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Intersection Control Evaluation Report

Ulysses Street NE and Paul Pkwy

Blaine, MN

January 16, 2020

Submitted by:

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Certification

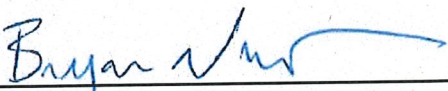
Intersection Control Evaluation Report

Ulysses Street NE and Paul Pkwy NE

in

Blaine, Anoka County, Minnesota

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


Bryan Nemeth, P.E., PTOE

43354
Reg. No.

1/16/2020
Date

REVIEWED:

Blaine City Engineer

Date

APPROVED:

MnDOT District State Aid Engineer

Date

Project Summary

The intersection of Ulysses Street and Paul Pkwy is currently all-way stop controlled (AWSC) intersection located in Blaine, Anoka County, Minnesota. The intersection is located west of Trunk Highway (TH) 65, between County State Aid Highway (CSAH) 14, locally known as Main Street, and CSAH 12, locally known as 109th Avenue. The project location is shown in **Figure 1**.

The intersection is currently stop controlled on all approaches and recent traffic counts satisfy traffic signal warrants. As traffic volumes increase in the project area, the current traffic control is anticipated to experience unacceptable operations.

Multiple intersection and traffic control alternatives were considered as part of this analysis including signalized and roundabout intersections. A traffic signal, with the inplace intersection geometry, is the recommended alternative for this intersection. A traffic signal is anticipated to provide acceptable operations through the Design Year (2040).

Existing Conditions

Ulysses Street, south of Paul Pkwy, is a three-lane roadway that includes a center two-way left turn lane. The northbound approach has left and right turn lanes at the intersection. Ulysses Street, north of Paul Pkwy, is a 4-lane undivided roadway. The southbound approach includes a left turn lane and a shared through/right lane. Ulysses Street serves 7,900 vehicles per day. The roadway has a posted speed limit of 35 miles per hour north of the intersection and 40 miles per hour to the south.

Paul Pkwy is an overpass over TH 65 to the east. Paul Pkwy is a 4-lane divided roadway with left turn lanes on both approaches and right turn lane on the eastbound approach. The road serves 3,700 vehicles per day west of Ulysses Street NE and 5,300 vehicles per day east of Ulysses Street.

Traffic Data Collection

24 hour turning movement counts collected in September 2019 over one day of normal weekday conditions. The AM peak hour was found to be from 7:15 to 8:15 AM and the PM peak hour was found to be from 4:30 to 5:30 PM. Each period was used to analyze traffic operations at the study location.

Figure 2 details the existing peak hour turning movement counts and the daily traffic volume for each leg of the intersection. Complete traffic count details can be found in **Appendix A**.

Safety Analysis

Crash data was obtained from the City of Blaine for the last three complete years of available data (2016-2018). Crash data is classified by severity:

- F – Fatal
- A – Capacitating Injury
- B – Non-Capacitation Injury
- C – Possible Injury
- PDO – Property Damage Only

Table 1 details the observed crash rate and fatal & serious injury rates for the intersection and **Table 2** details the crash severities and types. The crash rate considers all crash severities while the fatal & serious (K & A) injury rates consider only incapacitating injury and fatal crashes. The observed rates are compared to similar type intersections statewide in respect to entering volume, traffic control,

environment and speed limits. The statewide average is the average observed rate for similar type intersections and the critical rate is the rate at which an intersection is considered unsafe.

The critical and K & A critical index is the comparison of the observed rate to the critical rate; a critical or K & A critical index greater than 1.0 indicates that the observed rate is greater than the critical rate and that the intersection operates outside the expected, normal range.

Table 1: Safety Analysis Summary

Total Crashes (3 Years)	Entering Volume	Crash Rate				Fatal & Serious Injury Rate			
		Observed*	Statewide Average	Critical Rate	Critical Index	Observed**	Statewide Average	Critical Rate	K & A Critical Index
6	12,100	0.45	0.34	0.80	0.56	0.00	0.72	7.46	0.00

* Crashes per million entering vehicles

** Crashes per 100 million entering vehicles

Table 2: Crash Severity and Crash Type

Crash Severity					Crash Type		
F	A	B	C	PDO	Angle Crashes	Rear End Crashes	Sideswipe passing
0	0	0	0	6	3	2	1

Crash data from 2016 to 2018 indicates the intersection of Ulysses Street and Paul Pkwy has an observed crash rate less than the critical rate for similar intersection resulting in a critical index of 0.56. No fatal or serious crashes were reported from 2016 to 2018 and therefore there is no K & A Critical Index. Statistically, the intersection of Ulysses Street and Paul Parkway is considered to be operating within of the expected, normal range for similar type intersections. However, three of the six crashes reported involved right-angle crashes, which is unusual for an AWSC intersection. This may be due to the number of approach lanes and traffic volumes present at the intersection. A change in traffic control or design may reduce these types of crashes. The Crash Diagram is shown in **Figure 4**, additional crash details can be found in **Appendix B**.

Although the recent crash history does not indicate a trend in westbound crashes, the downhill grade of the approach is a safety concern for vehicles required to stop at Ulysses Street. This is especially a concern during the winter months when the road may be icy.

Warrant Analysis

Traffic control signal warrant analysis was completed using the turning movement count data for the intersection. Ulysses Street was considered the major approach for the analysis.

Traffic Control Signal Warrant Analysis

Traffic signal warrants have been developed as national guidelines to promote continuity of traffic control devices to ensure that traffic signals are installed at intersections that would benefit from their use.

A traffic control signal should not be installed unless one or more of the warrants can be met, however the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic signal. Furthermore, a traffic control signal should not be installed unless an engineering study indicates that the traffic control signal will improve the overall safety and operation of the intersection. Finally, the signal should not disrupt the progressive flow of traffic.

The MnMUTCD (Chapter 4C) states that the investigation of the need for a traffic control signal shall include an analysis of the applicable factors contained in the following traffic signal warrants. **Table 3**

summarizes each warrant and the associated study results. Additional details regarding each warrant can be found in the MnMUTCD.

Table 3: Traffic Control Signal Warrant Results

Warrant		Hours Required	Hours Satisfied
1A	Eight-Hour Vehicular Volume (Minimum Volume)	8	7
1B	Eight-Hour Vehicular Volume (Interruption of Traffic)	8	4
2	Four-Hour Vehicular Volume	4	4
3	Peak Hour	1	2
4	Pedestrian Volume	Not Applicable	
5	School Crossing	Not Applicable	
6	Coordinated Signal System	Not Applicable	
7	Crash Experience	8	10
8	Roadway Network	Not Applicable	
9	Intersection Near a Grade Crossing	Not Applicable	

As shown in **Table 3**, warrants 2, 3 and 7 satisfy the required traffic volume thresholds at the intersection. Traffic volumes satisfies 7 of the required 8 hours for Warrant 1A and 4 of the required 8 hours for Warrant 1B. Warrant 7 is considered satisfied if the volume thresholds are met and there have been five or more correctable crashes at the intersection within a 12-month period. At no point in the analysis period were there five or more crashes reported within a 12-month period. Based on the above, the intersection traffic volumes satisfy Warrants 2 and 3 for traffic control signalization.

Traffic signal warrant details can be found in **Appendix C**.

Traffic Forecasting

The growth rate between the 2015 and forecasted 2040 traffic volumes ranges between 0.5 to 1.13% in the vicinity of Ulysses Street and Paul Pkwy based on Anoka County 2015 and 2040 congestions maps. Based on the historical trends and the surrounding roadway forecasts, the traffic growth for the intersection ranges from 0.7 to 2.9% for each leg of the intersection. **Table 4** details the existing and forecasted growth for each leg of the intersection. **Figure 3** details the projected 2040 peak hour turning movement forecasts for each leg of the intersection.

Table 4: Traffic Forecasting Results

Street	Leg	2017*	2040	Growth Rate
Ulysses St NE	North	7300	14100	2.9%
	South	7900	14460	2.7%
Paul Pkwy NE	West	3700	4350	0.7%
	East	5300	7880	1.7%
Total		12100	20395	

*2017 AADT from MnDOT Traffic Mapping Application

Alternatives

Stop control, traffic signal and roundabouts were considered as alternatives for this intersection. Each alternative is summarized below.

Do-Nothing (AWSC): Maintain existing geometry and traffic control.

Traffic Signal: Maintain existing geometry and install traffic signal. All left turns would operate with permitted/protected left turn signalization.

Single-Lane Roundabout: Convert the intersection to a single-lane roundabout. All approaches are single-lane approaches. The current eastbound, westbound and southbound approaches would be reduced to a single lane prior to the intersection.

Multi-Lane Roundabout (2x1 North/South): Convert the intersection to a multi-lane roundabout. Northbound and southbound approaches on Ulysses Street would be dual entry and exit lanes. Eastbound and westbound approaches would be single lane approaches. This alternative provides additional capacity for the northbound and southbound approaches that have the highest entering volumes. However, the eastbound and westbound approaches would be reduced to a single lane at this intersection. Currently Paul Pkwy is four-lanes (two lanes of approach in each direction).

Multi-Lane Roundabout (2x1 East/West): Convert the intersection to a multi-lane roundabout. Eastbound and westbound approaches would be dual entry and exit lanes. Northbound and southbound approaches would be single lane approaches. The dual eastbound and westbound approaches better match the existing approaches on Paul Pkwy. The southbound approach would be reduced to a single lane at the intersection.

Multi-Lane Roundabout (2x1 North/East/West): Convert the intersection to a multi-lane roundabout. All approaches would be dual entry and exit lanes except for the southbound approach. This alternative provides additional capacity for the northbound approach that has the highest entering volumes. The dual eastbound and westbound approaches better match the existing approaches on Paul Pkwy. The southbound approach would be reduced to a single lane at the intersection.

Operations Analysis

An operations analysis was completed for the AM and PM peak hours using the existing and Design Year (2040) turning movement counts. The operational analysis results are described as a Level of Service (LOS) ranging from A to F. These letters serve to describe a range of operating conditions for different types of facilities. Levels of Service are calculated based on the Highway Capacity Manual 6th Edition, which base the level of service on control delay. Control delay is the delay experienced by vehicles slowing down as they are approaching the intersection, the wait time at the intersection, and the time for the vehicle to speed up through the intersection and enter into the traffic stream. The average intersection control delay is a volume weighted average of delay experienced by all motorists entering the intersection on all intersection approaches. Level of service D is commonly taken as an acceptable design year LOS.

The level of service and its associated intersection delay for a signalized and unsignalized intersection is presented below. The delay threshold for unsignalized intersections is lower compared to signalized intersections, which accounts for the fact that people expect a higher level of service when at a stop-controlled intersection. Roundabout intersections are evaluated based on which control it is being compared against. For this study, control delay per vehicle for a roundabout was evaluated utilizing unsignalized intersection parameters since the existing intersection is unsignalized. **Table 5** details the control delay thresholds for signalized and unsignalized intersections.

Table 5: Level of Service Criteria

	Signalized Intersection	Unsignalized Intersection
LOS	Control Delay per Vehicle (sec.)	Control Delay per Vehicle (sec.)
A	≤ 10	≤ 10
B	>10 and ≤ 20	>10 and ≤ 15
C	>20 and ≤ 35	>15 and ≤ 25
D	>35 and ≤ 55	>25 and ≤ 35
E	>55 and ≤ 80	>35 and ≤ 50
F	>80	>50

The Do-Nothing (AWSC) and Signalized Control alternatives were analyzed using Synchro/SimTraffic and methods within the Highway Capacity Manual to determine LOS, average vehicle delays, and other measures of effectiveness. The roundabout alternatives are analyzed using Junctions 9 ARCADY (Assessment of Roundabout Capacity and Delay) software. This software provides many of the same outputs as Synchro/SimTraffic but is designed to simulate roundabout operations. **Tables 6 and 7** detail the approach and intersection delay and LOS for each alternative with the existing traffic volumes and the Design Year (2040) traffic volumes, respectively.

Traffic operations details, including vehicle queue lengths, can be found in **Appendix D**.

Table 6: Existing Operation Results

Control	Aprch	AM Peak Hour				PM Peak Hour			
		LOS by Approach		LOS		LOS by Approach		LOS	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
<i>Existing AWSC</i>	EB	7	A	8	A	9	A	11	B
	WB	7	A			9	A		
	NB	7	A			13	B		
	SB	9	A			11	B		

- The intersection currently operates at LOS A and B during the AM and PM peak hours, respectively. The northbound approach has the highest average delay of 13 seconds per vehicle operating at a LOS B.

Table 7: Design Year (2040) Operation Results

Control	Aprch	AM Peak Hour				PM Peak Hour			
		LOS by Approach		LOS		LOS by Approach		LOS	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
<i>Existing AWSC</i>	EB	15	C	45	E	14	B	125	F
	WB	38	E			29	D		
	NB	14	B			298	F		
	SB	81	F			53	F		
<i>Traffic Signal</i>	EB	15	B	17	B	20	C	19	B
	WB	29	C			29	C		
	NB	9	A			16	B		
	SB	14	B			16	B		
<i>Single-Lane Roundabout</i>	EB	10	B	10	B	13	B	174	F
	WB	8	A			30	D		
	NB	6	A			383	F		
	SB	13	B			12	B		
<i>Multi-Lane Roundabout (2 x 1 North/South)</i>	EB	8	A	5	A	11	B	12	B
	WB	7	A			36	E		
	NB	2	A			5	A		
	SB	3	A			3	A		
<i>Multi-Lane Roundabout (2 x 1 East/West)</i>	EB	4	A	7	A	3	A	146	F
	WB	3	A			3	A		
	NB	8	A			333	F		
	SB	12	B			11	B		
<i>Multi-Lane Roundabout (2 x 1 North/East/West)</i>	EB	3	A	6	A	3	A	5	A
	WB	3	A			4	A		
	NB	2	A			5	A		
	SB	11	B			11	B		

- The existing AWSC is not anticipated to provide acceptable LOS. The northbound and southbound approaches are anticipated to operate at LOS F during the AM and/or PM peak hour.
- A traffic signal is anticipated to improve the overall operations compared to the existing conditions. A traffic signal with the existing geometry is anticipated to operate at LOS B during both peak hours.
- Single-lane roundabout is not anticipated to provide acceptable LOS. Northbound approach is anticipated to operate at LOS F during the PM peak hour.
- A multi-lane roundabout with dual northbound and southbound approach lanes is anticipated to provide LOS B or better during both peak hours. However, the eastbound approach is anticipated to operate at LOS E during the PM peak hour.
- A multi-lane roundabout with dual eastbound and westbound approach lanes is anticipated to provide LOS F during the PM peak hour. Northbound approach is anticipated to operate at LOS F during the PM peak hour.
- A multi-lane roundabout with dual northbound, eastbound and westbound approach lanes is anticipated to operate at LOS A during both peak hours. All approaches are anticipated to operate at LOS B or better.

Do Nothing (AWSC) Alternative

The Do-Nothing (AWSC) alternative currently operates at LOS A and B during the AM and PM peak hours, respectively, with the existing traffic volumes. The northbound and southbound approaches are anticipated to operate unacceptably with the Design Year (2040) traffic volumes during the AM and/or PM peak hours. The westbound approach is anticipated to operate at LOS E and D during the AM and PM peak hours, respectively

Design Year (2040) anticipated maximum queues under AWSC:

- Northbound – 1,700 feet
 - Extends past the existing turn lanes and adjacent access on Ulysses Street
- Southbound – 975 feet
 - Extends past the existing turn lanes and adjacent access on Ulysses Street
- Westbound – 400 feet
 - Westbound left turn lane at capacity
- Eastbound – 100 feet

Traffic Signal Alternative

A traffic signal with the existing lane geometry is anticipated to operate at LOS B during the AM and PM peak hour with the Design Year (2040) traffic volumes. All approaches are anticipated to operate at LOS C or better.

Design Year (2040) anticipated maximum queues under signal control:

- Northbound – 450 feet
 - Extends into adjacent access on Ulysses Street but would not block the inplace turn lanes
- Southbound – 250 feet
- Westbound – 350 feet
- Eastbound – 150 feet

Single Lane Roundabout Alternative

A single-lane roundabout is anticipated to operate at LOS C and F during the AM and PM peak hour, respectively, with the Design Year (2040) traffic volumes. The single lane of approach is not anticipated to provide acceptable operations for northbound and eastbound approaches during the peak hours.

Design Year (2040) anticipated maximum queues with a single lane roundabout:

- Northbound – 5,200 feet
 - Extends past the adjacent intersection on Ulysses Street.
- Southbound – 165 feet
- Westbound – 440 feet
- Eastbound – 130 feet

Although not shown in **Table 7**, the addition of a northbound exclusive right turn lane would be anticipated to result in LOS E for the northbound approach. Although, maximum northbound queues would still be anticipated to be 975 feet, extending past the adjacent intersection on Ulysses Street.

Multi-Lane Roundabout (2x1 North/South) Alternative

A multi-lane roundabout with dual northbound and southbound approaches is anticipated to operate at LOS B during both peak hours with the Design Year (2040) traffic volumes. The additional northbound

and southbound lanes greatly reduce the overall delay and the northbound delay compared to the single lane roundabout. However, the eastbound approach is anticipated to operate at LOS E during the AM peak hour.

Design Year (2040) anticipated maximum queues with a 2x1 (North/South) multi-lane roundabout:

- Northbound – 120 feet
- Southbound – 50 feet
- Westbound – 460 feet
- Eastbound – 110 feet

Multi-Lane Roundabout (2x1 East/West) Alternative

A multi-lane roundabout with dual eastbound and westbound approaches is anticipated to operate at LOS F during the PM peak hour with the Design Year (2040) traffic volumes. The additional eastbound and westbound lanes are anticipated to result in LOS A for the eastbound and westbound approaches. However, the northbound approach is anticipated to operate at LOS F during the PM peak hour.

Design Year (2040) anticipated maximum queues with a 2x1 (East/West) multi-lane roundabout:

- Northbound – 5,100 feet
 - Extends past the adjacent intersection on Ulysses Street.
- Southbound – 135 feet
- Westbound – 60 feet
- Eastbound – 35 feet

Although not shown in **Table 7**, the addition of a northbound exclusive right turn lane would be anticipated to result in LOS E for the northbound approach. Although, maximum northbound queues would still be anticipated to be 725 feet, extending past the adjacent intersection on Ulysses Street.

Multi-Lane Roundabout (2x1 North/East/West) Alternative

A multi-lane roundabout with dual lanes for the northbound, eastbound, and westbound approaches is anticipated to operate at LOS A during both peak hours with the Design Year (2040) traffic volumes. All approaches are anticipated to operate at LOS B or better during both peak hours.

Design Year (2040) anticipated maximum queues with a 2x1 (North/East/West) multi-lane roundabout:

- Northbound – 145 feet
- Southbound – 140 feet
- Westbound – 60 feet
- Eastbound – 50 feet

Sensitivity Analysis

The single lane roundabout is anticipated to operate unacceptable with the Design Year (2040) traffic volumes. However, additional analysis considered the anticipated traffic operations for a single lane roundabout as traffic volumes increase from the current traffic volumes to the Design Year (2040) traffic volumes. **Table 8** details the approach and intersection delay and LOS for a single lane roundabout as traffic volumes increase in five-year increments.

Table 8: Single Lane Roundabout Sensitivity Analysis

Traffic Control (Traffic Volume Year)	Aprch	AM Peak Hour				PM Peak Hour			
		LOS by Approach		LOS		LOS by Approach		LOS	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
<i>Single-Lane Roundabout (Existing)</i>	EB	6	A	5	A	7	A	9	A
	WB	5	A			8	A		
	NB	5	A			12	B		
	SB	6	A			6	A		
<i>Single-Lane Roundabout (2025)</i>	EB	7	A	6	A	8	A	14	B
	WB	6	A			11	B		
	NB	5	A			21	C		
	SB	7	A			7	A		
<i>Single-Lane Roundabout (2030)</i>	EB	8	A	7	A	9	A	25	D
	WB	7	A			15	C		
	NB	5	A			46	E		
	SB	8	A			8	A		
<i>Single-Lane Roundabout (2035)</i>	EB	9	A	8	A	11	B	67	F
	WB	7	A			23	C		
	NB	5	A			139	F		
	SB	10	B			10	B		

- Single-lane roundabout is anticipated to provide acceptable LOS through the year 2025. Northbound approach is anticipated to operate at LOS E with the 2030 traffic volumes, but all other approaches are anticipated to operate at LOS C or better. The single-lane roundabout may need to be expanded to provide additional capacity sometime after the year 2030.

Similarly, **Table 9** details the approach and intersection delay and LOS for a traffic signal as traffic volumes increase. Contrary to the single-lane roundabout, a traffic signal is anticipated to provide acceptable LOS throughout the design life and beyond the Design Year (2040) as shown in **Table 7**.

Table 9: Traffic Signal Sensitivity Analysis

Traffic Control (Traffic Volume Year)	Aprch	AM Peak Hour				PM Peak Hour			
		LOS by Approach		LOS		LOS by Approach		LOS	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
<i>Traffic Signal (Existing)</i>	EB	11	B	9	A	14	B	12	B
	WB	13	B			16	B		
	NB	6	A			9	A		
	SB	7	A			11	B		
<i>Traffic Signal (2025)</i>	EB	12	B	10	B	14	B	13	B
	WB	13	B			16	B		
	NB	7	A			11	B		
	SB	9	A			12	B		
<i>Traffic Signal (2030)</i>	EB	12	B	12	B	16	B	14	B
	WB	17	B			16	B		
	NB	7	A			13	B		
	SB	10	B			14	B		
<i>Traffic Signal (2035)</i>	EB	13	B	13	B	17	B	17	B
	WB	17	B			21	C		
	NB	8	A			15	B		
	SB	12	B			14	B		

- A traffic signal is anticipated to improve the overall operations compared to the existing conditions. A traffic signal with the existing geometry is anticipated to operate at LOS B during both peak hours throughout the design life.

Recommendations

The traffic operations analysis indicates that a traffic signal with the existing lane geometry or multi-lane roundabout would be anticipated to operate acceptably during the AM and PM peak hours through the Design Year (2040). However, a traffic signal is the recommended alternative for this intersection. The traffic signal can be installed at the intersection without geometric or lane changes. Vehicles queues are anticipated to be acceptable for all approaches. Although the northbound maximum queue may extend to the adjacent access on Ulysses Street, the queue is not expected to block the intersection. Signal timing adjustments can be made in the future if queuing issues were to occur.

Statistically, the intersection of Ulysses Street and 117th Avenue is considered to be operating within of the expected, normal range for similar type intersections. Nevertheless, providing protected left turns during peak times of the day would provide a safer opportunity for left turns when compared to the existing AWSC at the intersection. Furthermore, traffic warrant analysis indicate that multiple signal warrants are satisfied with the existing traffic volumes.

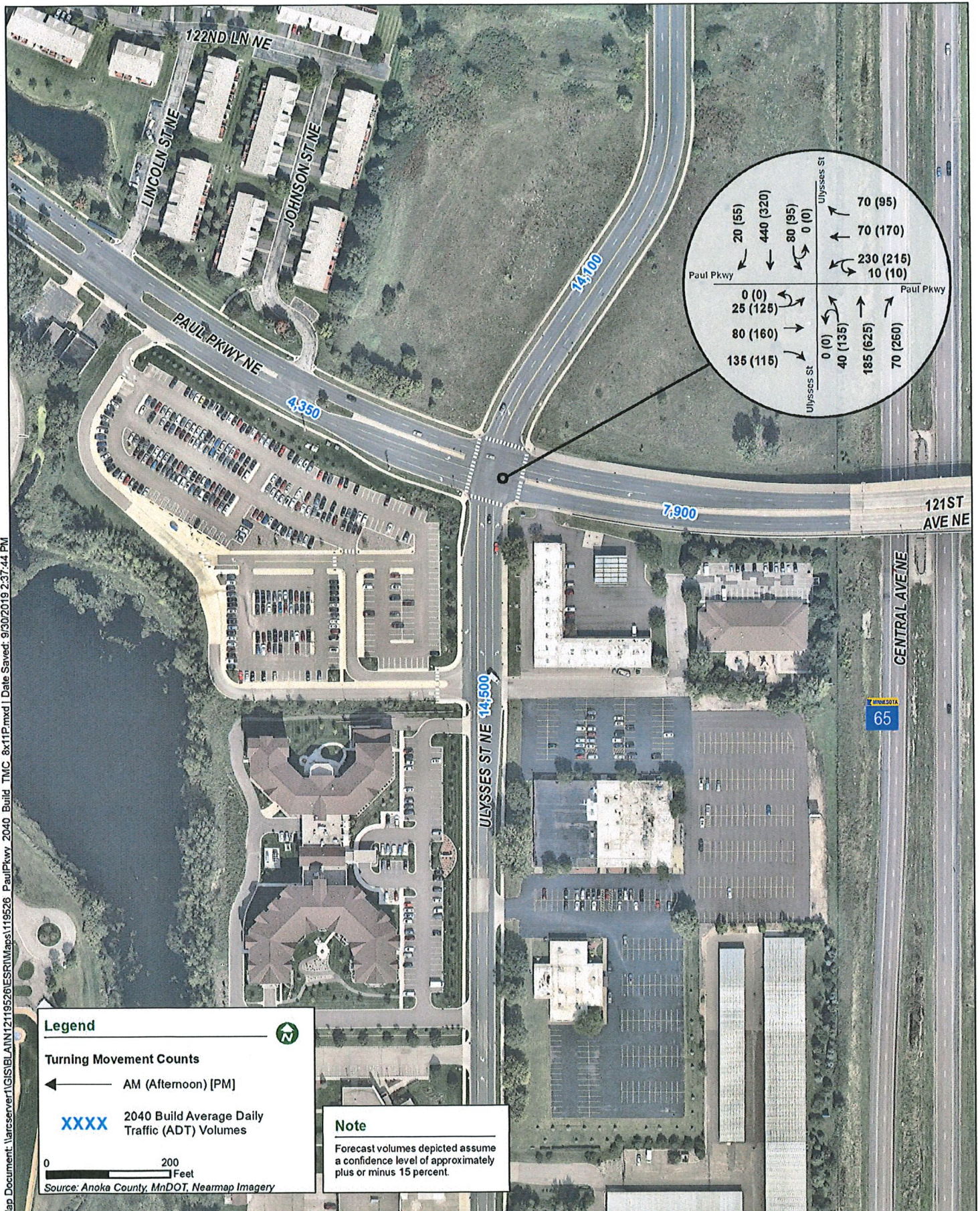


Figure 1: Project Location
Ulysess Street ICE
City of Blaine, MN

Paul Parkway
October 2019

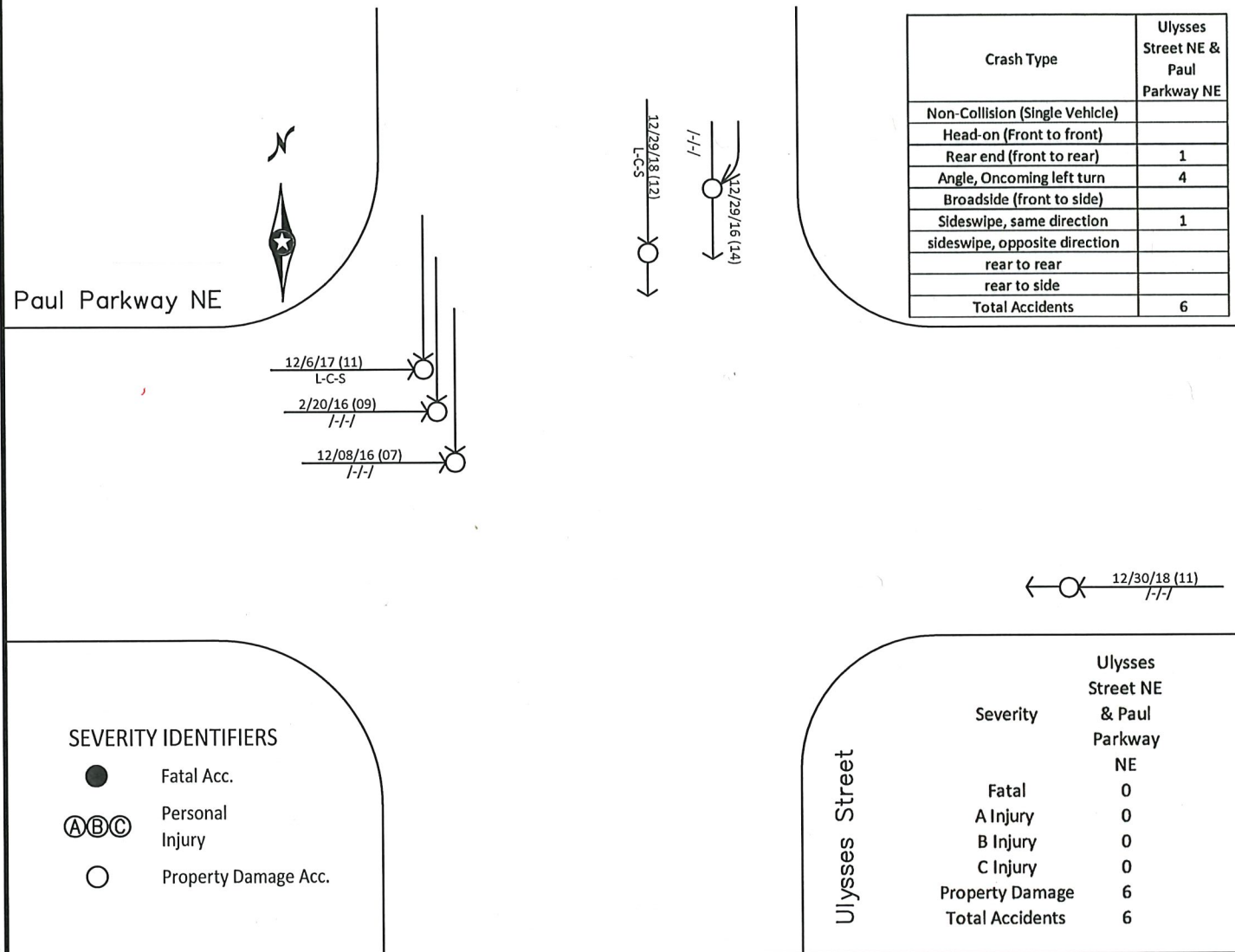






COLLISION DIAGRAM

LOCATION: Ulysses Street & Paul Pkwy
 TIME PERIOD: 01/01/2016 - 12/31/2018 DATE: 09/10/19
 PREPARED BY: S.A.



Drawing name: H:\BLA\N1219526\CAD\C3D\crash-drawing.dwg Printed: Sep 11, 2019 -- 10:20am

SEVERITY IDENTIFIERS

- Fatal Acc.
- ⒶⒷⒸ Injury
- Property Damage Acc.

NOTES

[1] ADT = 12,100

[2] CR = 0.45

KEY

- ↔ Motor Vehicle Backing Up
- ⚡ Motor Vehicle Out of Control
- ↔ SIDESWIPE
- ↔ Rear End
- ↔ Right Angle
- ⚡ Pedestrian
- ⚡ Bicycle/Moped
- ⚡ Motorcycle
- ↔ Left Turn
- ⚡ Fixed Object

INTERSECTION CONTROL EVALUATION

CITY OF BLAINE
ANOKA.MN

Figure 4: Collision Diagram

BOLTON & MENK

309 E 5TH STREET, SUITE 202
 DES MOINES, IOWA 50309
 Phone: (515) 259-9190
 Email: DesMoines@bolton-menk.com
 www.bolton-menk.com

Light:
 L= Daylight (1)
 DN= Dawn (2)
 DU= Dusk (3)
 DL= Dark, Lighted (4)
 DO= Dark, Lights Off (5)
 D= Dark, Unlighted (6)
 X= Unknown (99)

Weather:
 C= Clear or Cloudy (1 or 2)
 R= Rain (3)
 S= Snow or Sleet (4 or 5)
 F= Fog, Smog, Smoke (6)
 B= Blowing Sand/Dust (7)
 W= Severe Crosswinds (8)
 X= Other or Unknown (99)

Surface:
 D= Dry (1)
 W= Wet (2)
 S= Snow or Ice (3 or 4)
 M= Muddy (5)
 DB= Debris (6)
 O= Oily (7)
 X= Other or Unknown (99)

Appendix A

Groups Printed- Cars + - Trucks																									
Ulysses St Southbound							Paul Pkwy Westbound							Ulysses St Northbound							Paul Pkwy Eastbound				
Start Time	Right	Thru	Left	UTM	Peds	App. Total	Right	Thru	Left	UTM	Peds	App. Total	Right	Thru	Left	UTM	Peds	App. Total	Int. Total						
12:00 AM	0	4	0	0	0	4	0	4	1	0	0	5	2	2	2	0	0	6	3	18					
12:15 AM	2	3	0	0	1	6	1	3	1	0	0	5	0	1	0	0	0	1	1	13					
12:30 AM	0	1	0	0	0	1	0	1	0	0	0	1	0	1	0	0	0	6	1	9					
12:45 AM	0	1	0	0	0	1	1	0	0	0	0	1	0	2	0	0	1	3	0	6					
Total	2	9	0	0	1	12	2	8	2	0	0	12	2	6	7	0	1	16	6	46					
01:00 AM	0	0	2	0	0	2	1	1	1	0	0	3	0	2	2	0	0	4	3	12					
01:15 AM	0	1	0	0	0	1	0	1	0	0	0	1	1	2	2	0	0	5	0	7					
01:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
01:45 AM	0	1	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	2	1	4					
Total	0	2	2	0	0	4	1	2	1	0	0	4	1	5	5	0	0	11	4	23					
02:00 AM	0	0	0	0	0	0	0	1	0	0	0	1	0	0	2	0	0	2	0	3					
02:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0					
02:30 AM	0	2	0	0	0	2	0	0	0	0	0	0	0	2	1	0	0	3	0	5					
02:45 AM	0	1	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	1	1	5					
Total	0	3	0	0	0	3	0	2	0	0	0	2	0	2	4	0	0	6	1	13					
03:00 AM	0	0	0	0	0	0	1	0	0	0	0	1	1	0	0	0	0	1	1	4					
03:15 AM	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	3	4					
03:30 AM	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	4					
03:45 AM	0	1	0	0	0	1	0	1	0	0	0	1	0	1	2	0	0	3	1	8					
Total	0	3	0	0	0	3	1	1	0	0	0	2	1	1	3	0	0	5	6	19					
04:00 AM	0	1	0	0	0	1	0	2	0	0	0	2	0	0	1	0	0	1	4	8					
04:15 AM	0	2	0	0	0	2	0	1	2	0	0	3	0	1	0	0	0	4	0	10					
04:30 AM	0	0	0	0	0	0	0	1	0	0	0	1	3	1	1	0	0	5	4	11					
04:45 AM	0	4	0	0	0	4	0	2	1	0	0	3	0	1	1	0	0	2	5	20					
Total	0	7	0	0	0	7	0	6	3	0	0	9	3	3	3	0	0	9	17	49					
05:00 AM	2	5	0	0	0	7	2	1	3	0	0	6	3	1	1	0	0	5	2	21					
05:15 AM	0	10	3	0	0	13	1	2	4	0	0	7	5	5	1	0	0	11	10	45					
05:30 AM	0	16	2	0	0	18	1	0	8	0	0	9	5	3	1	0	0	9	11	57					
05:45 AM	3	17	5	0	0	25	2	3	13	0	0	18	3	4	2	0	0	24	10	68					
Total	5	48	10	0	0	63	6	6	28	0	0	40	16	13	5	0	0	34	33	191					
06:00 AM	2	29	2	0	0	33	3	4	18	0	0	25	4	6	2	0	0	12	18	98					
06:15 AM	3	36	8	0	0	47	2	5	18	0	0	25	6	5	3	0	0	28	14	114					
06:30 AM	2	60	6	0	1	69	4	11	26	0	0	41	5	10	4	0	0	19	19	167					
06:45 AM	0	52	6	0	0	58	3	10	25	3	0	41	10	6	4	0	0	20	32	167					
Total	7	177	22	0	1	207	12	30	87	3	0	132	25	27	13	0	0	65	76	546					
07:00 AM	4	43	8	0	0	55	11	21	34	1	0	67	10	18	6	0	0	34	30	205					

Bolton and Menk, Inc.

Ulysses St and Paul Pkwy
Blaine, MN

File Name : Ulysses St and Paul Pkwy_9-10-19_0000-2400
Site Code : 1
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Groups Printed- Cars + - Trucks

Groups Printed- Cars + - Trucks																													
Ulysses St Southbound													Paul Pkwy Westbound						Ulysses St Northbound						Paul Pkwy Eastbound				
	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Int. Total				
Start Time																													
07:15 AM	1	55	5	0	1	62	14	19	27	1	1	62	8	20	9	0	0	0	37	17	16	5	0	0	38	199			
07:30 AM	4	52	17	0	1	74	8	17	48	2	0	75	8	32	5	0	0	45	26	26	4	0	0	56	250				
07:45 AM	5	60	14	0	0	79	8	9	26	1	0	44	14	17	9	0	2	42	33	16	9	0	0	58	223				
Total	14	210	44	0	2	270	41	66	135	5	1	248	40	87	29	0	2	158	106	74	21	0	0	201	877				
08:00 AM	2	32	16	0	0	50	6	11	20	2	0	39	9	13	6	0	0	28	33	17	4	0	0	54	171				
08:15 AM	3	34	5	0	0	42	3	12	20	2	0	37	14	22	5	0	0	41	14	10	5	0	0	29	149				
08:30 AM	0	34	6	0	0	40	4	6	13	2	0	25	16	19	11	0	0	46	14	22	2	0	0	38	149				
08:45 AM	4	22	10	0	0	36	4	13	15	3	0	35	13	30	5	0	0	48	12	21	2	0	0	35	154				
Total	9	122	37	0	0	168	17	42	68	9	0	136	52	84	27	0	0	163	73	70	13	0	0	156	623				
09:00 AM	5	25	5	0	1	36	6	6	11	0	0	23	12	24	8	0	1	45	7	14	7	0	0	28	132				
09:15 AM	5	35	4	0	0	44	8	15	10	0	0	33	13	32	6	0	0	51	16	20	5	0	0	41	169				
09:30 AM	5	39	4	0	0	48	8	10	13	2	0	33	22	24	12	0	1	59	16	12	4	0	1	33	173				
09:45 AM	5	30	7	0	0	42	6	14	11	0	0	31	16	29	12	0	0	57	13	10	5	0	0	28	158				
Total	20	129	20	0	1	170	28	45	45	2	0	120	63	109	38	0	2	212	52	56	21	0	1	130	632				
10:00 AM	4	33	5	0	0	42	7	11	7	1	0	26	11	36	17	0	2	66	11	24	2	0	0	37	171				
10:15 AM	3	31	7	0	0	41	10	15	12	1	0	38	11	28	5	0	0	44	14	10	2	0	1	27	150				
10:30 AM	2	26	8	0	0	36	14	12	13	0	0	39	14	33	13	0	0	60	11	18	2	0	0	31	166				
10:45 AM	1	27	3	0	0	31	8	20	9	0	0	37	12	35	16	0	0	63	15	15	2	0	0	32	163				
Total	10	117	23	0	0	150	39	58	41	2	0	140	48	132	51	0	2	233	51	67	8	0	1	127	650				
11:00 AM	4	16	5	0	0	25	4	19	9	0	0	32	13	35	15	0	0	63	13	11	2	0	0	26	146				
11:15 AM	0	24	4	0	1	29	4	8	15	0	1	28	15	46	9	0	0	70	12	14	5	0	0	31	158				
11:30 AM	2	35	2	0	0	39	2	20	17	2	0	41	14	35	12	0	0	61	16	12	2	0	0	30	171				
11:45 AM	2	36	8	0	0	46	6	18	22	1	0	47	17	27	13	0	0	57	15	12	3	0	0	30	180				
Total	8	111	19	0	1	139	16	65	63	3	1	148	59	143	49	0	0	251	56	49	12	0	0	117	655				
12:00 PM	5	23	6	0	0	34	6	22	13	0	0	41	14	38	20	0	0	72	12	10	2	0	0	24	171				
12:15 PM	5	33	10	0	0	48	6	21	17	2	0	46	22	30	18	0	0	70	19	13	2	0	0	34	198				
12:30 PM	3	30	8	0	0	41	10	13	20	1	0	44	17	40	15	0	0	72	20	9	3	0	0	32	189				
12:45 PM	3	44	6	0	0	53	3	6	13	2	0	24	18	41	18	0	0	77	20	11	1	0	0	32	186				
Total	16	130	30	0	0	176	25	62	63	5	0	155	71	149	71	0	0	291	71	43	8	0	0	122	744				
01:00 PM	2	36	11	0	0	49	4	17	17	1	0	39	12	39	12	0	0	63	17	15	4	0	0	36	187				
01:15 PM	2	46	5	0	1	54	7	11	17	1	1	37	19	40	20	0	0	79	7	11	1	0	0	19	189				
01:30 PM	6	32	12	0	0	50	3	15	20	0	0	38	14	55	14	0	0	83	10	10	3	0	0	23	194				
01:45 PM	5	30	9	0	0	44	12	15	14	1	1	43	21	41	18	0	1	81	18	13	2	0	0	33	201				
Total	15	144	37	0	1	197	26	58	68	3	2	157	66	175	64	0	1	306	52	49	10	0	0	111	771				
02:00 PM	1	30	7	0	0	38	7	16	15	0	0	38	28	55	18	1	0	102	6	12	1	0	0	19	197				
02:15 PM	4	34	9	0	0	47	1	24	14	0	0	39	16	31	15	0	1	63	18	19	2	0	0	39	188				

Belton and Menk, Inc.

Ulysses St and Paul Pkwy
Blaine, MN

File Name : Ulysses St and Paul Pkwy_9-10-19_0000-2400
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Groups Printed- Cars + - Trucks

Groups Printed- Cals + - Trucks																														
Ulysses St Southbound													Paul Pkwy Westbound						Ulysses St Northbound						Paul Pkwy Eastbound					
Start Time	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Int. Total					
02:30 PM	3	44	11	0	1	59	6	21	17	1	0	45	19	46	17	0	0	82	18	19	3	0	0	40	226					
02:45 PM	4	32	6	0	0	42	11	20	20	1	0	52	28	58	24	0	1	111	14	16	2	0	0	32	237					
Total	12	140	33	0	1	186	25	81	66	2	0	174	91	190	74	1	2	358	56	66	8	0	0	130	848					
03:00 PM	2	36	16	0	0	54	12	37	15	1	0	65	33	57	22	0	3	115	13	11	3	0	2	29	263					
03:15 PM	4	35	11	0	0	50	4	22	20	0	0	46	28	57	26	0	0	111	17	35	2	0	0	54	261					
03:30 PM	10	28	6	0	0	44	7	23	20	1	1	52	42	71	41	0	0	154	23	18	4	0	0	45	295					
03:45 PM	4	32	9	0	0	45	11	28	19	0	0	58	37	62	29	0	0	128	20	21	14	0	1	56	287					
Total	20	131	42	0	0	193	34	110	74	2	1	221	140	247	118	0	3	508	73	85	23	0	3	184	1106					
04:00 PM	8	24	7	0	0	39	12	35	20	2	0	69	44	84	18	0	0	146	25	33	0	0	1	59	313					
04:15 PM	4	44	10	0	0	58	8	25	32	4	0	69	39	68	26	0	0	133	16	23	6	0	0	45	305					
04:30 PM	4	38	17	0	1	60	10	28	25	1	0	64	33	80	31	0	0	144	23	32	20	0	0	75	343					
04:45 PM	9	37	11	0	0	57	13	39	24	2	0	78	42	66	20	0	0	128	23	32	18	0	0	73	336					
Total	25	143	45	0	1	214	43	127	101	9	0	280	158	298	95	0	0	551	87	120	44	0	1	252	1297					
05:00 PM	12	42	10	0	0	64	15	49	31	1	0	96	36	69	23	0	3	131	21	45	20	0	0	86	377					
05:15 PM	15	32	12	0	0	59	10	39	38	1	0	88	37	78	33	0	3	151	22	40	36	0	0	98	396					
05:30 PM	16	46	11	0	0	73	12	34	20	0	0	66	32	64	24	0	1	121	18	33	12	0	0	63	323					
05:45 PM	6	45	8	0	0	59	8	42	31	4	0	85	24	58	29	0	0	111	22	30	2	0	0	54	309					
Total	49	165	41	0	0	255	45	164	120	6	0	335	129	269	109	0	7	514	83	148	70	0	0	301	1405					
06:00 PM	21	46	9	0	0	76	18	42	25	1	0	86	30	61	23	0	0	114	40	46	25	0	0	111	387					
06:15 PM	13	29	10	0	0	52	9	31	25	0	0	65	29	53	30	0	2	114	21	28	8	0	0	57	288					
06:30 PM	11	36	7	0	4	58	4	30	24	0	0	58	29	41	20	0	1	91	11	19	6	0	0	36	243					
06:45 PM	8	40	7	0	0	55	12	26	16	1	0	55	27	37	19	0	3	86	19	20	4	0	1	44	240					
Total	53	151	33	0	4	241	43	129	90	2	0	264	115	192	92	0	6	405	91	113	43	0	1	248	1158					
07:00 PM	3	35	7	0	2	47	7	24	19	1	0	51	23	37	27	0	5	92	22	24	12	0	0	58	248					
07:15 PM	8	25	5	0	0	38	3	20	20	1	0	44	15	27	24	0	0	66	9	10	4	0	0	23	171					
07:30 PM	8	27	4	0	0	39	3	23	16	0	0	42	20	34	14	0	0	68	13	16	4	0	1	34	183					
07:45 PM	6	27	3	0	0	36	4	18	20	2	0	44	19	21	16	1	1	58	22	22	9	0	0	53	191					
Total	25	114	19	0	2	160	17	85	75	4	0	181	77	119	81	1	6	284	66	72	29	0	1	168	793					
08:00 PM	9	21	5	0	3	38	5	20	9	0	0	34	12	32	24	0	6	74	12	20	12	0	0	44	190					
08:15 PM	2	18	6	0	0	26	6	11	8	0	0	25	13	31	14	0	0	58	11	9	1	0	0	21	130					
08:30 PM	4	18	7	0	0	29	5	11	7	1	0	24	9	29	20	0	1	59	6	8	2	0	0	16	128					
08:45 PM	4	13	7	0	0	24	3	12	6	0	0	21	10	24	24	0	0	58	6	4	1	0	0	11	114					
Total	19	70	25	0	3	117	19	54	30	1	0	104	44	116	82	0	7	249	35	41	16	0	0	92	562					
09:00 PM	1	19	2	0	0	22	3	10	7	2	0	22	8	16	16	0	0	40	8	9	1	0	0	18	102					
09:15 PM	2	13	5	0	0	20	3	14	9	0	0	26	5	26	12	0	0	43	99	4	5	1	0	10	99					
09:30 PM	2	11	3	0	0	16	2	7	8	0	0	17	6	7	14	0	0	27	3	5	2	0	1	11	71					

Ulysses St and Paul Pkwy
Blaine, MN

File Name : Ulysses St and Paul Pkwy_9-10-19_0000-2400
Site Code : 1
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Groups Printed- Cars + - Trucks

Groups Printed- Cars +- Trucks																												
Ulysses St Southbound												Paul Pkwy Westbound						Ulysses St Northbound						Paul Pkwy Eastbound				
Start Time	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Right	Thru	Left	UTrn	Peds	App. Total	Int. Total			
09:45 PM	3	10	5	0	0	18	1	7	4	2	0	14	2	9	9	0	0	20	3	2	1	0	0	6	58			
Total	8	53	15	0	0	76	9	38	28	4	0	79	21	58	51	0	0	130	18	21	5	0	1	45	330			
10:00 PM	1	4	0	0	0	5	2	4	4	1	0	11	8	20	5	0	0	33	3	4	0	0	0	7	56			
10:15 PM	1	6	5	0	0	12	1	4	2	0	0	7	7	4	5	0	0	16	3	2	1	0	0	6	41			
10:30 PM	4	4	2	0	0	10	2	3	2	0	0	7	3	7	4	0	0	14	0	2	2	0	0	4	35			
10:45 PM	0	5	2	0	0	7	1	1	1	0	0	3	3	5	9	0	0	17	4	1	1	0	0	6	33			
Total	6	19	9	0	0	34	6	12	9	1	0	28	21	36	23	0	0	80	10	9	4	0	0	23	165			
11:00 PM	0	3	2	0	0	5	1	5	2	0	0	8	3	10	3	0	0	16	5	0	0	0	0	5	34			
11:15 PM	0	4	2	0	0	6	0	6	1	0	0	7	4	10	6	0	0	20	2	0	1	0	0	3	36			
11:30 PM	3	5	2	0	0	10	1	4	2	0	0	7	2	3	4	1	0	10	1	3	0	0	0	4	31			
11:45 PM	2	3	0	0	0	5	0	2	1	0	0	3	3	2	2	0	0	7	2	1	0	0	0	3	18			
Total	5	15	6	0	0	26	2	17	6	0	0	25	12	25	15	1	0	53	10	4	1	0	0	15	119			
Grand Total	328	2213	512	0	18	3071	457	1268	1203	63	5	2996	1255	2486	1109	3	39	4892	1133	1166	354	0	10	2663	13622			
Approch %	10.7	72.1	16.7	0	0.6		15.3	42.3	40.2	2.1	0.2		25.7	50.8	22.7	0.1	0.8		42.5	43.8	13.3	0	0.4					
Total %	2.4	16.2	3.8	0	0.1	22.5	3.4	9.3	8.8	0.5	0	22	9.2	18.2	8.1	0	0.3	35.9	8.3	8.6	2.6	0	0.1	19.5				
Cars +	304	2188	507	0	13	3012	456	1256	1194	63	4	2973	1242	2457	1090	3	35	4827	1097	1156	338	0	9	2600	13412			
% Cars +	92.7	98.9	99	0	72.2	98.1	99.8	99.1	99.3	100	80	99.2	99	98.8	98.3	100	89.7	98.7	96.8	99.1	95.5	0	90	97.6	98.5			
Trucks	24	25	5	0	5	59	1	12	9	0	1	23	13	29	19	0	4	65	36	10	16	0	1	63	210			
% Trucks	7.3	1.1	1	0	27.8	1.9	0.2	0.9	0.7	0	20	0.8	1	1.2	1.7	0	10.3	1.3	3.2	0.9	4.5	0	10	2.4	1.5			

Appendix B

Intersection Safety Screening

Intersection: Ulysses Street NE & Paul Parkway



Crash Data, 2016-2018.

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

Intersection Characteristics	
Entering Volume	12,100
Traffic Control	All stop
Environment	Suburban
Speed Limit	40 mph

Annual crash cost = \$15,200

Statewide Comparison

All Way Stop

Total Crash Rate	
Observed	0.45
Statewide Average	0.34
Critical Rate	0.80
Critical Index	0.56

Fatal & Serious Injury Crash Rate	
Observed	0.00
Statewide Average	0.72
Critical Rate	7.46
Critical Index	0.00

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

The observed total crash rate for this period is 0.45 per MEV; this is 44% below the critical rate. Based on similar statewide intersections, an additional 5 crashes over the three years would indicate this intersection operates outside the normal range.

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

Appendix C



BOLTON & MENK

Real People. Real Solutions.

2019 Traffic Volumes SIGNAL WARRANTS ANALYSIS

FOR

Ulysses Ave and Paul Pkwy

(MINOR APPROACH RT TRAFFIC REMOVED)

Northbound-Southbound Major Approach

LOCATION: Blaine, MN
COUNTY: Anoka
REF. POINT:
DATE: 9/27/2019
OPERATOR: MPN

Speed	Approach Description	Lanes
35	Major App1: SB Ulysses Ave	2
40	Major App3: NB Ulysses Ave	2
30	Minor App2: EB Paul Pkwy	3
30	Minor App4: WB Paul Pkwy	3

0.70 FACTOR USED?
POPULATION < 10,000?
EXISTING SIGNAL ?
THRESHOLDS 1A/1B:

No
No
No

				420/630			140/70	140/70	
HOUR	MAJOR APP. 1	MAJOR APP. 3	TOTAL 1+3	MAJOR 1A/1B	MINOR APP. 2	MINOR 2 1A/1B	MINOR APP. 4	MINOR 4 1A/1B	MET SAME 1A/1B
0:00 - 1:00	11	15	26	/	0	/	10	/	/
1:00 - 2:00	4	11	15	/	0	/	3	/	/
2:00 - 3:00	3	6	9	/	1	/	2	/	/
3:00 - 4:00	3	5	8	/	3	/	1	/	/
4:00 - 5:00	7	9	16	/	7	/	9	/	/
5:00 - 6:00	63	34	97	/	20	/	34	/	/
6:00 - 7:00	206	65	271	/	66	/	120	/X	/
7:00 - 8:00	268	156	424	X/	95	/X	206	X/X	X/
8:00 - 9:00	168	163	331	/	83	/X	119	/X	/
9:00 - 10:00	169	210	379	/	77	/X	92	/X	/
10:00 - 11:00	150	231	381	/	75	/X	101	/X	/
11:00 - 12:00	138	251	389	/	61	/	131	/X	/
12:00 - 13:00	176	291	467	X/	51	/	130	/X	/
13:00 - 14:00	196	305	501	X/	59	/	129	/X	/
14:00 - 15:00	185	356	541	X/	74	/X	149	X/X	X/
15:00 - 16:00	193	505	698	X/X	108	/X	186	X/X	X/X
16:00 - 17:00	213	551	764	X/X	164	X/X	237	X/X	X/X
17:00 - 18:00	255	507	762	X/X	218	X/X	290	X/X	X/X
18:00 - 19:00	237	399	636	X/X	156	X/X	221	X/X	X/X
19:00 - 20:00	158	278	436	X/	101	/X	164	X/X	X/
20:00 - 21:00	114	242	356	/	57	/	85	/X	/
21:00 - 22:00	76	130	206	/	26	/	70	/X	/
22:00 - 23:00	34	80	114	/	13	/	22	/	/
23:00 - 24:00	26	53	79	/	5	/	23	/	/

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

ALL WAY STOP WARRANT

LOCATION: Blaine, MN

COUNTY: Anoka

REF. POINT:

DATE: 9/27/2019

OPERATOR: MPN

0.70 FACTOR USED?

No

Speed	Approach Description	Lanes
35	Major App1: SB Ulysses Ave	2
40	Major App3: NB Ulysses Ave	2
30	Minor App2: EB Paul Pkwy	3
30	Minor App4: WB Paul Pkwy	3

HOUR	MAJOR APP. 1	MAJOR APP. 3	MINOR APP. 2	MINOR APP. 4	300	200	WARRANT MET
					MAJOR TOTAL Σ (APP. 1 & APP. 3)	MINOR TOTAL APP. 2 + APP. 4	
0:00 - 1:00	11	15	0	10	26	10	/
1:00 - 2:00	4	11	0	3	15	3	/
2:00 - 3:00	3	6	1	2	9	3	/
3:00 - 4:00	3	5	3	1	8	4	/
4:00 - 5:00	7	9	7	9	16	16	/
5:00 - 6:00	63	34	20	34	97	54	/
6:00 - 7:00	206	65	66	120	271	186	/
7:00 - 8:00	268	156	95	206	424	301	X/X
8:00 - 9:00	168	163	83	119	331	202	X/X
9:00 - 10:00	169	210	77	92	379	169	X/
10:00 - 11:00	150	231	75	101	381	176	X/
11:00 - 12:00	138	251	61	131	389	192	X/
12:00 - 13:00	176	291	51	130	467	181	X/
13:00 - 14:00	196	305	59	129	501	188	X/
14:00 - 15:00	185	356	74	149	541	223	X/X
15:00 - 16:00	193	505	108	186	698	294	X/X
16:00 - 17:00	213	551	164	237	764	401	X/X
17:00 - 18:00	255	507	218	290	762	508	X/X
18:00 - 19:00	237	399	156	221	636	377	X/X
19:00 - 20:00	158	278	101	164	436	265	X/X
20:00 - 21:00	114	242	57	85	356	142	X/
21:00 - 22:00	76	130	26	70	206	96	/
22:00 - 23:00	34	80	13	22	114	35	/
23:00 - 24:00	26	53	5	23	79	28	/

Met (Hr) Required (Hr)

Allway Stop Warrant:

8

8

Satisfied

REMARKS:

Appendix D

Synchro/SimTraffic Analysis Results Summary
Ulysses St and Paul Pkwy - Alternate Review

Vehicle Delay

Vehicle Delay																														
Traffic Volume	Intersection	Peak Hour	Intersection Delay (Sec/Veh)		Movement Delay (Sec/Veh)														WBR											
			NBL	NBT	NBR	SBL	SBT	SBR	EBL	EBT	EBR	WBU	WBL	WBT																
Existing	Existing AWS/C	AM	5	A	10	B	3	A	6	A	10	B	5	A	6	A	8	A	7	A	8	A	7	A	3	A				
			10	B	17	C	5	A	8	A	13	B	7	A	12	B	10	B	5	A	9	A	10	B	10	B	5	A		
		PM	11	B	18	C	4	A	14	B	92	F	95	F	9	A	13	B	17	C	45	E	55	F	10	B	4	A		
		AM	45	F	11	B	18	C	4	A	14	B	92	F	95	F	9	A	13	B	17	C	45	E	55	F	10	B	4	A
2040	Existing AWS/C	PM	125	F	227	F	339	F	232	F	15	C	60	F	69	F	16	C	10	B	45	E	51	F	14	B	8	A		
			12	B	11	B	3	A	10	B	14	B	9	A	16	B	21	C	10	B	41	D	39	D	15	B	4	A		
		AM	17	B	12	B	11	B	3	A	10	B	14	B	9	A	16	B	21	C	10	B	41	D	39	D	15	B	4	A
		PM	12	B	11	B	3	A	10	B	14	B	9	A	16	B	21	C	10	B	41	D	39	D	15	B	4	A		
	Traffic Signal	AM	17	B	19	B	7	A	18	B	16	B	11	B	24	C	25	C	7	A	32	C	41	D	23	C	10	B	4	A
		PM	19	B	19	B	7	A	18	B	16	B	11	B	24	C	25	C	7	A	32	C	41	D	23	C	10	B	4	A

Vehicle Queue Lengths

Traffic Volume	Intersection	Peak Hour	Queue Lengths																	
			EBL			EBT 1			EBT 2			EBR			WBU/L			WBT/R		
			Avg	Max	SBT	Avg	Max	EBT	Avg	Max	EBR	Avg	Max	NBR	Avg	Max	WBU	Avg	Max	SBT/R
Existing	Existing AWSC	AM	25	50	75	25	50	75	25	50	75	25	50	75	25	50	75	25	50	75
		PM	50	100	150	50	100	150	50	100	150	50	100	150	50	100	150	50	100	150
		AM	25	50	75	25	50	75	25	50	75	25	50	75	25	50	75	25	50	75
		PM	50	100	150	50	100	150	50	100	150	50	100	150	50	100	150	50	100	150
		PM	25	50	75	25	50	75	25	50	75	25	50	75	25	50	75	25	50	75
2040	Traffic Signal	AM	75	150	225	75	150	225	75	150	225	75	150	225	75	150	225	75	150	225
		PM																		

Junctions 9 ARCADY Analysis Results Summary

Ulysses St and Paul Pkwy ARCADY Analysis

Single Lane Roundabout

Ulysses St and Paul Pkwy ARCADY Analysis													
	AM					PM							
	Queue (Feet)	95% Queue (Feet)	Delay (s)	LOS	Junction Delay (s)	Junction LOS	Queue (Feet)	95% Queue (Feet)	Delay (s)	LOS	Junction Delay (s)	Junction LOS	
Single Lane Roundabout - 2019													
Paul Pkwy WB	12.5	47.5	5.12	A	5.31	A	25	90	8.51	A	9.13	A	
Ulysses St SB	12.5	55	5.53	A			10	47.5	5.9	A			
Paul Pkwy EB	10	40	5.83	A			22.5	90	7.09	A			
Ulysses St NB	7.5	47.5	4.54	A			47.5	137.5	12.12	B			
Single Lane Roundabout - 2025													
Paul Pkwy WB	15	47.5	5.96	A	6.25	A	45	187.5	11.41	B	13.8	B	
Ulysses St SB	22.5	80	6.92	A			17.5	57.5	7.15	A			
Paul Pkwy EB	12.5	52.5	6.71	A			25	95	8.3	A			
Ulysses St NB	7.5	25	5.02	A			120	450	20.89	C			
Single Lane Roundabout - 2030													
Paul Pkwy WB	20	65	6.52	A	7.03	A	55	192.5	15.44	C	25.46	D	
Ulysses St SB	22.5	85	8.05	A			22.5	80	8.41	A			
Paul Pkwy EB	12.5	47.5	7.8	A			30	105	9.28	A			
Ulysses St NB	10	35	5.18	A			362.5	967.5	45.91	E			
Single Lane Roundabout - 2035													
Paul Pkwy WB	22.5	90	6.94	A	8.18	A	85	275	22.75	C	66.98	F	
Ulysses St SB	40	127.5	10.33	B			35	115	10.05	B			
Paul Pkwy EB	20	70	8.97	A			37.5	120	10.58	B			
Ulysses St NB	12.5	47.5	5.29	A			1307.5	2440	138.82	F			
Single Lane Roundabout - 2040													
Paul Pkwy WB	25	95	7.97	A	9.58	A	130	440	30.18	D	174.22	F	
Ulysses St SB	52.5	192.5	12.55	B			45	162.5	11.97	B			
Paul Pkwy EB	20	70	10.08	B			40	130	12.66	B			
Ulysses St NB	12.5	50	5.76	A			3537.5	5210	382.89	F			
2 x 1 Roundabout (NS) - 2019													
Paul Pkwy WB	10	47.5	5.07	A	3.78	A	20	82.5	7.61	A	4.7	A	
Ulysses St SB	5	35	2.16	A			5	22.5	2.19	A			
Paul Pkwy EB	12.5	45	5.68	A			17.5	65	6.86	A			
Ulysses St NB	2.5	25	1.99	A			15	62.5	2.71	A			
2 x 1 Roundabout (NS) - 2025													
Paul Pkwy WB	12.5	45	5.65	A	3.98	A	27.5	85	10.22	B	5.51	A	
Ulysses St SB	10	42.5	2.25	A			7.5	47.5	2.4	A			
Paul Pkwy EB	12.5	47.5	6.26	A			22.5	80	7.97	A			
Ulysses St NB	2.5	25	2.07	A			17.5	57.5	3.11	A			
2 x 1 Roundabout (NS) - 2030													
Paul Pkwy WB	17.5	67.5	6.31	A	4.39	A	42.5	160	14.18	B	6.5	A	
Ulysses St SB	10	37.5	2.51	A			10	47.5	2.52	A			
Paul Pkwy EB	12.5	47.5	7.43	A			22.5	72.5	8.38	A			
Ulysses St NB	2.5	25	2.04	A			25	87.5	3.45	A			
2 x 1 Roundabout (NS) - 2035													
Paul Pkwy WB	20	72.5	6.76	A	4.6	A	75	235	20.73	C	8.28	A	
Ulysses St SB	12.5	47.5	2.62	A			7.5	32.5	2.62	A			
Paul Pkwy EB	17.5	70	8.19	A			32.5	112.5	9.83	A			
Ulysses St NB	5	22.5	2.13	A			30	90	4	A			
2 x 1 Roundabout (NS) - 2040													
Paul Pkwy WB	20	77.5	7.45	A	4.8	A	162.5	460	35.61	E	11.82	B	
Ulysses St SB	15	47.5	2.78	A			10	45	2.77	A			
Paul Pkwy EB	20	70	8.29	A			35	110	11.35	B			
Ulysses St NB	7.5	27.5	2.17	A			40	117.5	4.75	A			

Multi-Lane Roundabout (2x1 NS)

Multi-Lane Roundabout (2x1 EW)

AM													PM			
	Queue (Feet)	95% Queue (Feet)	Delay (s)	LOS	Junction Delay (s)	Junction LOS	Queue (Feet)	95% Queue (Feet)	Delay (s)	LOS	Junction Delay (s)	Junction LOS				
2 x 1 Roundabout (EW) - 2019																
Paul Pkwy WB	5	47.5	2.1	A	3.59	A	7.5	47.5	2.47	A	6.21	A				
Ulysses St SB	10	37.5	5.52	A			12.5	55	5.84	A						
Paul Pkwy EB	5	22.5	2.25	A			7.5	27.5	2.32	A						
Ulysses St NB	5	25	4.49	A			47.5	160	10.86	B						
2 x 1 Roundabout (EW) - 2025																
Paul Pkwy WB	7.5	32.5	2.16	A	4.13	A	10	42.5	2.8	A	9.74	A				
Ulysses St SB	17.5	60	6.55	A			17.5	57.5	6.75	A						
Paul Pkwy EB	5	20	2.33	A			7.5	35	2.44	A						
Ulysses St NB	7.5	47.5	4.65	A			112.5	355	18.69	C						
2 x 1 Roundabout (EW) - 2030																
Paul Pkwy WB	5	47.5	2.24	A	4.8	A	10	47.5	2.97	A	19.98	C				
Ulysses St SB	25	95	7.96	A			20	77.5	7.85	A						
Paul Pkwy EB	5	22.5	2.45	A			7.5	35	2.59	A						
Ulysses St NB	10	45	4.92	A			337.5	880	42.34	E						
2 x 1 Roundabout (EW) - 2035																
Paul Pkwy WB	10	37.5	2.39	A	5.41	A	12.5	45	3.18	A	45.76	E				
Ulysses St SB	35	120	9.11	A			27.5	90	9.52	A						
Paul Pkwy EB	5	20	2.61	A			10	45	2.74	A						
Ulysses St NB	12.5	45	5.2	A			975	2027.5	101.87	F						
2 x 1 Roundabout (EW) - 2040																
Paul Pkwy WB	7.5	37.5	2.36	A	6.66	A	15	57.5	3.36	A	154.6	F				
Ulysses St SB	50	165	11.89	B			40	132.5	11.24	B						
Paul Pkwy EB	5	22.5	2.73	A			7.5	32.5	2.83	A						
Ulysses St NB	15	47.5	5.73	A			3167.5	5082.5	351.46	F						
2 x 1 Roundabout (NEW) - 2019																
Paul Pkwy WB	5	27.5	2.07	A	3.12	A	7.5	47.5	2.55	A	3.11	A				
Ulysses St SB	12.5	45	5.5	A			12.5	42.5	5.78	A						
Paul Pkwy EB	5	17.5	2.25	A			7.5	37.5	2.35	A						
Ulysses St NB	2.5	25	1.94	A			15	65	2.75	A						
2 x 1 Roundabout (NEW) - 2025																
Paul Pkwy WB	10	40	2.18	A	3.61	A	10	40	2.76	A	3.57	A				
Ulysses St SB	20	72.5	6.45	A			15	67.5	6.81	A						
Paul Pkwy EB	2.5	25	2.37	A			10	52.5	2.52	A						
Ulysses St NB	5	20	2	A			20	65	3.1	A						
2 x 1 Roundabout (NEW) - 2030																
Paul Pkwy WB	7.5	32.5	2.29	A	4.2	A	12.5	47.5	3.05	A	4.14	A				
Ulysses St SB	27.5	80	7.77	A			22.5	95	8.38	A						
Paul Pkwy EB	5	47.5	2.48	A			7.5	47.5	2.61	A						
Ulysses St NB	5	22.5	2.11	A			22.5	72.5	3.49	A						
2 x 1 Roundabout (NEW) - 2035																
Paul Pkwy WB	10	37.5	2.39	A	4.81	A	12.5	57.5	3.24	A	4.63	A				
Ulysses St SB	32.5	107.5	9.14	A			30	120	9.35	A						
Paul Pkwy EB	5	47.5	2.64	A			10	35	2.73	A						
Ulysses St NB	5	22.5	2.14	A			32.5	112.5	3.98	A						
2 x 1 Roundabout (NEW) - 2040																
Paul Pkwy WB	7.5	32.5	2.44	A	5.7	A	15	60	3.65	A	5.36	A				
Ulysses St SB	52.5	155	11.29	B			40	137.5	11.07	B						
Paul Pkwy EB	5	47.5	2.76	A			10	47.5	2.93	A						
Ulysses St NB	5	25	2.15	A			37.5	142.5	4.49	A						

Multi-Lane Roundabout (2x1 NEW)

