School crosswalk	Pedestrians/Bikes	High School	
Open House Comments	Crossing for High School students by cemetery	Pedestrians/Bikes	High School	
Email Response	Consider improvements in the context of the larger transportation network and surrounding land uses. This intersection is critical, but providing safe, convenient bike and pedestrian connections needs a larger context. The north-south corridor from (at least) Woodley and Division Streets south of CSAH 1, as well as east-west from the Cannon River (especially including the planned Mills Towns Trail state bike trail along Jefferson Parkway need to be considered. I realize asking for a larger context may exceed the scope of the project as currently described and the City Council may need to weigh in.	Pedestrians/Bikes	Larger Transportation Network	Betsy Buckheit
Open House Comments	Extend Maple to County Road 1	Traffic	Larger Transportation Network	
Open House Comments	Reduce traffic on Jefferson Parkway by extending Ford Street	Traffic	Larger Transportation Network	
Open House Comments	Build connectivity back into town	Comments	Larger Transportation Network	
Open House Comments	A lot of dead end streets	Comments	Larger Transportation Network	
Aerial Notes	Roundabout at northern middle school driveway?	Access/Intersection Design	Middle School	
Aerial Notes	Cross walk at northern middle school driveway	Pedestrians/Bikes	Middle School	
Aerial Notes	Problem with left turns at northern middle school driveway for AM drop-off	Traffic	Middle School	
Aerial Notes	One-way traffic in at northern middle school driveway	Access	Middle School	
Aerial Notes	Don't want a connection between middle school and Carter Dr	Access	Middle School	
Aerial Notes	Staff parking west of middle school near Carter Dr	Parking	Middle School	
Aerial Notes	Parking for pick-up/drop off west of school in Carter Dr turn around	Access	Middle School	
Aerial Notes	Lots of walkers using Carter Dr to get to the middle school	Pedestrians/Bikes	Middle School	
Aerial Notes	Problem: vehicles dropping students off in Carter Dr turn around block driveways	Traffic	Middle School	
Aerial Notes	Arrive at middle school at 7 AM	Access	Middle School	
Aerial Notes	Drop off area for middle school backed up between 7:45-8:00 AM	Traffic	Middle School	
Aerial Notes	Signage encouraging to pull all the way forward in the middle school drop off area	Traffic	Middle School	
Aerial Notes	Vehicles will enter northern driveway and exit southern driveway	Access	Middle School	
Aerial Notes	One-way exit from southern middle school driveway	Access	Middle School	
Aerial Notes	Events leaving from both middle school driveways	Access	Middle School	

Comment Format	Comment	Comment Category	Location	Email/Contact
Aerial Notes	By-pass lane is a problem at southern middle school driveway	Traffic	Middle School	
Comment Card	Please do not allow a drive through/connection between Carter Drive and the middle school. Young families live on Carter, Hayes, Johnson Street. Cars are literally backed up in the cul-de-sac all the way down Carter Drive at opening/closing times	Access/Traffic	Middle School	Wayne Eisenhuth
Open House Comments	Middle School south driveway needs street light for events	Traffic	Middle School	
Open House Comments	Middle School events using both entrances make it confusing at TH 246- should gate be kept closed the whole time?	Access	Middle School	
Open House Comments	Direct traffic back of Middle School	Traffic	Middle School	
Open House Comments	Consider RRFB at Arbor	Pedestrians/Bikes	Middle School	
Aerial Notes	How to get buses from the middle school to the elementary school?	Access	Middle/Elementary School	
Aerial Notes	Underpass for pedestrians near elementary school access under Highway 246	Pedestrians/Bikes	Middle/Elementary School	
Aerial Notes	Parking during soccer/lacrosse at fields between middle and elementary schools	Parking	Middle/Elementary School	
Aerial Notes	School zone speed limit when children are present	Speed	Middle/Elementary School	
Comment Card	3 big traffic generators maybe they should have frontage road	Access	Middle/Elementary School	
Comment Card	The Mill Town State Trail is strongly considering re-routing through Northfield. The preferred route would be on the south side of Jefferson Parkway, necessitating a safe crossing at #246. The state trail will be 10 feet wide and will serve all three schools with safe access for students.	Pedestrians/Bikes	Mill Towns State Trail	Peggy Prowe
Comment Card	Please keep in mind in your planning and design that both the Northfield Park Board and the Mill Towns Trail JPB have recommended a reroute of the trail, which would bring this state trail across the Jefferson Pkwy/246 intersection (running along Jefferson Pkwy)	Pedestrians/Bikes	Mill Towns State Trail	Erica Zweifel
Aerial Notes	Clear, safe, and convenient bike & pedestrian connects all directions	Pedestrians/Bikes	TH 246 & Jefferson Parkway	
Aerial Notes	Need to slow traffic on 246 w/ driver cues- bump ruts, trees... anything to indicate "you're in town"	Speed	TH 246 & Jefferson Parkway	
Aerial Notes	No blvd on Jefferson Pkwy at 246	Pedestrians/Bikes	TH 246 & Jefferson Parkway	
Aerial Notes	AM sun traveling eastbound on Jefferson Parkway?	Intersection Design	TH 246 & Jefferson Parkway	
Aerial Notes	Grade separated pedestrian crossings	Pedestrians/Bikes	TH 246 & Jefferson Parkway	
Aerial Notes	A roundabout would solve the morning-sun-in-eyes problem and allow safe passage for peds + bikes	Intersection Design	TH 246 & Jefferson Parkway	
Aerial Notes	Utilize existing elevation difference to punch bike/ped paths under the roadways. Particularly Mill Towns Trail	Pedestrians/Bikes	TH 246 & Jefferson Parkway	
Aerial Notes	Have pedestrian crossing away from intersection on Jefferson Parkway	Pedestrians/Bikes	TH 246 & Jefferson Parkway	
Aerial Notes	Too many lanes at 4-way stop when busy	Existing Intersection	TH 246 & Jefferson Parkway	
Aerial Notes	Close Highway 246/Jefferson Pkwy intersection to pedestrians	Pedestrians/Bikes	TH 246 & Jefferson Parkway	
Aerial Notes	Tunnel for pedestrians near Jefferson Pkwy intersection under Highway 246	Pedestrians/Bikes	TH 246 & Jefferson Parkway	
Aerial Notes	NB right turn lane on Highway 246 too close to shoulder	Existing Intersection	TH 246 & Jefferson Parkway	
Aerial Notes	Should be a lower speed limit on Highway 246	Speed	TH 246 & Jefferson Parkway	
Aerial Notes	30 MPH speed limit on Highway 246	Speed	TH 246 & Jefferson Parkway	
Aerial Notes	Re-route Semis	Traffic	TH 246 & Jefferson Parkway	
Aerial Notes	School speed limit 1/4 mile south of arbor	Speed	TH 246 & Jefferson Parkway	
Aerial Notes	Sidewalk along Jefferson Pkwy used for walking to school- don't create a bike path	Pedestrians/Bikes	TH 246 & Jefferson Parkway	
Aerial Notes	Cut back median on Jefferson parkway at Estate Ln so people don't go the wrong way	Roadway Section	TH 246 & Jefferson Parkway	
Aerial Notes	Tunnel!!! At Highway 246/Jefferson	Pedestrians/Bikes	TH 246 & Jefferson Parkway	

Comment Format	Comment	Comment Category	Location	Email/Contact
Email Response	This intersection is dangerous for vehicle traffic and all but impassible for people walking and riding bikes. Improving this intersection is key to making it possible for hundreds of children to walk and bike to school (which could also help reduce vehicle traffic).	Pedestrians/Bikes	TH 246 & Jefferson Parkway	Betsy Buckheit
Email Response	Past land use decisions put an enormous pressure on this intersection with the end result that <i>all</i> school automobile traffic must funnel through the Jefferson Parkway/246 intersection. The intersection was not redesigned to accommodate walkers or cyclists when Bridgewater Elementary and Northfield Middle Schools were built (nor increased vehicle traffic), so this single crossing point is difficult at best and deadly at worst	Traffic	TH 246 & Jefferson Parkway	Betsy Buckheit
Email Response	Vehicle level of service and similar measures of congestion should not be the appropriate metric: Redesign the Jefferson Parkway/246 intersection for people rather than cars only. The intersection must accommodate school buses, cars, and larger vehicles because 246 is a key route into and out of Northfield, but the trail connections, sidewalks, bike facilities must also be safe (and more importantly <i>feel</i> safe) and easy for kids to navigate	Intersection Design	TH 246 & Jefferson Parkway	Betsy Buckheit
Email Response	Connect places with at-grade connections from neighborhoods to schools and the Senior Center. Bridges and underpasses are usually put forward as solutions, but I'd advocate for changing the roadway design to build the people back into the street network and make the public right-of-way truly public (as well as safe and attractive).	Pedestrians/Bikes	TH 246 & Jefferson Parkway	Betsy Buckheit
Email Response	Finally, this cannot be a project designed for cars with bike and pedestrian improvements considered as "amenities" to be added afterwards. Too many important community places and neighborhoods- including planned state bike trail- which are used by kids, families, and seniors who may not or cannot drive are impacted by this intersection and surrounding streets; please seek out the best bike and pedestrian design advice for rebuilding this intersection to reconnect Northfield	Pedestrians/Bikes	TH 246 & Jefferson Parkway	Betsy Buckheit
Newspaper Article	It needs to work for everyone, including buses	Traffic	TH 246 & Jefferson Parkway	Nancy Johnson
Newspaper Article	If you move one piece, it affects another, it's very complicated	Intersection Design	TH 246 & Jefferson Parkway	Mar Valdecantos
Newspaper Article	Residents are worried about the high speed of vehicles from the south nearing the middle school	Speed	TH 246 & Jefferson Parkway	
Email Response	I was unable to attend the meeting. The entire area from the High School to Cnty Rd 1 needs attention. A round about is not the solution. I saw in the report that two Benjamin bus employees were interested in a solution for all modes of transportation. A round about is not the best option for semi tractor/trailers that travel through nor is it an option for farm implements that use these routes. Extend Prairie St or Maple St south the Cnty Rd 1. This will allow vehicles to avoid the intersection as they head out of town. Also, I don't think a round about is the best option for pedestrians crossing 246.	Intersection Design	TH 246 & Jefferson Parkway	Bruce Stowe
Comment Card	Unless alternative routes are provided, any improvements must accommodate trucks and farm equipment. Roundabouts are not friendly to trucks and tractors unless they are built big enough. I don't believe there is sufficient space for a roundabout here. Even though I am a big fan of circular intersections, they do cause problems when squeezed into inadequate spave.	Intersection Design	TH 246 & Jefferson Parkway	Scott Tempel
Comment Card	The raised road here seems very conducive to grade/separating ped/bike trails	Pedestrians/Bikes	TH 246 & Jefferson Parkway	Scott Tempel
Comment Card	Add turn lanes onto 246 and punch trails underneath	Intersection Design	TH 246 & Jefferson Parkway	Scott Tempel

Comment Format	Comment	Comment Category	Location	Email/Contact
Comment Card	I think roundabouts at both 246 and Jefferson and 246 and Co. Rd. 1 would greatly enhance safety & efficient traffic flow for all users- motor vehicles, pedestrians, and bicylists. A roundabout at Co. Rd. 1 and 246 would enhance motor vehicle/bicycle safety at that intersection, which has had many t-bone crashes over the years, and would provide traffic calming and slow northbound motor vehicles	Intersection Design	TH 246 & Jefferson Parkway	Bruce Anderson
Comment Card	An underpass under Highway 246 would accomplish optimal student safety and traffic flow	Pedestrians/Bikes	TH 246 & Jefferson Parkway	Josh Ramaker
Comment Card	Single lane roundabouts all along Hwy 246 would be ideal for peak and off-peak traffic and student pedestrian crossing.	Intersection Design	TH 246 & Jefferson Parkway	Josh Ramaker
Comment Card	No round a bouts	Intersection Design	TH 246 & Jefferson Parkway	
Comment Card	I am lookin for improved safety for all modes of transportation. This would include elements that make it clear where each mode should be within the infrastructure	Intersection Design	TH 246 & Jefferson Parkway	Erica Zweifel
Comment Card	The traffic in front of the middle school is fast. I live 1/4 mile south of the school on 246. The amount of semis and cars exceeding the speed limit is considerable. I am concerned that the vehicles will not slow down enough prior to running over a pedestrian. Even with signs I am concerned that vehicles will <u>not</u> slow down.	Speed	TH 246 & Jefferson Parkway	
Open House Comments	Problem with semis on 246 from CR 1	Traffic	TH 246 & Jefferson Parkway	
Open House Comments	Speed on south end of 246	Speed	TH 246 & Jefferson Parkway	
Open House Comments	Concerned with roundabout at Jefferson Parkway	Intersection Design	TH 246 & Jefferson Parkway	
Open House Comments	Concerns with sun to the east	Intersection Design	TH 246 & Jefferson Parkway	
Open House Comments	One cop should control traffic at Jefferson Parkway and 246- maybe CSO?	Traffic	TH 246 & Jefferson Parkway	
Open House Comments	Confusion at 4-way stop	Existing Intersection	TH 246 & Jefferson Parkway	
Open House Comments	Not a roundabout	Intersection Design	TH 246 & Jefferson Parkway	
Open House Comments	Jefferson Parkway/246 should have signal with no right turn land on red	Intersection Design	TH 246 & Jefferson Parkway	
Open House Comments	There have been 2 fatalities at this intersection	Safety	TH 246 & Jefferson Parkway	
Open House Comments	Keep in mind bikes- build street for bikes and pedestrians	Pedestrians/Bikes	TH 246 & Jefferson Parkway	
Open House Comments	Trucks turn onto County Road 1 instead of coming into town	Traffic	TH 246 & Jefferson Parkway	
Open House Comments	Can semis be rerouted to TH3?	Traffic	TH 246 & Jefferson Parkway	
Open House Comments	Wants a permanent 30 MPH zone on TH 246, not just a school zone	Speed	TH 246 & Jefferson Parkway	
Open House Comments	More police presence	Comments	TH 246 & Jefferson Parkway	
Email Response	I do agree that something needs to be done about the intersections of Hwy. 246 and Jefferson Parkway. I think a four-way traffic light would be our best option.	Intersection Design	TH 246 & Jefferson Parkway	Jeanne Duke
Email Response	Talking to other people who live in other communities that have round-about, they seem to cause more problems than they solve. Because people aren't used to them, they don't know what to do when traffic is moving through the round-about.	Intersection Design	TH 246 & Jefferson Parkway	Jeanne Duke
Email Response	I also have concerns about people waling and riding bikes. If there isn't something regulating traffic, it is a roulette game for those walking and riding bikes. I have seen it happen. You will need crossing guards for the children going to and from school to help keep them safe. So that will be another expense.	Intersection Design	TH 246 & Jefferson Parkway	Jeanne Duke
Email Response	I have seen large vehicles take out most of the middle section and curb of a round-about trying to get through. What about plows in the winter? I have seen the damage they do trying to get through them also. So the up keep and maintenance of a round-about seems to be very substantial compared to a traffic light. The initial expense is there but in the long run I think a four way traffic light is more economical	Intersection Design	TH 246 & Jefferson Parkway	Jeanne Duke
Email Response	Please do not put a round-about at the intersection of 246 and Jefferson. I have never met anyone who thinks they are a good idea. They work well in England because of their traffic system. We don't have that type of system.	Intersection Design	TH 246 & Jefferson Parkway	Jeanne Duke
Comment Card	Fix it once don't put a Band Aid on	Comments	Whole Area	

Comment Format	Comment	Comment Category	Location	Email/Contact
Open House Comments	Goal- get kids to and from school safely	Pedestrians/Bikes	Whole Area	
Open House Comments	Safety issue for kids that walk to school	Pedestrians/Bikes	Whole Area	
Open House Comments	Safety issue for kids carrying band instruments while walking to school	Pedestrians/Bikes	Whole Area	
Open House Comments	How many cops are on duty in the morning?	Comments	Whole Area	
Open House Comments	Pedestrian signal for crossing	Pedestrians/Bikes	Whole Area	

Appendix G

Detailed Existing Crash Analysis Tables

**Table A1
Northfield Project Crash Analysis
2013 to 2015 Crash Data
MnDOT Crash Mapping Software Information**

Northfield ICE Project	Crash Severity						Intersection Rates	MnDOT* Average Rates	Calculated Critical Rates
	Fatal	A	B	C	Property	Total	Crash Rate	Crash Rate	Critical Crash Rate
Jefferson Parkway at Jefferson Road	0	0	0	2	3	5	0.32	0.36	0.69
Jefferson Parkway at Raider Drive	0	0	0	0	4	4	0.49	0.19	0.52
Jefferson Parkway at Elementary Bus Exit	0	0	0	0	0	0	0.00	0.19	0.53
Jefferson Parkway at Elementary Access	0	0	0	0	0	0	0.00	0.19	0.52
Jefferson Parkway at TH 246	0	0	1	3	2	6	0.51	0.36	0.74
TH 246 at Woodley Street	0	0	0	0	2	2	0.16	0.36	0.72
TH 246 at High School Access	0	0	0	0	0	0	0.00	0.19	0.57
TH 246 at Elementary Access	0	0	0	1	0	1	0.20	0.19	0.63
TH 246 at North Middle School Access	0	0	0	2	1	3	0.59	0.19	0.63
TH 246 at South Middle School Access	0	0	0	0	0	0	0.00	0.19	0.64
TOTAL	0	0	1	8	12	21			
	0%	0%	5%	38%	57%		XX		
							Above Critical Rate	Avg Rate Exceeded	

**Signalized Intersections

NOTES:
Exceeding the Calculated Critical Rates indicated a sustained crash problem.

MnDOT Statewide Average Rates (2014 Data; 3-Year)*	
Intersection Type	Crash Rate
Urban Thru/Stop	0.19
All Way Stop	0.36



Table A2
Northfield Project Crash Analysis
2013 to 2015 Crash Data
MnDOT Crash Mapping Software Information

Northfield ICE Project	Diagram - Crash Type								Intersection Rates	
	From	Rear End	Left Turn	Right Angle	Side Swipe	Head On	Ran Off Road	Other	Total	Crash Rate
Jefferson Parkway at Jefferson Road	0	1	4	0	0	0	0	0	5	0.32
Jefferson Parkway at Raider Drive	0	1	0	1	2	0	0	0	4	0.49
Jefferson Parkway at Elementary Bus Exit	0	0	0	0	0	0	0	0	0	0.00
Jefferson Parkway at Elementary Access	0	0	0	0	0	0	0	0	0	0.00
Jefferson Parkway at TH 246	0	0	2	2	0	0	0	2	6	0.51
TH 246 at Woodley Street	0	0	0	0	0	0	0	2	2	0.16
TH 246 at High School Access	0	0	0	0	0	0	0	0	0	0.00
TH 246 at Elementary Access	1	0	0	0	0	0	0	0	1	0.20
TH 246 at North Middle School Access	2	0	1	0	0	0	0	0	3	0.59
TH 246 at South Middle School Access	0	0	0	0	0	0	0	0	0	0.00
TOTAL	3	2	7	3	2	0	4	21		
	14%	10%	33%	14%	10%	0%	19%			

**Signalized Intersections

Critical Rate Exceeded

