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Intersection Control Evaluation Report

Glory Road and Isle Drive

City of Baxter, MN

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Council Approval Date: September 21, 2021

Certification

Intersection Control Evaluation Report

Glory Road at Isle Drive

in

Baxter, Crow Wing 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.

Michael S. Larson

Michael S. Larson, P.E.	58850	09/15/2021
	Reg. No.	Date

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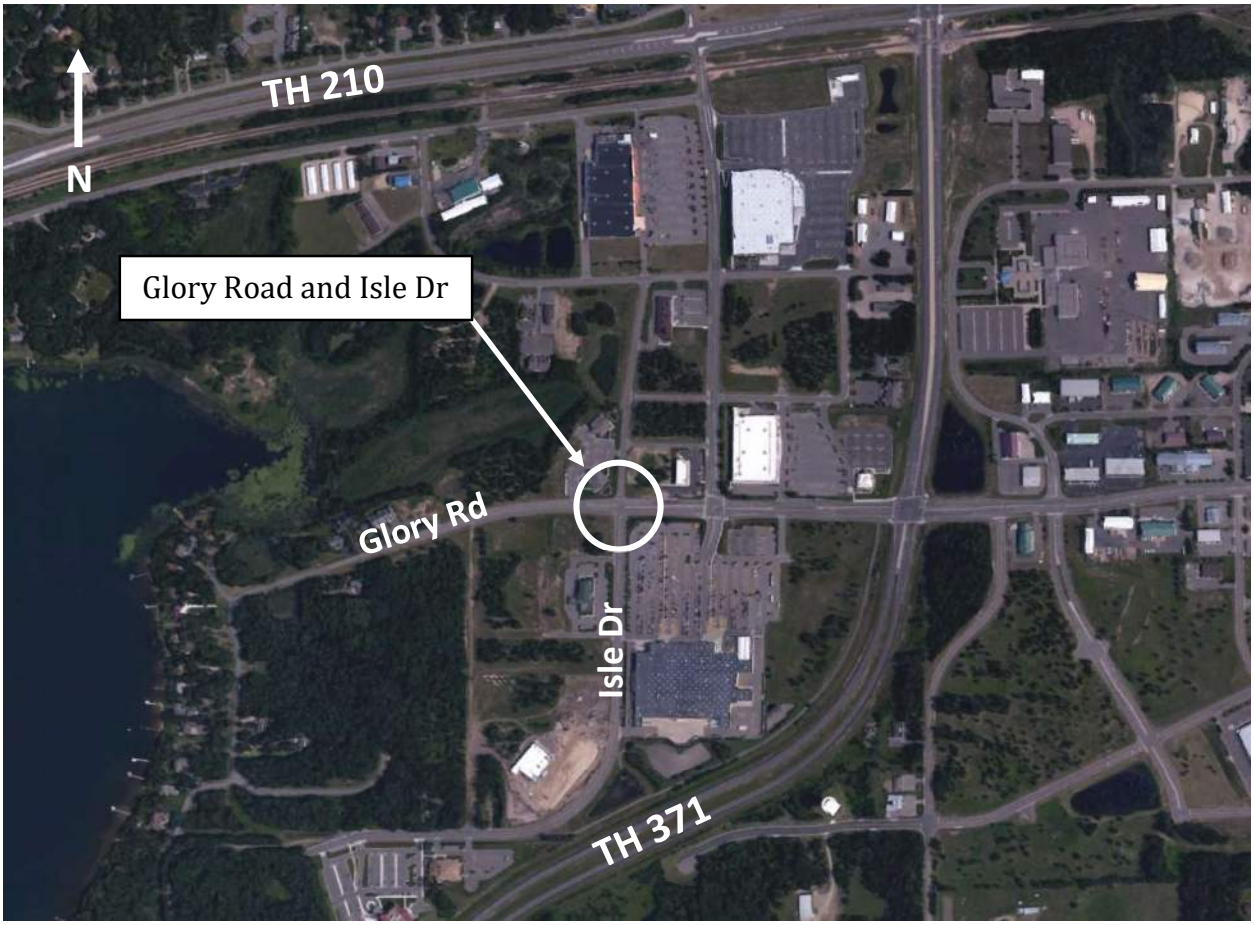
Introduction

An Intersection Control Evaluation (ICE) is being performed for the intersection of Glory Road and Isle Drive. This ICE memorandum will analyze the existing conditions, future conditions, and the analysis of alternatives at the intersection. The intersection of Glory Road and Isle Drive is in the City of Baxter, MN along the southwest edge of Crow Wing County. The intersection is east of Perch Lake and directly northwest of the Walmart Supercenter. The location of the intersection can be seen in **Figure 1**. The City of Baxter has plans to mill & overlay Glory Road west of the intersection with Isle Drive in 2022. However, the City has received comments from residents on safety concerns at this intersection and is looking to address them in the short term before the 2022 project. The city has installed "Cross Traffic Does Not Stop" signage at the intersection as a measure to increase visibility and awareness of the intersection control condition. Additionally, the City envisions Isle Drive as becoming the West Reliever Road, serving north-south vehicle and pedestrian mobility as an alternate route to TH 371 in the event that TH 371 is congested or upgraded to a freeway, furthering the need for analysis of the intersection which will become more important to local mobility. This report presents alternatives to solve the current concerns as well as potential future development.

Figure 1. Intersection Location Map



Existing Conditions

The existing intersection is a four-legged intersection with two-way stop-control for the north and southbound traffic on Isle Drive. The eastbound approach of Glory Road has a left-turn lane and a wide through/right turn lane, transitioning to two through lanes past Isle Drive. Westbound, Glory Road has a left-turn lane, a right-turn lane, and a through lane. There is a narrow raised median dividing east and westbound traffic on the east leg. Isle Drive is a two-lane road with a left-turn lane for northbound traffic. There is a pedestrian trail on the south side of Glory Road and on the east side of Isle Drive south of the intersection, with a marked crosswalk across the south leg of the intersection. The speed limit on both Glory Road and Isle Drive is 30 mph, and both are classified as local roads. This report also mentions the adjacent, signalized intersection of Glory Road and Elder Drive to the east, as seen in **Figure 2**.

Figure 2. Glory Road and Isle Drive/Elder Drive Existing Conditions

Data Collection

24-hour traffic count data for the intersection of Glory Road and Isle Drive, as well as Glory Road and Elder Drive, was collected on Wednesday, June 30th, 2021.The AM peak hour was found to be 10:30-11:30 AM, and the PM peak hour was 12:45-1:45 PM.

Safety Analysis

A 5-year crash review was completed for the intersection using the Minnesota Crash Mapping Analysis Tool (MnCMAT). Crashes analyzed for this intersection were gathered from 2017-2021. A summary of the crashes at the intersection is shown in **Table 1**.

Table 1. Glory Road & Isle Drive Crash Detail

Intersection: Glory Rd & Isle Dr															
Traffic Control	Total Crashes (2017-2021)	Max Leg ADT	Crash Severity					Crash Rate				Fatal & Serious Injury Rate			
			F	A	B	C	PDO	Int. Rate	Statewide Average	Critical Rate	Critical Index	Int. Rate	Statewide Average	Critical Rate	Critical Index
Thru-Stop	1	2,750	0	0	0	1	0	0.091	0.09	0.37	0.25	0	0.22	6.60	0

MnDOT uses a comparison of the crash rate and the critical rate when determining whether there is a safety issue at an intersection. The 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 of the expected, normal range. The critical index reports the magnitude of this difference and a critical index of less than one indicates that the intersection is operating within the normal range. The critical index for total crashes for this intersection is 0.25 which shows the intersection is operating within the normal range. The critical index for serious & fatal crashes is 0, due to there having been none in the past decade, which indicates the intersection operates well within the normal range. An intersection crash rate worksheet is included in **Appendix A**. Further, in the past 10 years, there has only been one other crash reported.

While the results of the safety analysis considering the reported crash data indicate there are no safety concerns present, qualitative safety must also be considered. The City has received feedback from residents that the intersection may feel unsafe and uncomfortable to users. There is reported confusion on whether or not east-west traffic must stop and yield to stopped traffic on Isle Drive. Considered alternatives and countermeasures should weigh the perceived safety as well as the quantitative safety.

Warrant Analysis

Existing Traffic Volumes

Signal and all-way stop warrant analyses were completed for the intersection using the existing traffic volumes. 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.

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

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

Table 2A: Existing Condition Warrant Analysis Results

Warrant	Hours Required	Hours Met
		2021 Volumes
Warrant 1A	8	0
Warrant 1B	8	0
Warrant 2	4	5
Warrant 3	1	0
Warrant 7	8	0
AWSC Warrants	8	0

A traffic signal shall not be installed unless one or more of the warrants can be met. Furthermore, a signal shall not be installed unless an engineering study indicates that the signal will improve the overall safety and operation of the intersection.

Using existing traffic volumes, only the criteria for Warrant 2 was satisfied for the intersection. The criteria for an all way stop warrant are not met for the intersection. The results of this analysis are shown in **Appendix B.**

Table 2B: Future Condition Warrant Analysis Results

Warrant	Hours Required	Hours Met
		2021 Volumes
Warrant 1A	8	0
Warrant 1B	8	0
Warrant 2	4	7
Warrant 3	1	0
Warrant 7	8	5
AWSC Warrants	8	3

Forecasted Traffic Volumes

Using the 2041 forecasted traffic volumes, the criteria for only Warrant 2 was met, similar to the result from the 2021 analysis. The results of this analysis are also in **Appendix B.**

Operational Analysis

A level of service (LOS) analysis of the AM and PM peak hours was completed using the existing turning movement counts in Synchro/SimTraffic. The LOS results are based on average delay per vehicle as calculated by the 2010 Highway Capacity Manual (HCM), which defines the level of service, based on control delay. Control delay is the delay experienced by vehicles slowing down as they are approaching the intersection, the wait time at the intersection, and the time for the vehicle to speed up through the intersection and enter the traffic stream. The average intersection control delay is a volume weighted average of delay experienced by all motorists entering the intersection on all intersection approaches. Intersections and each intersection approach are given a ranking from LOS A through LOS F. LOS A indicates the best traffic operation, with vehicles experiencing minimal delays. LOS A through D is generally perceived to be acceptable to drivers. LOS E indicates that an intersection is operating at, or very near, its capacity and that drivers experience considerable delays. LOS F indicates an intersection where demand exceeds capacity and drivers experience substantial delays.

Existing turning movement counts were used to model the intersections of Glory Rd and Isle Dr as well as Glory Rd and Elder Dr in Synchro in order to determine existing traffic operations during the AM and PM peak hours. The results are shown in **Table 3** below.

Table 3. Existing (2021) Traffic Operational Analysis

Intersection	Peak Hour	Control	Approach	Traffic Delay (sec/veh)					Traffic Queuing (feet)								
				Movement (Delay - LOS)			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn			Through			Right Turn		
				L	T	R			Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Glory Rd & Isle Dr	AM Peak	Stop	EB	-	0 - A	0 - A	0 - A	4 - A	-	-	-	-	-	-	-	-	-
			WB	3 - A	1 - A	1 - A	3 - A		100	25	50	-	-	-	-	0	25
			NB	-	9 - A	4 - A	6 - A		-	0	25	-	50	125	-	50	125
			SB	6 - A	7 - A	2 - A	7 - A		-	25	50	-	25	50	-	25	50
Glory Rd & Elder Dr		Signalized	EB	19 - B	16 - B	5 - A	17 - B	14 - B	150	50	75	-	50	100	-	25	50
			WB	19 - B	13 - B	4 - A	16 - B		200	100	200	-	50	100	-	25	75
			NB	27 - C	18 - B	4 - A	11 - B		-	25	50	-	50	125	-	50	75
			SB	23 - C	14 - B	4 - A	13 - B		-	50	100	-	75	150	-	50	100
Glory Rd & Isle Dr	PM Peak	Stop	EB	2 - A	0 - A	0 - A	1 - A	4 - A	-	-	-	-	-	-	-	-	-
			WB	3 - A	2 - A	1 - A	3 - A		100	25	50	-	-	-	-	0	25
			NB	12 - B	9 - A	4 - A	6 - A		-	25	25	-	75	100	-	75	100
			SB	7 - A	7 - A	2 - A	7 - A		-	25	50	-	25	50	-	25	50
Glory Rd & Elder Dr		Signalized	EB	17 - B	16 - B	10 - B	17 - B	14 - B	150	25	75	-	50	100	50	25	75
			WB	19 - B	14 - B	4 - A	16 - B		200	100	175	-	50	100	-	50	75
			NB	23 - C	18 - B	5 - A	12 - B		-	25	50	-	50	125	-	50	100
			SB	25 - C	12 - B	3 - A	14 - B		-	75	150	-	75	125	-	50	75

Delay:

- The intersection of Glory Rd and Isle Dr has an overall LOS of A during both peak hours.
- The intersection of Glory Rd and Elder Dr has an overall LOS of B during both peak hours.
- The north and southbound left turning movements at Elder Dr operate at LOS C during both peak hours.

Queuing:

- All movements at the intersection with Isle Dr have acceptable queue lengths during the peak hours. Eastbound queues are not shown to spill into the Isle Drive intersection from Elder Drive.
- Due to the short eastbound right-turn lane at Elder Dr, the maximum queue slightly exceeds the storage length of that movement. All other turning movements at Elder Dr have acceptable queues at the peak hours.

Future Conditions

Traffic Forecasting

Future traffic volumes were developed for a 20-year design forecast, with a design year of 2041. The forecast assumed a linear annual growth rate of 0.5% to be consistent with the traffic forecasting methodology used by both of MnDOT's recent studies in the Baxter and Brainerd area: the TH 210 (Washington Street) Brainerd Corridor Study and the Baxter TH 210 Corridor Study. Expected commercial and office development was included in the 2041 forecast. The City of Baxter Comprehensive Plan (updated in 2015) was used to determine the amount of development that would occur, and ITE trip generation methods were used to calculate how much traffic it would produce. The 0.5% growth rate was developed by considering and Crow Wing County historical population growth and state demographer input developed from 2010 census data. Trip distribution was produced based on existing traffic patterns and future zoning plans for the City of Baxter. **Appendix C** shows the forecasted 2041 peak hour turning movement counts.

Operational Analysis

The peak hour traffic volumes for the Do-Nothing alternative were analyzed for the 2041 forecast. The results of this analysis are shown in **Table 4. Appendix C** shows the demand and modeled volumes, percentage error, and GEH statistic.

Table 4. 2041 Do-Nothing Traffic Operational Analysis

Intersection	Peak Hour	Control	Approach	Traffic Delay (sec/veh)					Traffic Queuing (feet)								
				Movement (Delay - LOS)			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn			Through			Right Turn		
				L	T	R			Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Glory Rd & Isle Dr	AM Peak	Stop	EB	2 - A	0 - A	0 - A	1 - A	4 - A	150	0	25	-	0	25	-	0	25
			WB	3 - A	2 - A	1 - A	3 - A		100	25	50	-	-	-	-	0	25
			NB	11 - B	10 - B	5 - A	7 - A		-	25	50	-	75	125	-	75	125
			SB	8 - A	9 - A	4 - A	7 - A		-	50	100	-	50	100	-	50	100
Glory Rd & Elder Dr		Signalized	EB	22 - C	16 - B	7 - A	17 - B	14 - B	150	50	75	-	50	100	50	25	50
			WB	20 - C	14 - B	4 - A	16 - B		200	125	225	-	50	100	-	50	100
			NB	32 - C	18 - B	5 - A	12 - B		-	25	50	-	75	125	-	50	100
			SB	26 - C	14 - B	3 - A	14 - B		-	50	100	-	75	150	-	50	75
Glory Rd & Isle Dr	PM Peak	Stop	EB	2 - A	0 - A	0 - A	1 - A	5 - A	150	25	50	-	0	25	-	0	25
			WB	4 - A	2 - A	1 - A	4 - A		100	25	75	-	-	-	-	25	25
			NB	7 - A	12 - B	6 - A	8 - A		-	25	50	-	75	200	-	75	200
			SB	9 - A	9 - A	3 - A	9 - A		-	50	75	-	50	75	-	50	75
Glory Rd & Elder Dr		Signalized	EB	26 - C	19 - B	7 - A	20 - C	18 - B	150	50	100	-	75	125	50	25	75
			WB	28 - C	16 - B	6 - A	19 - B		200	125	225	-	75	225	-	50	125
			NB	35 - D	23 - C	6 - A	14 - B		-	25	50	-	75	125	-	50	100
			SB	28 - C	15 - B	4 - A	17 - B		-	100	175	-	75	150	-	50	100

Delay:

- The intersection of Glory Rd and Isle Dr has an overall LOS of A during both peak hours.
- The intersection of Glory Rd and Elder Dr has an overall LOS of B during both peak hours.
- The left-turn movements at Elder Dr operate at LOS C during both peak hours, with the northbound left-turn specifically operating at LOS D during the PM peak hour.

Queuing:

- All movements at the intersection with Isle Dr have acceptable queue lengths during the peak hours.
- Due to the short eastbound right-turn lane at Elder Dr, the maximum queue slightly exceeds the storage length of that movement.
- The westbound left-turn movement at Elder Dr has a maximum queue longer than the storage length.

Alternatives

Six alternative intersection controls were considered at Glory Rd and Isle Dr. The alternatives were Do-Nothing (TWSC), Modified TWSC, AWSC, Signalized, Mini-Roundabout, and Roundabout.

1. Do-Nothing (TWSC): Maintain the existing two-way stop-control and lane configuration.

2. Modified TWSC: Maintain the existing two-way stop control and modify existing lane configuration by adding a left-turn lane to the north leg to mirror the south leg and a right turn lane to the west leg to mirror the east leg.

3. AWSC: Add signage to make the intersection all-way stop controlled. Maintain existing lane configuration or modify as described in the Modified TWSC alternative.

4. Signalized: Add a traffic signal system to the intersection of Glory Rd and Isle Dr. Add a left-turn lane to the north leg and a right-turn lane to the west leg.

5. Mini-Roundabout: Convert the intersection into a mini-roundabout. The intersection legs will be modified to have a single approach lane.

6. Roundabout: Convert the intersection into a single-lane roundabout. The intersection legs will be modified to have a single approach lane. This alternative would provide higher operational capacity than the mini-roundabout.

Future Operations Analysis

The peak hour traffic volumes for the Modified TWSC alternative were analyzed for the 2041 forecast. The results of this analysis are shown in **Table 5. Appendix C** shows the demand and modeled volumes and percentage error.

Table 5. 2041 Modified TWSC Traffic Operational Analysis

Intersection	Peak Hour	Control	Approach	Traffic Delay (sec/veh)					Traffic Queuing (feet)								
				Movement (Delay - LOS)			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn			Through			Right Turn		
				L	T	R			Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Glory Rd & Isle Dr	AM Peak	Stop	EB	2 - A	0 - A	0 - A	1 - A	4 - A	150	0	25	-	-	-	150	0	25
			WB	3 - A	2 - A	1 - A	3 - A		100	25	50	-	-	-	-	25	25
			NB	8 - A	10 - B	5 - A	7 - A		-	25	50	-	75	175	-	75	175
			SB	8 - A	8 - A	3 - A	6 - A		150	25	50	-	25	100	-	25	100
Glory Rd & Elder Dr		Signalized	EB	21 - C	16 - B	6 - A	17 - B	14 - B	150	50	75	-	75	125	50	25	50
			WB	20 - C	14 - B	4 - A	16 - B		200	125	225	-	50	100	-	50	75
			NB	28 - C	18 - B	5 - A	11 - B		-	25	50	-	75	125	-	50	100
			SB	26 - C	14 - B	4 - A	14 - B		-	50	100	-	75	125	-	50	75
Glory Rd & Isle Dr	PM Peak	Stop	EB	2 - A	0 - A	0 - A	1 - A	5 - A	150	25	50	-	-	-	150	0	25
			WB	4 - A	2 - A	2 - A	4 - A		100	25	100	-	-	-	-	0	25
			NB	7 - A	13 - B	6 - A	8 - A		-	25	75	-	75	200	-	75	200
			SB	10 - B	9 - A	3 - A	9 - A		150	25	50	-	25	75	-	25	75
Glory Rd & Elder Dr		Signalized	EB	25 - C	18 - B	8 - A	19 - B	17 - B	150	50	75	-	75	150	50	25	75
			WB	28 - C	16 - B	6 - A	19 - B		200	125	225	-	75	225	-	50	150
			NB	34 - C	23 - C	6 - A	14 - B		-	25	50	-	75	150	-	50	125
			SB	27 - C	15 - B	4 - A	17 - B		-	100	175	-	75	175	-	50	100

Delay:

- The intersection of Glory Rd and Isle Dr has an overall LOS of A during both peak hours.
- The intersection of Glory Rd and Elder Dr has an overall LOS of B during both peak hours.
- The left-turn movements at Elder Dr operate at LOS C during both peak hours.

Queuing:

- All movements at the intersection with Isle Dr have acceptable queue lengths during the peak hours.
- Due to the short eastbound right-turn lane at Elder Dr, the maximum queue slightly exceeds the storage length of that movement.
- The westbound left-turn movement at Elder Dr has a maximum queue longer than the storage length.

The peak hour traffic volumes for the AWSC alternative were analyzed for the 2041 forecast. The results of this analysis are shown in **Table 6. Appendix C** shows the demand and modeled volumes and percentage error. Note that while AWSC warrants are not met, an AWSC installation may be warranted as warrants for signalization are met.

Table 6. 2041 AWSC Traffic Operational Analysis

Intersection	Peak Hour	Control	Approach	Traffic Delay (sec/veh)					Traffic Queuing (feet)								
				Movement (Delay - LOS)			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn			Through			Right Turn		
				L	T	R			Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Glory Rd & Isle Dr	AM	Stop	EB	5 - A	6 - A	4 - A	6 - A	6 - A	150	25	50	-	25	50	-	25	50
			WB	6 - A	8 - A	3 - A	7 - A		100	50	100	-	50	75	-	25	50
			NB	5 - A	7 - A	4 - A	5 - A		-	25	50	-	75	125	-	75	125
			SB	6 - A	7 - A	3 - A	6 - A		-	50	75	-	50	75	-	50	75
Glory Rd & Elder Dr		Signalized	EB	21 - C	16 - B	6 - A	17 - B	14 - B	150	50	75	-	75	125	50	25	75
			WB	20 - C	14 - B	4 - A	16 - B		200	125	225	-	50	125	-	50	100
			NB	27 - C	19 - B	4 - A	11 - B		-	25	50	-	75	125	-	50	75
			SB	25 - C	14 - B	3 - A	14 - B		-	50	100	-	75	150	-	50	75
Glory Rd & Isle Dr	PM	Stop	EB	5 - A	7 - A	4 - A	7 - A	6 - A	150	25	50	-	50	100	-	50	100
			WB	8 - A	3 - A	4 - A	7 - A		100	75	125	-	25	50	-	25	50
			NB	4 - A	8 - A	4 - A	6 - A		-	25	50	-	75	125	-	75	125
			SB	6 - A	8 - A	3 - A	7 - A		-	50	75	-	50	75	-	50	75
Glory Rd & Elder Dr		Signalized	EB	26 - C	20 - C	10 - B	21 - C	18 - B	150	50	100	-	75	125	50	25	75
			WB	27 - C	17 - B	6 - A	19 - B		200	125	225	-	75	225	-	50	125
			NB	34 - C	24 - C	6 - A	15 - B		-	25	50	-	75	150	-	50	100
			SB	29 - C	16 - B	4 - A	18 - B		-	100	200	-	75	175	-	50	100

Delay:

- The intersection of Glory Rd and Isle Dr has an overall LOS of A during both peak hours.
- The intersection of Glory Rd and Elder Dr has an overall LOS of B during both peak hours.

- The left-turn movements at Elder Dr operate at LOS C during both peak hours.

Queuing:

- The westbound left-turn movement at Isle Dr has a maximum queue longer than the storage length for the PM peak hour.
- Due to the short eastbound right-turn lane at Elder Dr, the maximum queue slightly exceeds the storage length of that movement.
- The westbound left-turn movement at Elder Dr has a maximum queue longer than the storage length.

The peak hour traffic volumes for the Signalized alternative were analyzed for the 2041 forecast. The results of this analysis are shown in **Table 7. Appendix C** shows the demand and modeled volumes and percentage error.

Table 7. 2041 Signalized Traffic Operational Analysis

Intersection	Peak Hour	Control	Approach	Traffic Delay (sec/veh)					Traffic Queuing (feet)								
				Movement (Delay - LOS)			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn			Through			Right Turn		
				L	T	R			Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
Glory Rd & Isle Dr	AM Peak	Signalized	EB	34 - C	25 - C	6 - A	20 - C	17 - B	150	25	50	-	25	75	-	25	75
			WB	36 - D	28 - C	4 - A	31 - C		100	125	125	-	100	250	-	25	75
			NB	46 - D	8 - A	4 - A	6 - A		-	25	50	-	75	150	-	75	150
			SB	12 - B	8 - A	3 - A	7 - A		200	25	25	-	25	75	-	25	75
Glory Rd & Elder Dr		Signalized	EB	36 - D	26 - C	10 - B	28 - C	20 - C	150	50	100	-	75	150	50	25	75
			WB	36 - D	23 - C	5 - A	28 - C		200	150	225	-	75	275	-	50	100
			NB	39 - D	16 - B	4 - A	10 - B		-	25	50	-	50	150	-	50	100
			SB	36 - D	12 - B	3 - A	15 - B		-	75	125	-	75	150	-	50	75
Glory Rd & Isle Dr	PM Peak	Signalized	EB	21 - C	18 - B	7 - A	18 - B	14 - B	150	25	100	-	50	125	-	50	125
			WB	19 - B	5 - A	4 - A	14 - B		100	100	125	-	50	225	-	25	50
			NB	24 - C	21 - C	9 - A	13 - B		-	25	50	-	100	225	-	100	225
			SB	26 - C	14 - B	5 - A	17 - B		200	25	75	-	50	100	-	50	100
Glory Rd & Elder Dr		Signalized	EB	38 - D	23 - C	10 - B	25 - C	22 - C	150	50	125	-	100	150	50	25	75
			WB	30 - C	16 - B	6 - A	20 - C		200	150	225	-	75	275	-	50	150
			NB	39 - D	33 - C	6 - A	19 - B		-	25	50	-	75	175	-	50	75
			SB	36 - D	23 - C	4 - A	24 - C		-	125	200	-	100	200	-	50	100

Delay:

- The intersection of Glory Rd and Isle Dr has an overall LOS of B during both peak hours.
- The intersection of Glory Rd and Elder Dr has an overall LOS of C during both peak hours.
- The north and westbound left-turn movements at Isle Dr operate at LOS D during the AM peak hour.
- The eastbound and westbound approaches at Isle Dr operate at LOS C during both peak hours.
- The left-turn movements at Elder Dr operate at LOS D during both peak hours.

Queuing:

- The westbound left-turn movement at Isle Dr has an average/maximum queue longer than the storage length for both peak hours. Maximum westbound through queues at Isle Drive reach up to 250 feet, leaving approximately 150 feet between the back of queue and Elder Drive.
- Due to the short eastbound right-turn lane at Elder Dr, the maximum queue slightly exceeds the storage length of that movement for both peak hours.
- The westbound left-turn movement at Elder Dr has a maximum queue longer than the storage length.

The peak hour traffic volumes for the Mini-Roundabout alternative were analyzed for the 2041 forecast at Glory Rd and Isle Dr. Approaches and total delay and queueing were analyzed. The results of this analysis are shown in **Table 8.** The modeled volumes can be found in **Appendix C.**

Table 8. 2041 Mini-Roundabout Traffic Operational Analysis

Approach	AM Peak Hour						PM Peak Hour					
	Approach		Intersection		Queue Length (ft)		Approach		Intersection		Queue Length (ft)	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Avg	Max	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Avg	Max
EB Glory Road	5	A	6	A	25	25	6	A	6	A	25	50
WB Glory Road	7	A			25	75	6	A			25	75
NB Isle Drive	6	A			25	50	7	A			25	75
SB Isle Drive	6	A			25	25	5	A			25	25

Delay:

- The intersection of Glory Rd and Isle Dr has an overall LOS of A during both peak hours.

Queuing:

- All approaches have acceptable queue lengths for both peak hours.

The peak hour traffic volumes for the Roundabout alternative were analyzed for the 2041 forecast at Glory Rd and Isle Dr. Approaches and total delay and queueing were analyzed. The results of this analysis are shown in **Table 9.** The modeled volumes can be found in **Appendix C.** While the roundabout analysis did not include the intersection of Glory Rd and Elder Dr, the queueing analysis shows there would be no negative impact on Elder Dr

Table 9. 2041 Roundabout Traffic Operational Analysis

Approach	AM Peak Hour						PM Peak Hour					
	Approach		Intersection		Queue Length (ft)		Approach		Intersection		Queue Length (ft)	
	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Avg	Max	Delay (sec/veh)	LOS	Delay (sec/veh)	LOS	Avg	Max
EB Glory Road	4	A	4	A	0	25	4	A	4	A	25	50
WB Glory Road	5	A			25	75	4	A			25	50
NB Isle Drive	4	A			25	75	5	A			25	75
SB Isle Drive	4	A			25	25	4	A			25	25

Delay:

- The intersection of Glory Rd and Isle Dr has an overall LOS of A during both peak hours.

Queuing:

- All approaches have acceptable queue lengths for both peak hours.

Concept and Cost Estimate Development

The recommended alternative for the intersection in the short-term is the Do-Nothing alternative. Due to the existing operational and safety analysis showing acceptable results for both peak hours, leaving the existing geometrics and stop control is the best option in terms of performance and cost. Further, signal and AWSC warrants show little to no need for either.

The recommended alternative, if the City plans to reconstruct portions or the entire intersection, is to convert it into a roundabout. Operations analysis shows that a roundabout would result in the lowest

delays for both peak hours. Further, while safety analysis shows no current issue with crashes at the intersection, roundabouts greatly reduce the chances of severe crashes and increase safety for pedestrians. A roundabout would also provide the greatest flexibility for future operations if mainline traffic were to shift from east/west to north/south due to access modifications by MnDOT on TH 210 or TH 371. The cost of this alternative is estimated to be approximately $1,162,000 and does not include right-of-way acquisition. **Appendix D** has a conceptual design figure and a cost estimate for the Roundabout alternative.

The Mini Roundabout alternative would also be suitable for a full reconstruction of the intersection. A mini roundabout would provide the same safety benefits and operational flexibility that a full roundabout would offer. However, a mini-roundabout has a lower operational capacity which may limit the peak period operations depending on future development and area traffic growth. Traffic operations would be comparable to, or improve upon, the existing conditions. Further analysis of vehicle use and types in the area shall be evaluated if this option is considered in the future. The cost of this alternative is estimated to be approximately $642,900. **Appendix E** has a conceptual design figure and a cost estimate for the Mini Roundabout alternative.

Conclusion

Crash, warrant, and operational analysis show no present concern at the intersection of Glory Rd and Isle Dr. No improvements would be necessary at this intersection at this time. However, the concerns of residents in the area indicate the possibility of a considerable number of close calls at this intersection due to the stop-condition not being clear.

If crashes become more common at the intersection, or area development continues and brings additional traffic through the intersection, an AWSC may be considered as a low-cost, short-term improvement to accommodate the changes in intersection safety or traffic patterns. However, an AWSC should not be implemented for safety reasons unless five or more correctable crashes occur within a 12-month period, with crash types considered correctable by AWSC implementation (right-angle, left-turns) per the MnMUTCD. This means if the recently incorporated signage still doesn't improve the perceived public safety issue, an AWSC shouldn't be the go-to option without engineering reasons such as crashes or volume warrants being met. Intersection safety should be monitored as additional countermeasures may be needed if crashes increase. Similarly, AWSC warrants analysis should be performed if development occurs and the interactions between the Isle Dr and Elder Dr intersections should be modeled to confirm no problematic queues will be present.

The recommended long-term intersection control, a single-lane roundabout, should ultimately be considered for development and construction in the event that these safety or operational issues arise. A roundabout would provide lower delays for traffic over TWSC, AWSC, or a traffic signal based on current and forecasted traffic volumes, as well as greater safety for car and pedestrian traffic. As stated previously, a roundabout also provides the greatest flexibility for future operations if mainline traffic were to shift from east/west to north/south due to access modifications by MnDOT on TH 210 or TH 371.

Appendix A
Safety & Crash Analysis

Intersection Safety Screening

Intersection: Glory Road at Isle Drive

Statewide Averages based on 2015-2019 crashes

Crashes by Crash Severity	
Fatal	0
Incapacitating Injury	0
Minor Injury	0
Possible Injury	1
Property Damage	0
Total Crashes	1

Intersection Characteristics	
Entering Volume	6,000
Environment	Urban
Lighting	Lit
Traffic Control	Thru-Stop

Annual crash cost = $24,000

Statewide comparison = Thru/STOP, Urban

Total Crash Rate	
Observed	0.091
Statewide Average	0.090
Critical Rate	0.370
Critical Index	**0.25**

Fatal & Serious Injury Crash Rate	
Observed	0.000
Statewide Average	0.220
Critical Rate	6.600
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 0.09 per MEV; this is 75% below the critical rate. Based on similar statewide intersections, an additional 4 crashes over the five 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 B
Warrant Analysis

SIGNAL WARRANTS ANALYSIS

Existing Volumes
Minor Rights Excluded

LOCATION: Baxter, MN
COUNTY: Crow Wing
REF. POINT:
DATE: 8/6/2021
OPERATOR: C Loyd

Speed	Approach Description	Lanes
30	Major App1: EB Glory Rd	1
30	Major App3: WB Glory Rd	1
30	Minor App2: NB Isle Dr	1
30	Minor App4: SB Isle Dr	1

0.70 FACTOR USED? Yes
POPULATION < 10,000? Yes
EXISTING SIGNAL ? No

THRESHOLDS 1A/1B:				350/525			105/52	105/52	
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	0	0	0	/	6	/	0	/	/
1:00 - 2:00	0	2	2	/	2	/	0	/	/
2:00 - 3:00	0	0	0	/	0	/	0	/	/
3:00 - 4:00	0	6	6	/	1	/	0	/	/
4:00 - 5:00	2	5	7	/	1	/	1	/	/
5:00 - 6:00	0	13	13	/	4	/	0	/	/
6:00 - 7:00	4	49	53	/	18	/	7	/	/
7:00 - 8:00	16	193	209	/	72	/X	21	/	/
8:00 - 9:00	15	166	181	/	119	X/X	31	/	/
9:00 - 10:00	13	202	215	/	153	X/X	42	/	/
10:00 - 11:00	20	196	216	/	227	X/X	47	/	/
11:00 - 12:00	18	182	200	/	236	X/X	42	/	/
12:00 - 13:00	17	202	219	/	244	X/X	62	/X	/
13:00 - 14:00	18	221	239	/	253	X/X	64	/X	/
14:00 - 15:00	17	234	251	/	237	X/X	57	/X	/
15:00 - 16:00	17	176	193	/	262	X/X	40	/	/
16:00 - 17:00	33	187	220	/	286	X/X	41	/	/
17:00 - 18:00	20	137	157	/	198	X/X	32	/	/
18:00 - 19:00	13	122	135	/	131	X/X	19	/	/
19:00 - 20:00	12	90	102	/	106	X/X	16	/	/
20:00 - 21:00	10	50	60	/	79	/X	8	/	/
21:00 - 22:00	1	37	38	/	51	/	8	/	/
22:00 - 23:00	0	15	15	/	33	/	2	/	/
23:00 - 24:00	1	3	4	/	12	/	0	/	/

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

LOCATION: Baxter, MN
COUNTY: Crow Wing
REF. POINT:
DATE: 8/6/2021
OPERATOR: C Loyd

Speed	Approach Description	Lanes
30	Major App1: EB Glory Rd	1
30	Major App3: WB Glory Rd	1
30	Minor App2: NB Isle Dr	1
30	Minor App4: SB Isle Dr	1

0.70 FACTOR USED? Yes
POPULATION < 10,000? Yes
EXISTING SIGNAL ? No

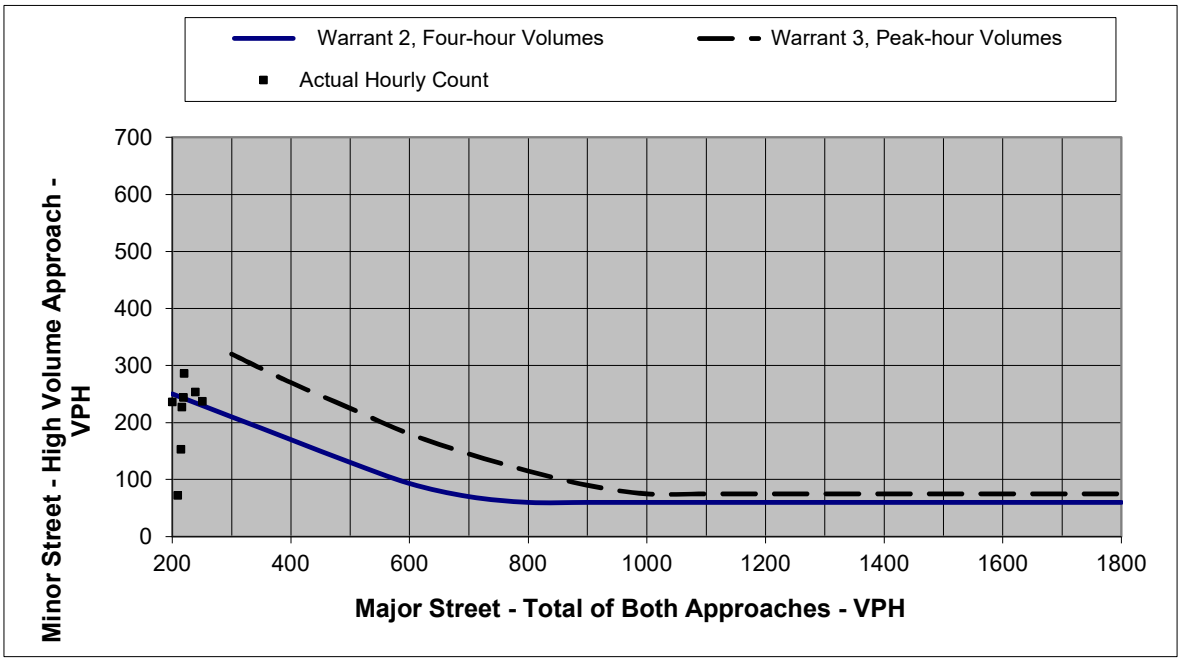


Figure 1. Four Hour and Peak Hour Warrant Analysis

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

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2, F	Warrant 3, Pe	Major	Actual Hourly Count
200	250		0	6
300	210	320	2	2
400	170	270	0	0
500	130	225	6	1
600	93	180	7	1
700	70	145	13	4
800	60	115	53	18
900	60	90	209	72
1000	60	75	181	119
1100	60	75	215	153
1200	60	75	216	227
1300	60	75	200	236
1400	60	75	219	244
1500	60	75	239	253
1600	60	75	251	237
1700	60	75	193	262
1800	60	75	220	286
			157	198
			135	131
			102	106
			60	79
			38	51
			15	33
			4	12

SIGNAL WARRANTS ANALYSIS

Forecasted Volumes
Minor Rights Excluded

LOCATION: Baxter, MN
COUNTY: Crow Wing
REF. POINT:
DATE: 8/20/2021
OPERATOR: C Loyd

Speed	Approach Description	Lanes
30	Major App1: EB Glory Rd	1
30	Major App3: WB Glory Rd	1
30	Minor App2: NB Isle Dr	1
30	Minor App4: SB Isle Dr	1

0.70 FACTOR USED? Yes
POPULATION < 10,000? Yes
EXISTING SIGNAL ? No

THRESHOLDS 1A/1B: 350/525 105/52 105/52

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	0	0	0	/	6	/	0	/	/
1:00 - 2:00	0	2	2	/	2	/	0	/	/
2:00 - 3:00	0	0	0	/	0	/	0	/	/
3:00 - 4:00	0	6	6	/	1	/	0	/	/
4:00 - 5:00	9	7	16	/	1	/	1	/	/
5:00 - 6:00	0	14	14	/	4	/	0	/	/
6:00 - 7:00	13	58	71	/	18	/	12	/	/
7:00 - 8:00	48	231	279	/	75	/X	41	/	/
8:00 - 9:00	45	202	247	/	121	X/X	62	/X	/
9:00 - 10:00	39	243	282	/	156	X/X	77	/X	/
10:00 - 11:00	51	227	278	/	230	X/X	86	/X	/
11:00 - 12:00	52	212	264	/	239	X/X	77	/X	/
12:00 - 13:00	48	236	284	/	249	X/X	153	X/X	/
13:00 - 14:00	46	256	302	/	259	X/X	143	X/X	/
14:00 - 15:00	43	276	319	/	242	X/X	112	X/X	/
15:00 - 16:00	51	197	248	/	266	X/X	88	/X	/
16:00 - 17:00	90	235	325	/	292	X/X	99	/X	/
17:00 - 18:00	62	161	223	/	202	X/X	94	/X	/
18:00 - 19:00	42	170	212	/	134	X/X	28	/	/
19:00 - 20:00	40	112	152	/	109	X/X	25	/	/
20:00 - 21:00	32	83	115	/	80	/X	11	/	/
21:00 - 22:00	2	45	47	/	52	/X	11	/	/
22:00 - 23:00	0	15	15	/	33	/	14	/	/
23:00 - 24:00	3	7	10	/	12	/	0	/	/

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

LOCATION: Baxter, MN
COUNTY: Crow Wing
REF. POINT:
DATE: 8/20/2021

OPERATOR: C Loyd

	Speed	Approach Description	Lanes
	30	Major App1: EB Glory Rd	1
	30	Major App3: WB Glory Rd	1
	30	Minor App2: NB Isle Dr	1
	30	Minor App4: SB Isle Dr	1

0.70 FACTOR USED? Yes
POPULATION < 10,000? Yes
EXISTING SIGNAL ? No

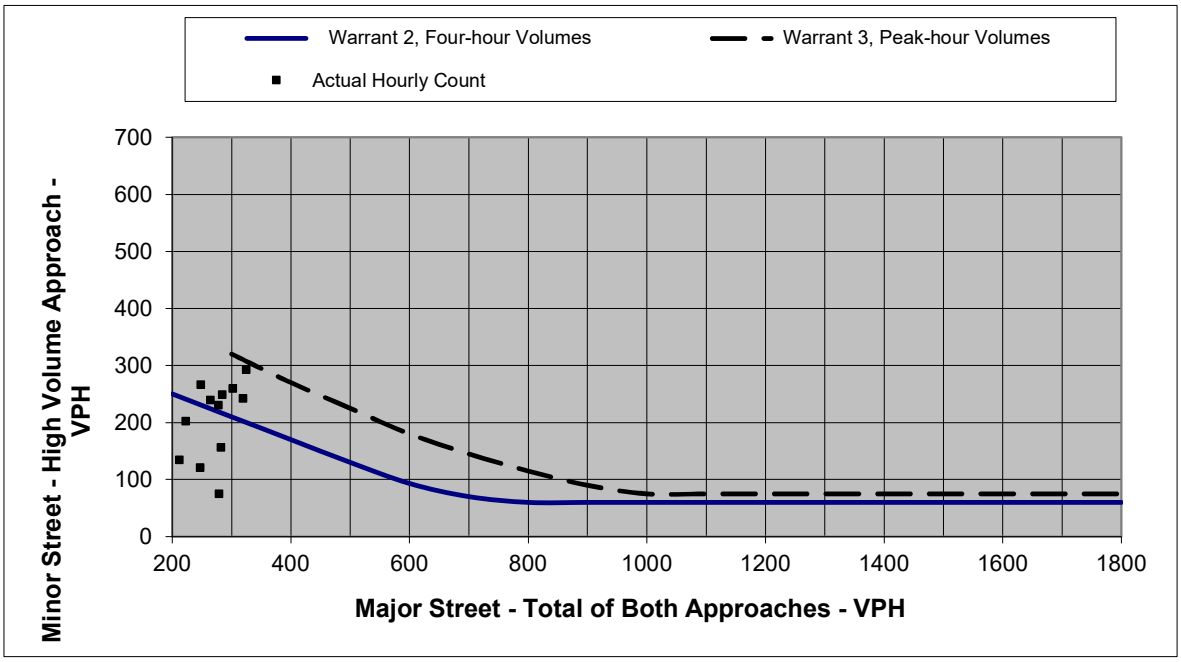


Figure 1. Four Hour and Peak Hour Warrant Analysis

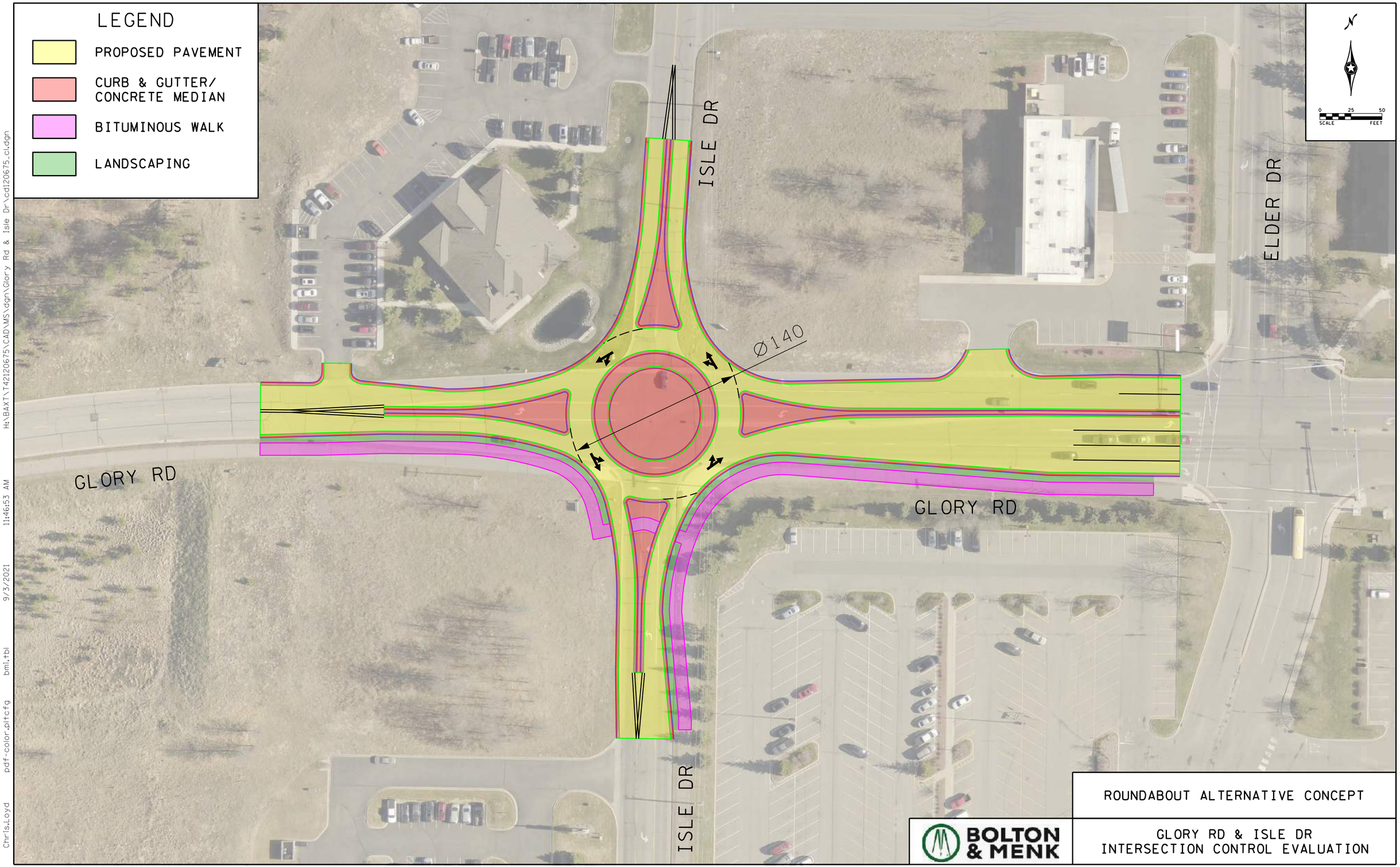
Note: For data points outside the graph range, check the minor street volume against the lower thresholds

Warrant Criteria			Actual Hourly Count	
Major	Warrant 2, F	Warrant 3, Pe	Major	Actual Hourly Count
200	250		0	6
300	210	320	2	2
400	170	270	0	0
500	130	225	6	1
600	93	180	16	1
700	70	145	14	4
800	60	115	71	18
900	60	90	279	75
1000	60	75	247	121
1100	60	75	282	156
1200	60	75	278	230
1300	60	75	264	239
1400	60	75	284	249
1500	60	75	302	259
1600	60	75	319	242
1700	60	75	248	266
1800	60	75	325	292
			223	202
			212	134
			152	109
			115	80
			47	52
			15	33
			10	12

Appendix C
Traffic Operations Analysis

Alternative	Control	Approach	Traffic Volumes (veh)									Traffic Delay (sec/veh)					Traffic Queuing (feet)								
			Demand Volumes				Modeled Volumes				GEH	Movement (Delay - LOS)			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn			Through			Right Turn		
			L	T	R	Total	L	T	R	Total		L	T	R			Storage	Avg	Max	Link Length	Avg	Max	Storage	Avg	Max
2020 Existing PM Peak	Stop	EB	75	475	0	550	75	466	-	541	0	21 - C	2 - A	-	5 - A	10 - B	300	25	150	-	0	0	-	-	-
		WB	0	670	80	750	-	642	77	719	1	-	1 - A	2 - A	2 - A		-	-	-	-	0	0	350	0	0
		SB	70	0	140	210	65	-	141	206	0	129 - F	-	22 - C	56 - F		-	75	400	-	-	-	125	25	200
2040 No-Build PM Peak	Stop	EB	60	545	0	605	60	543	-	603	0	21 - C	2 - A	-	4 - A	16 - C	300	25	125	-	0	0	-	-	-
		WB	0	740	90	830	-	705	86	791	1	-	1 - A	2 - A	2 - A		-	-	-	-	0	0	350	0	0
		SB	80	0	155	235	72	-	154	226	1	219 - F	-	47 - E	102 - F		-	150	525	-	-	-	125	50	425
2040 Build AM Peak	Signalized	EB	90	915	15	1020	91	917	16	1024	0	26 - C	14 - B	3 - A	15 - B	14 - B	350	50	125	861	125	225	350	25	25
		WB	65	385	45	495	62	392	43	497	0	24 - C	12 - B	3 - A	13 - B		350	50	100	959	75	150	350	25	50
		NB	15	15	65	95	14	14	63	91	0	29 - C	31 - C	7 - A	15 - B		-	25	50	195	25	50	-	25	75
		SB	85	50	145	280	85	46	144	275	0	24 - C	17 - B	4 - A	13 - B		-	50	125	151	25	75	100	50	100
2040 Build PM Peak	Signalized	EB	85	490	10	585	85	479	9	573	0	91 - F	14 - B	3 - A	26 - C	30 - C	300	50	250	-	25	275	300	0	50
		WB	65	675	90	830	62	646	82	790	1	85 - F	20 - C	4 - A	24 - C		300	50	175	-	50	400	350	25	100
		NB	90	55	35	180	94	56	36	186	0	67 - E	72 - E	10 - B	58 - E		200	50	250	200	25	200	200	25	75
		SB	75	35	155	265	68	34	152	254	1	67 - E	74 - E	13 - B	36 - D		150	50	200	150	25	125	150	25	175
2040+Summer Build PM Peak	Signalized	EB	85	621	10	716	84	608	10	702	1	92 - F	15 - B	4 - A	25 - C	29 - C	300	50	250	-	50	325	300	0	50
		WB	65	859	90	1014	60	809	80	949	2	90 - F	21 - C	5 - A	25 - C		300	50	200	-	75	450	350	25	100
		NB	90	55	35	180	91	53	36	180	0	70 - E	73 - E	11 - B	60 - E		200	50	275	200	25	150	200	25	75
		SB	75	35	155	265	68	34	152	254	1	68 - E	76 - E	16 - B	38 - D		150	50	225	150	25	125	150	25	175

Appendix D
Roundabout Alternative
Concept and Cost Estimate



ROUNDABOUT ALTERNATIVE CONCEPT

BOLTON & MENK

GLORY RD & ISLE DR
INTERSECTION CONTROL EVALUATION

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Preliminary Design Opinion of Probable Cost

Glory Rd & Isle Drive Roundabout Concept

Preliminary Cost Estimate

City of Baxter

9/15/2021

	Item	Unit	Total Qty	Unit Price	Total Cost
MAJOR ROADWAY AND TRAIL					
	SAWING BITUMINOUS PAVEMENT FULL DEPTH	LF	260	$ 3.00	$ 780
	REMOVE CURB & GUTTER	LF	2,960	$ 5.00	$ 14,800
	REMOVE CONCRETE PAVEMENT	SF	790	$ 2.00	$ 1,580
	REMOVE BITUMINOUS PAVEMENT	SY	6,840	$ 5.00	$ 34,200
	REMOVE BITUMINOUS WALK	SF	7,880	$ 2.00	$ 15,760
	REMOVE CONCRETE WALK	SF	880	$ 2.00	$ 1,760
	EXCAVATION - COMMON	CY	3,000	$ 10.00	$ 30,000
(1)	SELECT GRANULAR (CV)	CY	5,210	$ 14.00	$ 72,940
	COMMON EMBANKMENT (CV)	CY	3,000	$ 15.00	$ 45,000
(1)	AGGREGATE BASE (CV) CLASS 5	CY	1,310	$ 30.00	$ 39,300
(1)	TYPE SP BITUMINOUS MIX (ROAD - WEARING)	TON	1,410	$ 70.00	$ 98,700
(1)	TYPE SP BITUMINOUS MIX (ROAD - NON WEARING)	TON	940	$ 65.00	$ 61,100
	REMOVE CONCRETE MEDIAN	SY	200	$ 8.00	$ 1,600
	CONCRETE WALK/MEDIAN	SF	22,700	$ 5.00	$ 113,500
	CURB AND GUTTER	LF	4,500	$ 22.00	$ 99,000
	Subtotal				**$ 630,020**
OTHER ROADWAY ITEMS					
	LIGHTING SYSTEM	LS	1	$ 100,000.00	$ 100,000
PRECENTAGE ITEMS					
	MOBILIZATION	5.0%		of all	$ 31,500
	MISC REMOVALS (SIGNS, TREES, ETC.)	2.0%		of all	$ 12,600
	SIGNING & PAVEMENT MARKINGS	5.0%		of all	$ 31,500
	TURF ESTABLISHMENT AND EROSION CONTROL	4.0%		of all	$ 25,200
	TRAFFIC CONTROL	2.5%		of all	$ 15,800
	CONTINGENCY FOR MISSING ITEMS	20.0%		of all	$ 126,000
	Subtotal				**$ 242,600**
				Construction Cost (2021 Dollars)	**$ 972,500**
				(2) Construction Cost (2022 Dollars)	**$ 1,001,700**
				Design Engineering Cost (8%)	$ 80,150
				Construction Admin Cost (8%)	$ 80,150
				Total Cost (2022 Dollars)	**$ 1,162,000**

Notes:

1. Roadway Section = 3" Bit (wear) - 2" Bit (non-wear) - 6" Agg Base - 24" Select Granular
2. 3% Inflation
3. Estimate does not include Right-of-Way costs, TBD during final design

Appendix E
Mini Roundabout Alternative
Concept and Cost Estimate

LEGEND

- PROPOSED PAVEMENT
- CURB & GUTTER/ CONCRETE MEDIAN
- BITUMINOUS WALK
- LANDSCAPING

ISLE DR

ELDER DR

Ø89

GLORY RD

ISLE DR

N

0 25 50
SCALE FEET

MINI ROUNDABOUT
ALTERNATIVE CONCEPT

BOLTON & MENK

GLORY RD & ISLE DR
INTERSECTION CONTROL EVALUATION

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ChrisLoyd

Preliminary Design Opinion of Probable Cost

Glory Rd & Isle Drive Mini Roundabout Concept

Preliminary Cost Estimate

City of Baxter

9/15/2021

	Item	Unit	Total Qty	Unit Price	Total Cost
MAJOR ROADWAY AND TRAIL					
	SAWING BITUMINOUS PAVEMENT FULL DEPTH	LF	260	$ 3.00	$ 780
	REMOVE CURB & GUTTER	LF	2,590	$ 5.00	$ 12,950
	REMOVE CONCRETE PAVEMENT	SF	790	$ 2.00	$ 1,580
	REMOVE BITUMINOUS PAVEMENT	SY	6,130	$ 5.00	$ 30,650
	REMOVE BITUMINOUS WALK	SF	7,040	$ 2.00	$ 14,080
	REMOVE CONCRETE WALK	SF	880	$ 2.00	$ 1,760
	EXCAVATION - COMMON	CY	1,500	$ 10.00	$ 15,000
(1)	SELECT GRANULAR (CV)	CY	2,290	$ 14.00	$ 32,060
	COMMON EMBANKMENT (CV)	CY	1,500	$ 15.00	$ 22,500
(1)	AGGREGATE BASE (CV) CLASS 5	CY	580	$ 30.00	$ 17,400
(1)	TYPE SP BITUMINOUS MIX (ROAD - WEARING)	TON	620	$ 70.00	$ 43,400
(1)	TYPE SP BITUMINOUS MIX (ROAD - NON WEARING)	TON	420	$ 65.00	$ 27,300
	REMOVE CONCRETE MEDIAN	SY	200	$ 8.00	$ 1,600
	CONCRETE WALK/MEDIAN	SF	6,490	$ 5.00	$ 32,450
	CURB AND GUTTER	LF	4,500	$ 22.00	$ 99,000
	Subtotal				**$ 352,510**
OTHER ROADWAY ITEMS					
	LIGHTING SYSTEM	LS	1	$ 50,000.00	$ 50,000
PRECENTAGE ITEMS					
	MOBILIZATION	5.0%		of all	$ 17,600
	MISC REMOVALS (SIGNS, TREES, ETC.)	2.0%		of all	$ 7,100
	SIGNING & PAVEMENT MARKINGS	5.0%		of all	$ 17,600
	TURF ESTABLISHMENT AND EROSION CONTROL	4.0%		of all	$ 14,100
	TRAFFIC CONTROL	2.5%		of all	$ 8,800
	CONTINGENCY FOR MISSING ITEMS	20.0%		of all	$ 70,500
	Subtotal				$ 135,700
				Construction Cost (2021 Dollars)	**$ 538,000**
				(2) Construction Cost (2022 Dollars)	**$ 554,200**
				Design Engineering Cost (8%)	$ 44,350
				Construction Admin Cost (8%)	$ 44,350
				Total Cost (2022 Dollars)	**$ 642,900**

Notes:

1. Roadway Section = 3" Bit (wear) - 2" Bit (non-wear) - 6" Agg Base - 24" Select Granular
2. 3% Inflation
3. Estimate does not include Right-of-Way costs, TBD during final design