



Real People. Real Solutions.

MEMORANDUM

Date: 5/14/2026

To: City of Northfield

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Subject: TH 3 Unsignalized Intersection Multimodal Review
City of Northfield, MN
Project No.: 25X141359.000

Introduction

This memorandum documents traffic analysis that was conducted for four unsignalized intersections along Minnesota Trunk Highway 3 (TH 3) in Northfield, Minnesota. The primary goal of this traffic analysis is to identify potential traffic control and/or geometric changes that can be considered to improve multimodal accessibility and safety along the corridor, especially for pedestrian and bicyclist movements across TH 3 as stated in the City's Strategic Plan (2025-2028).

Analysis documented in this memorandum is intended to serve as a first step in identifying potentially viable solutions that can be studied in more detail in coordination with a future corridor study or could be implemented on their own. The City of Northfield would like to partner with the Minnesota Department of Transportation (MnDOT) to conduct a future corridor study on TH 3 to develop a plan for the traffic lanes and traffic control for the corridor through the City of Northfield, especially with the upcoming bridge projects in 2032 (TH 3 bridge over the Cannon River) and 2033 (Greenvale Viaduct Bridge over the RR, west of TH 3).

Study Area Overview

Traffic analysis was focused on the following four intersections on TH 3:

- TH 3 and Greenvale Avenue West
- TH 3 and Saint Olaf Avenue West
- TH 3 and Riverview Dr
- TH 3 and Heritage Drive/Cannon Lane

Existing Roadway Conditions

Land Use Context

Northern Study Area

The northern portion of the TH 3 study area near Greenvale Avenue and Saint Olaf Avenue is shown in **Figure 1**. Land uses in this area include:

- Largely residential west of TH 3
- Industrial uses along TH 3 north of Greenvale Avenue, with some industrial also present on the east side of TH 3 between Greenvale and Saint Olaf Avenues.
- Commercial uses along TH 3 south of Saint Olaf Avenue

Figure 1: Northern Study Area Land Use



Southern Study Area

The southern portion of the TH 3 study area near Heritage Drive/Cannon Lane and Riverview Drive is shown in **Figure 2**. Land uses in this area include:

- Predominantly commercial on both sides of TH 3.
- Residential area located further east of TH 3.
- Northfield Police Department is located along Riverview Drive, west of TH 3.
- Industrial area located northwest of TH 3

Figure 2: Southern Study Area Land Use



Corridor Profile

Key characteristics of the TH 3 corridor are provided below

- **Roadway functional classification**
 - TH 3 is a minor arterial roadway north of 5th Street and a principal arterial roadway south of 5th Street.
- **Typical roadway section**
 - At Heritage Drive/Cannon Lane and at Riverview Drive, TH 3 is a four-lane, median-divided section.
 - At Saint Olaf Avenue, two through lanes are provided in each direction. A narrow median is present on the south leg (no median on the north leg).
 - At Greenvale Avenue, two northbound through lanes and a single southbound through lane are present.
 - The south intersection leg opens up to two receiving southbound through lanes (only one southbound through lane on north leg)
- **Speed limits**
 - At the intersections with Heritage Drive/Cannon Lane and Riverview Drive, the posted speed limit on TH 3 is 50 mph.
 - At Saint Olaf Avenue, the posted speed limit on TH 3 is 30 mph.
 - Greenvale Avenue is a speed transition area. The speed limit on TH 3 is 40 mph north of Greenvale Avenue and 30 mph south of Greenvale Avenue.
- **Traffic Control**
 - All study intersections are under side street stop control.
- **Pedestrian and Bicyclist Facilities**
 - **Greenvale Avenue**
 - A crosswalk with a median refuge is present on the north leg.
 - This crossing is supplemented with an overhead rectangular rapid flashing beacon (RRFB)
 - Marked crosswalks are not present on other intersection approaches.
 - Sidewalks are present parallel to TH 3 on the northeast, northwest, and southeast intersection quadrants.
 - Sidewalks parallel to Greenvale Avenue are present on both sides of the roadway on the west intersection approach.
 - On-Street bike lanes on TH 3 north of Greenvale Ave.
 - Unmarked and unsigned south of Greenvale Ave

- **Saint Olaf Avenue**

- No marked crossings are provided to cross TH 3.
- Crosswalks are however present parallel to TH 3 on both the east and west intersection legs.
- Sidewalks are present parallel to TH 3 on the northeast, southeast, and southwest intersection quadrants.
- Sidewalks parallel to Saint Olaf Avenue are present on the east and west intersection legs.
- On-street shared bike/vehicle lanes on St Olaf Ave west of TH 3.
- On-street bike lanes on TH 3 north and south of St Olaf Ave.

- **Riverview Drive**

- No marked crossings are present at the intersection.
- No sidewalks are present at the intersection.
 - A trail along the east side of TH 3 is planned for future implementation

- **Heritage Drive/Cannon Lane**

- No marked crossings are present at the intersection.
 - A trail along the east side of TH 3 is planned for future implementation
- No sidewalks are present at the intersection, but a bidirectional on-street bike lane is present on the southeast approach of Heritage Drive (on the north side of Heritage Drive).

Existing Traffic Data

14-hour turning movement counts were collected at study intersections on November 6, 2025. **Figure 3** and **Figure 4** show estimated daily traffic volumes and 14-hour pedestrian counts at the south and north study subareas, respectively. Full turning movement count data can be found in **Appendix A**. Visual graphics detailing the collected AM and PM peak hour turning movement counts can be found in **Appendix B**. The peak hours were identified as:

- AM Peak: 7:15 to 8:15 am
- PM Peak: 4:30 to 5:30 pm

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Figure 3: Existing Traffic Data Near Heritage Drive/Cannon Lane and Riverview Drive

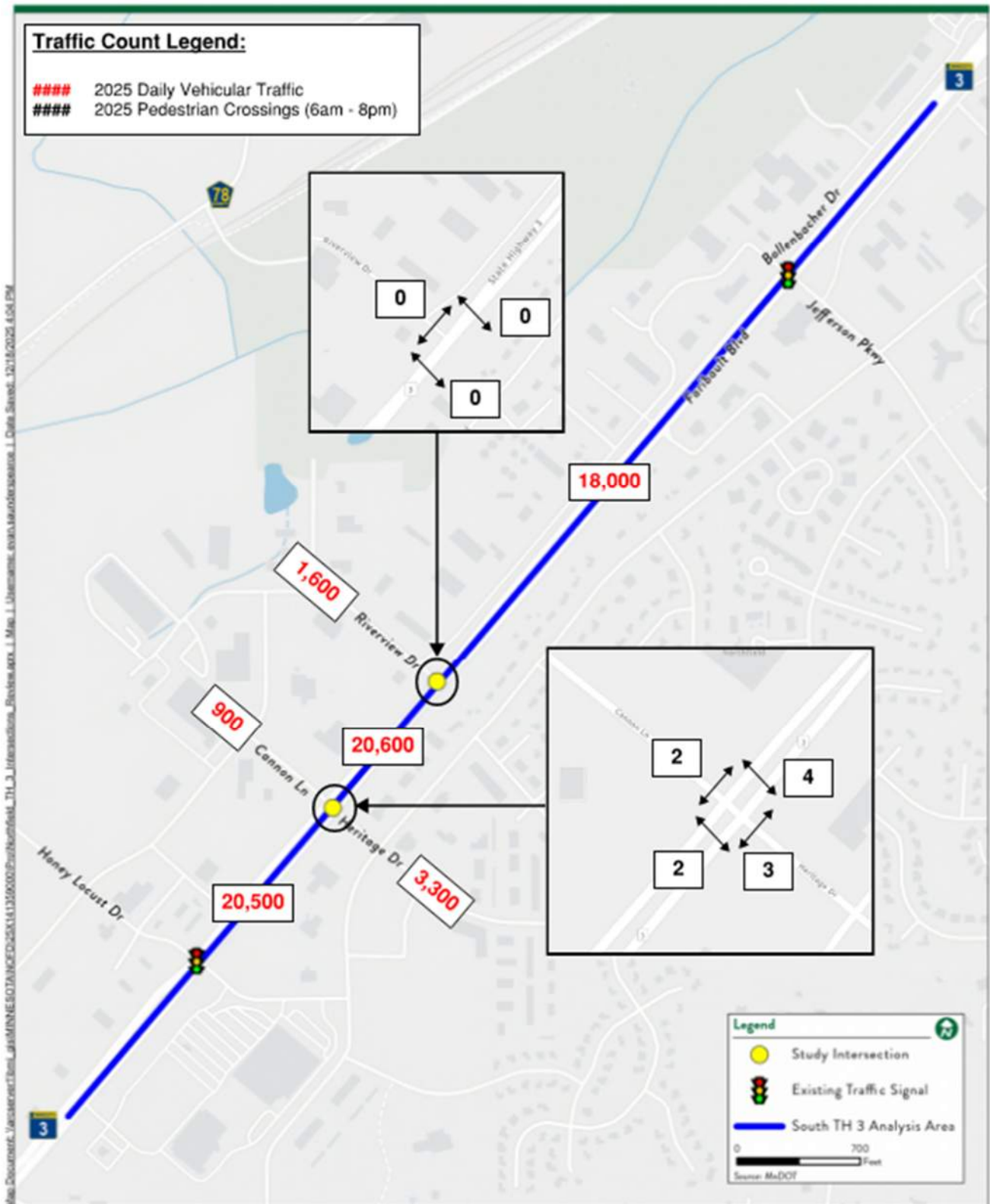
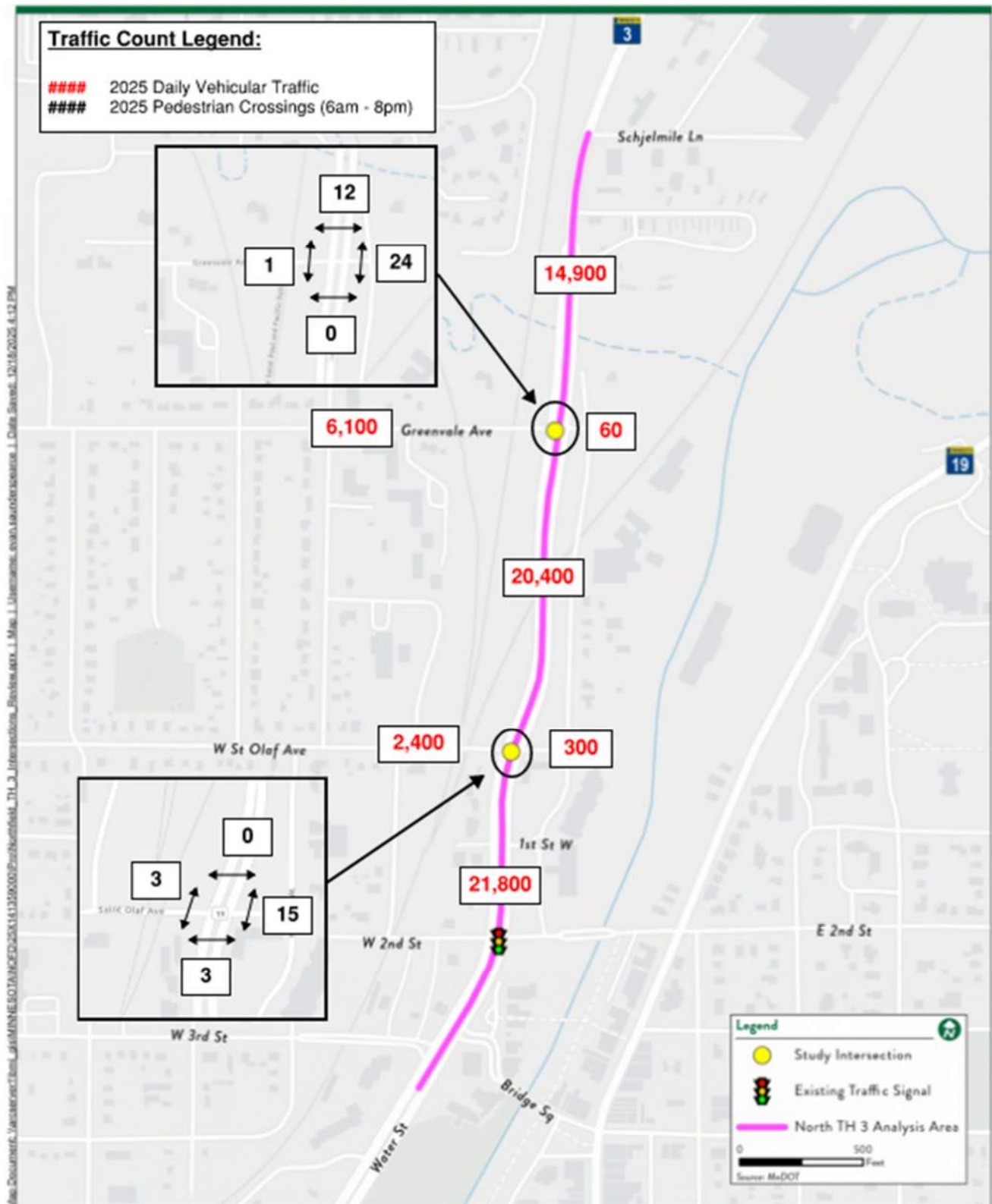


Figure 4: Existing Traffic Data Near Saint Olaf Avenue and Greenvale Avenue



Traffic Operations Analysis

AM and PM peak hour intersection level of service (LOS) analysis was performed for the four study intersections using the Synchro/SimTraffic software package (Version 12). LOS is a metric used to describe the quality of traffic flow, ranging from LOS A to LOS F. LOS A represents near free-flow traffic conditions with minimal delays and LOS F represents a breakdown in traffic flow characterized by severe congestion and major delays. In Minnesota, operations at LOS D or better are typically considered acceptable.

Table 1 below provides LOS and traffic queuing results for 2025 existing conditions.

Table 1: 2025 Existing Condition Traffic Operations Results

Scenario: Existing 2025 Layout		AM Peak										
		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/Water St & Greenvale Ave W	EB	39 - E	38 - E	12 - B	14 - B	3 - A	100	200	100	200	100	200
	WB	-	-	4 - A	4 - A		25	25	25	25	25	25
	NB	7 - A	0 - A	-	2 - A		50	100	-	-	-	-
	SB	-	1 - A	0 - A	1 - A		-	-	0	25	0	25
TH 3/Water St & Saint Olaf Ave W	EB	66 - F	47 - E	8 - A	14 - B	2 - A	25	25	50	75	50	75
	WB	56 - F	36 - E	6 - A	21 - C		25	25	25	25	25	25
	NB	6 - A	1 - A	0 - A	2 - A		25	50	25	25	25	25
	SB	5 - A	0 - A	0 - A	1 - A		25	25	0	25	0	25
TH 3/2nd Ave NW & Heritage Dr/Cannon Ln	NEB	2 - A	1 - A	0 - A	1 - A	1 - A	25	50	-	-	-	-
	NWB	15 - C	22 - C	5 - A	8 - A		50	75	50	75	50	75
	SEB	17 - C	20 - C	3 - A	12 - B		25	50	25	50	25	50
	SWB	4 - A	0 - A	0 - A	1 - A		25	50	-	-	-	-
TH 3/2nd Ave NW & Riverview Dr	NEB	3 - A	0 - A	-	1 - A	1 - A	25	50	-	-	-	-
	SEB	20 - C	-	6 - A	14 - B		50	100	-	-	50	100
	SWB	-	0 - A	0 - A	0 - A		-	-	-	-	-	-

Scenario: Existing 2025 Layout		PM Peak										
		Traffic Delay (sec/veh)					Traffic Queuing (feet)					
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/Water St & Greenvale Ave W	EB	111 - F	-	10 - B	11 - B	4 - A	75	150	75	150	75	150
	WB	-	-	2 - A	2 - A		25	25	25	25	25	25
	NB	16 - C	0 - A	0 - A	5 - A		100	175	25	75	25	25
	SB	3 - A	2 - A	0 - A	2 - A		25	25	25	25	25	25
TH 3/Water St & Saint Olaf Ave W	EB	393 - F	16 - C	19 - C	57 - F	4 - A	50	100	75	175	75	175
	WB	141 - F	-	14 - B	46 - E		25	25	25	25	25	25
	NB	8 - A	1 - A	0 - A	2 - A		25	50	25	25	0	25
	SB	7 - A	0 - A	0 - A	1 - A		25	25	25	25	-	-
TH 3/2nd Ave NW & Heritage Dr/Cannon Ln	NEB	3 - A	1 - A	0 - A	1 - A	2 - A	25	25	-	-	25	25
	NWB	34 - D	31 - D	11 - B	15 - C		50	100	50	100	50	100
	SEB	36 - E	28 - D	6 - A	20 - C		25	50	25	50	25	50
	SWB	6 - A	1 - A	0 - A	2 - A		50	75	-	-	-	-
TH 3/2nd Ave NW & Riverview Dr	NEB	6 - A	1 - A	-	2 - A	1 - A	25	50	-	-	-	-
	SEB	29 - D	-	9 - A	16 - C		50	75	-	-	50	75
	SWB	-	0 - A	0 - A	0 - A		-	-	-	-	-	-

Key takeaways from level of service analysis are:

- Given the free-flow traffic condition on TH 3 (stop signs only on side streets), overall intersection levels of service are at LOS A at each study intersection.
- Stop-controlled approaches do experience peak hour delays.
 - Side street delays are most significant at Saint Olaf Avenue (eastbound approach LOS F and westbound approach LOS E in the PM peak hour). Approach delays are most attributable to left turn movements from Saint Olaf Avenue to TH 3
 - Eastbound left turn movements at Greenvale Avenue experience high delay (LOS E in the AM peak and LOS F in the PM peak), however this is a low volume movement (15 vehicles in the AM peak hour, fewer than 10 vehicles per hour for the remainder of the day)
 - Side street delay is less significant at Heritage Drive/Cannon Lane and Riverview Drive, however left turns operate at LOS D or E in the PM peak hour
- Modeled queue analysis does not reveal widespread queuing issues, however the northbound left turn queue at Greenvale Avenue can exceed storage length at times in the PM peak hour (95th percentile queue exceeds storage length).

Crash Analysis

Crash data from 2021–2025 was collected for the four study intersections along TH 3 to assess the area's crash history and identify current safety concerns. Data was obtained from the Minnesota Department of Transportation (MnDOT) MnCMAT2 crash database. The assessment includes crash rates, crash severity, and crash types.

No fatal crashes were reported at the four study intersections during the analysis period.

Crash Rate Analysis

Crash rate analysis normalizes the number of crashes by the amount of traffic volume experienced at an intersection. Crash rate analysis included an assessment of the critical crash rate. The critical crash rate is a statistically derived crash rate above which a location's observed crash rate is unlikely due to random variation, indicating a potential safety problem.

Table 2 summarizes observed intersection crash rates, average crash rates for similar intersections, the critical crash rate for each intersection, and the critical index at each intersection. The critical index is calculated by dividing the observed crash rate by the critical crash rate. If the critical index is above 1.0, this means the observed crash rate exceeds the critical crash rate, indicating a potential safety concern.

After reviewing crash rates, observed crash rates at the Greenvale Avenue and Heritage Drive/Cannon Lane intersections exceed the critical crash rate. More discussion about crash patterns at study intersections is provided in the next section.

Table 2: Intersection Crash Rates (2021 - 2025)

Intersection	Traffic Control	Total Crashes (2021 - 2025)	Crash Rate				Fatal & Serious Injury Rate			
			Observed Rate	Statewide Average	Critical Rate	Critical Index	Observed Rate	Statewide Average	Critical Rate	Critical Index
Heritage Dr/Cannon Ln	TWSC	11	0.27	0.15	0.25	1.05	0.00	0.41	3.28	0.00
Riverview Dr	TWSC	3	0.05	0.15	0.24	0.23	0.00	0.41	3.53	0.00
St. Olaf Ave W	TWSC	2	0.05	0.15	0.26	0.21	0.00	0.41	3.53	0.00
Greenvale Ave W	TWSC	11	0.33	0.15	0.27	1.22	2.98	0.41	3.73	0.80

Crash Type and Severity Distribution

- The observed distribution of crash types (rear end, angle, etc.) and crash severities is summarized in **Table 3**. Key observations from this analysis are provided below:
- Greenvale Avenue** (crash rate is above the critical crash rate) – Rear end crashes are the most common crash type (7 of 11 reported crashes), with these most frequently occurring on the southbound approach (4 of 7 rear end crashes). Two rear end crashes resulted in possible injuries (no serious injuries).
 - Southbound rear end crash potential may be due to the lack of a southbound right turn lane or motorists stopping quickly due to a pedestrian crossing the roadway. Adding a right turn lane would increase pedestrian crossing distances, likely decreasing pedestrian safety. The overhead RRFB was installed prior to 2017 so there is advance notice to motorists of pedestrians crossing.
 - Three angle crashes were reported, with one resulting in a serious injury
- Heritage Drive/Cannon Lane** (crash rate is above the critical crash rate) – Angle crashes are the most common crash type (6 of 11 reported crashes).
 - Five crashes occurred in 2025, with three of these crashes being angle crashes
 - No crashes resulted in serious injuries
- Crash frequencies are much lower at the Riverview Drive and Saint Olaf Avenue intersections.
 - No crashes resulted in serious injuries

Table 3: Crash Severity and Crash Type

Intersection	Crash Severity					Crash Types								
	F	A	B	C	PDO	Right Angle	Left Turn	Head On	Rear End	Sideswipe Passing	Sideswipe Opposing	Run Off Road	Ped/Bike	Other
Heritage Dr/Cannon Ln	0	0	3	3	5	6	0	0	3	2	0	0	0	0
Riverview Dr	0	0	1	2	0	3	0	0	0	0	0	0	0	0
St. Olaf Ave W	0	0	0	0	2	0	0	0	1	0	0	0	0	1
Greenvale Ave W	0	1	1	2	7	3	0	0	7	0	0	1	0	0

Severity description: F – Fatal, A – Incapacitating injury, B – Non-incapacitating injury, C – Possible injury, PDO – Property Damage Only

Traffic Control Warrant Analysis (2025)

Signal warrant analysis was performed for the four study intersections following guidance in the Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD). All-way stop control was not considered as a viable option at any study intersection given the imbalance of traffic volumes on the major and minor approaches.

Assumptions related to the number of lanes and the consideration of minor approach right turn volumes were made based on guidance in the MnDOT Intersection Control Evaluation Manual.

Full results from warrant analyses for 2025 existing conditions are provided in **Appendix C**, with a summary of results provided below.

- **Greenvale Avenue**

- A traffic signal is warranted under existing traffic volumes. Warrant 1 (8 Hour Warrant), Warrant 2 (4 Hour Warrant), and Warrant 3 (Peak Hour Warrant) are all met.
- Note that a signal would not be warranted if minor approach right turns were omitted from analysis. No dedicated eastbound right turn lane exists today, therefore eastbound right turn volumes were included in the analysis.

- **Saint Olaf Avenue**

- No traffic signal warrants are met with existing traffic volumes.

- **Riverview Drive**

- No traffic signal warrants are met with existing traffic volumes.
- A traffic signal may however be warranted at Riverview Drive if the intersection at Heritage Drive/Cannon Lane were converted to a ¾ access (due to traffic shifting to Riverview Drive).
 - Angle crash history at Heritage Drive/Cannon Lane justifies the consideration of changes at that intersection

- **Heritage Drive/Cannon Lane**

- A traffic signal is warranted under existing traffic volumes. Warrant 1 (8 Hour Warrant), Warrant 2 (4 Hour Warrant), and Warrant 3 (Peak Hour Warrant) are all met.
- Note that a signal would not be warranted if minor approach right turns were omitted from analysis. No dedicated eastbound right turn lane exists today, therefore eastbound right turn volumes were included in analysis.
 - There is a two-way bike lane that prevents right turns from getting around through and left turning vehicles

Potential Intersection Improvements

Based on analysis described above, intersection improvements were considered at the four study intersections. Proposed improvements are described below.

Greenvale Avenue

Traffic analysis revealed an elevated crash rate and poor side street gap availability during high traffic time periods. Intersection improvement alternatives described below are intended to address both of these issues in addition to enhancing multimodal access and safety near the intersection.

Option 1 – Traffic Signal

- A drawing showing this concept is provided in **Figure 5**.
- A signal is warranted under existing traffic volumes and would provide increased traffic control to support pedestrian activity.
 - A traffic signal would meet MnDOT signal spacing guidelines (nearest signal is about 0.4 miles away at 2nd Street, MnDOT standard on TH 3 is 0.25 miles between signals)
- This option also assumes the northbound approach is converted to have a dedicated left turn lane and a shared through/right turn lane. This change is proposed to reduce pedestrian crossing distances on this approach (current configuration has two northbound through lanes and a dedicated left turn lane).
 - Assumes curb extensions on the east side of the intersection, benefitting pedestrians crossing both the north and south legs by reducing crossing distances.
 - The MnDOT corridor study should assess the viability of curb extensions on an arterial roadway that is part of the trunk highway system
- Based on safety research, a traffic signal is estimated to reduce crash potential by around 39% (CMF 7848 from the Crash Modification Factors Clearinghouse). It is assumed that a signal would also be justified by signal warrants in order to provide this safety improvement.
- Traffic operations analysis shows that acceptable operations are expected with signal control and proposed lane revisions (AM peak LOS A, PM peak LOS B).
 - Some longer queues are expected in the PM peak hour, but are not considered to be unacceptable
 - Traffic analysis with projected future traffic volumes may reveal the need for turn lanes not shown in **Figure 5**

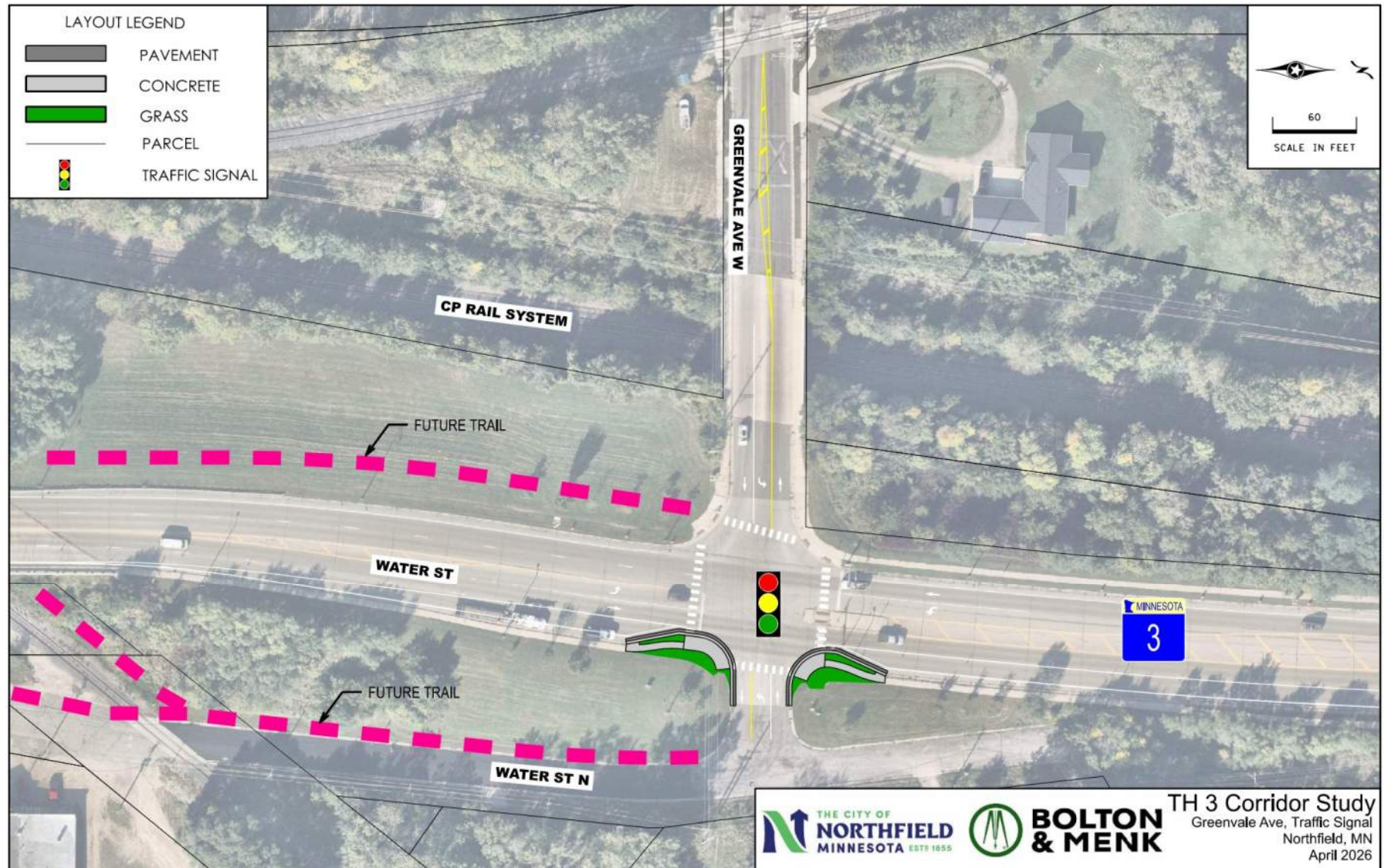
Table 4: Modeled 2025 AM/PM LOS at Greenvale Avenue – Traffic Signal With Lane Reconfiguration

Scenario: 2025 - Signal at Greenvale Ave w/NBLT and one NB shared TH+RT		AM Peak										
		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
		Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
Intersection	Approach	L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/Water St & Greenvale Ave W	EB	16 - B	-	6 - A	7 - A	8 - A	25	50	75	100	75	100
	WB	-	-	3 - A	3 - A		-	-	25	25	25	25
	NB	20 - C	4 - A	-	8 - A		50	125	50	100	50	100
	SB	-	9 - A	6 - A	9 - A		-	-	125	225	125	225

Scenario: 2025 - Signal at Greenvale Ave w/NBLT and one NB shared TH+RT		PM Peak										
		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
		Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
Intersection	Approach	L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/Water St & Greenvale Ave W	EB	22 - C	-	8 - A	9 - A	12 - B	25	50	75	125	75	125
	WB	-	-	3 - A	3 - A		-	-	25	25	25	25
	NB	32 - C	5 - A	10 - B	14 - B		100	225	50	200	50	200
	SB	34 - C	13 - B	9 - A	13 - B		25	25	175	325	175	325

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Figure 5: Traffic Signal Concept at Greenville Avenue

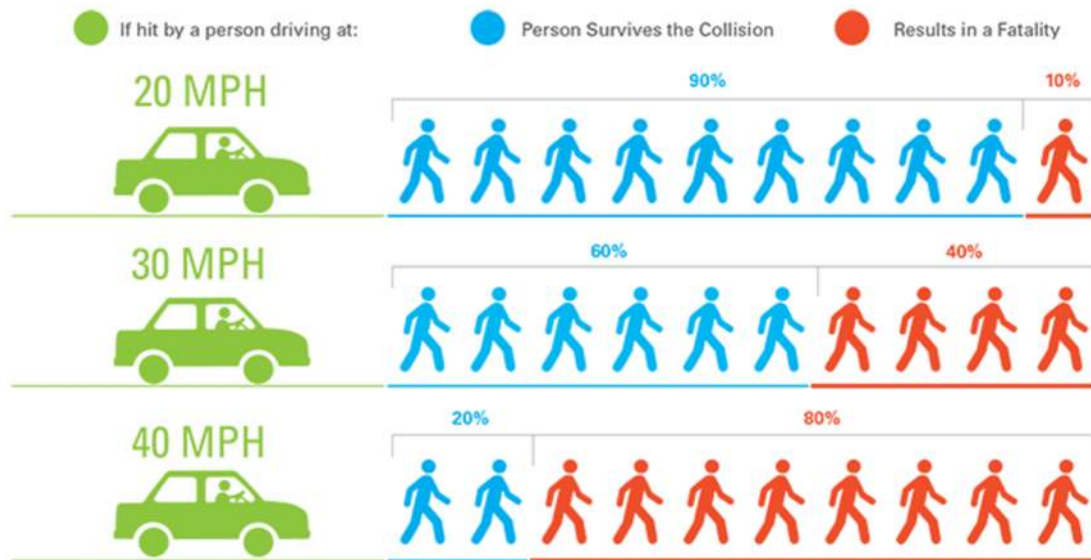


Option 2 – Roundabout

- A drawing showing this concept is provided in **Figure 7**.
- MnDOT typically considers a roundabout justified if signal warrants are met.
 - A traffic signal is warranted under existing traffic volumes. Warrant 1 (8 Hour Warrant), Warrant 2 (4 Hour Warrant), and Warrant 3 (Peak Hour Warrant) are all met
- Roundabouts are considered a proven safety measure by the Federal Highway Administration (FHWA).
 - FHWA data shows roundabouts reduce fatal and injury crash potential by 82% when replacing two-way stop control
 - It should be noted that low-severity crash potential may increase at roundabouts, but fatal and injury crash potential is significantly reduced
 - At intersections where the major roadway carries more than 10,000 vehicles per day, MnDOT crash data shows fatal and serious injury crash rates are 62% lower at roundabouts than at two-way stop controlled intersections (data includes both single and multilane roundabouts)
- Roundabouts also force vehicle speed reductions to traverse the intersection (typical circulating speeds are between 15 and 20 mph).
 - Greenvale Avenue is a speed limit transition area. A roundabout would support a reduction in TH 3 vehicle speeds at this location
 - Speed reduction benefits pedestrians at the intersection, and can offer downstream speed reduction benefits for the TH 3 corridor
 - Traffic speed data collected at the intersection found the following:
 - Typical existing southbound speeds: 43 to 47 mph
 - Typical existing northbound speeds: 35 to 39 mph
 - Research shows that pedestrian fatality risk increases significantly when traffic speeds are higher. **Figure 6** illustrates the likelihood of a pedestrian crash resulting in fatality at different vehicle speeds

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Figure 6: Pedestrian Fatality Risk at Different Vehicle Speeds



Source: San Francisco MTA Vision Zero Action Plan, February 2015

- Traffic operations analysis shows acceptable operations with a single lane roundabout with 2025 traffic demands (LOS C or better throughout the day).
 - Modeling shows acceptable delays but some longer queues on the northbound and southbound approaches similar to the signalized alternative. Analysis with future traffic volumes may reveal a 2x1 roundabout is required to accommodate anticipated traffic demands though a single lane would be preferred
 - The inscribed circle diameter of the roundabout shown in **Figure 7** is large enough to accommodate a 2x1 roundabout, however this would be a small 2x1 roundabout. A larger roundabout would impact the nearby railroad bridge.

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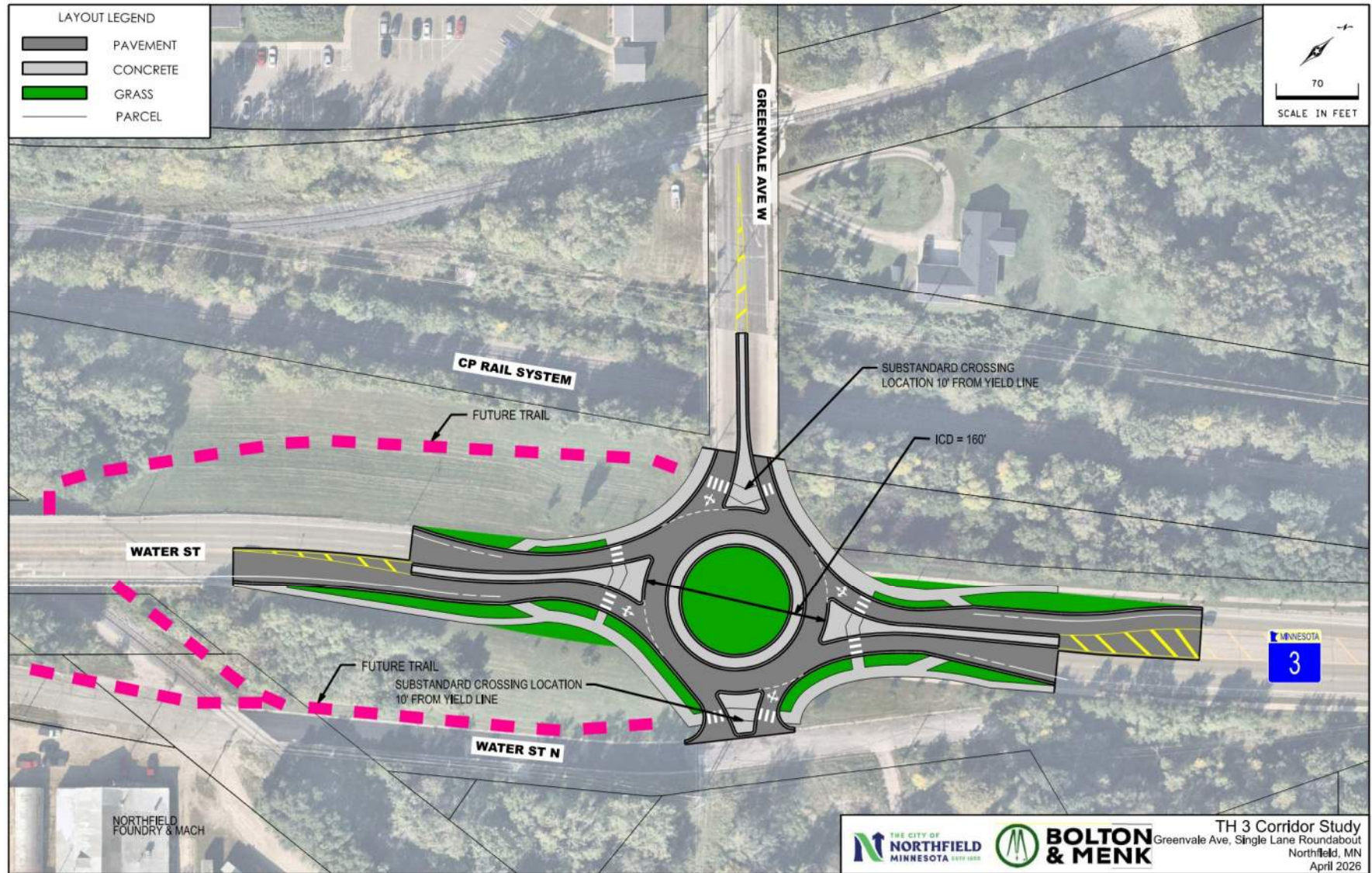
Table 5: Modeled 2025 AM/PM LOS at Greenvale Avenue – Single Lane Roundabout

Scenario: 2025 Single-Lane RAB		AM Peak		
		Traffic Delay (sec/veh)		Traffic Queueing (feet)
Intersection	Approach	Approach (Delay - LOS)	Intersection (Delay - LOS)	95th
TH 3/Water St & Greenvale Ave W	EB	11 - B	12 - B	50
	WB	7 - A		0
	NB	13 - B		175
	SB	12 - B		125

Scenario: 2025 Single-Lane RAB		PM Peak		
		Traffic Delay (sec/veh)		Traffic Queueing (feet)
Intersection	Approach	Approach (Delay - LOS)	Intersection (Delay - LOS)	95th
TH 3/Water St & Greenvale Ave W	EB	15 - B	23 - C	75
	WB	8 - A		0
	NB	17 - C		250
	SB	33 - D		375

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Figure 7: Roundabout Concept at Greenvale Avenue



Option 3 – Curb Extensions with Side Street Stop Control and RRFB

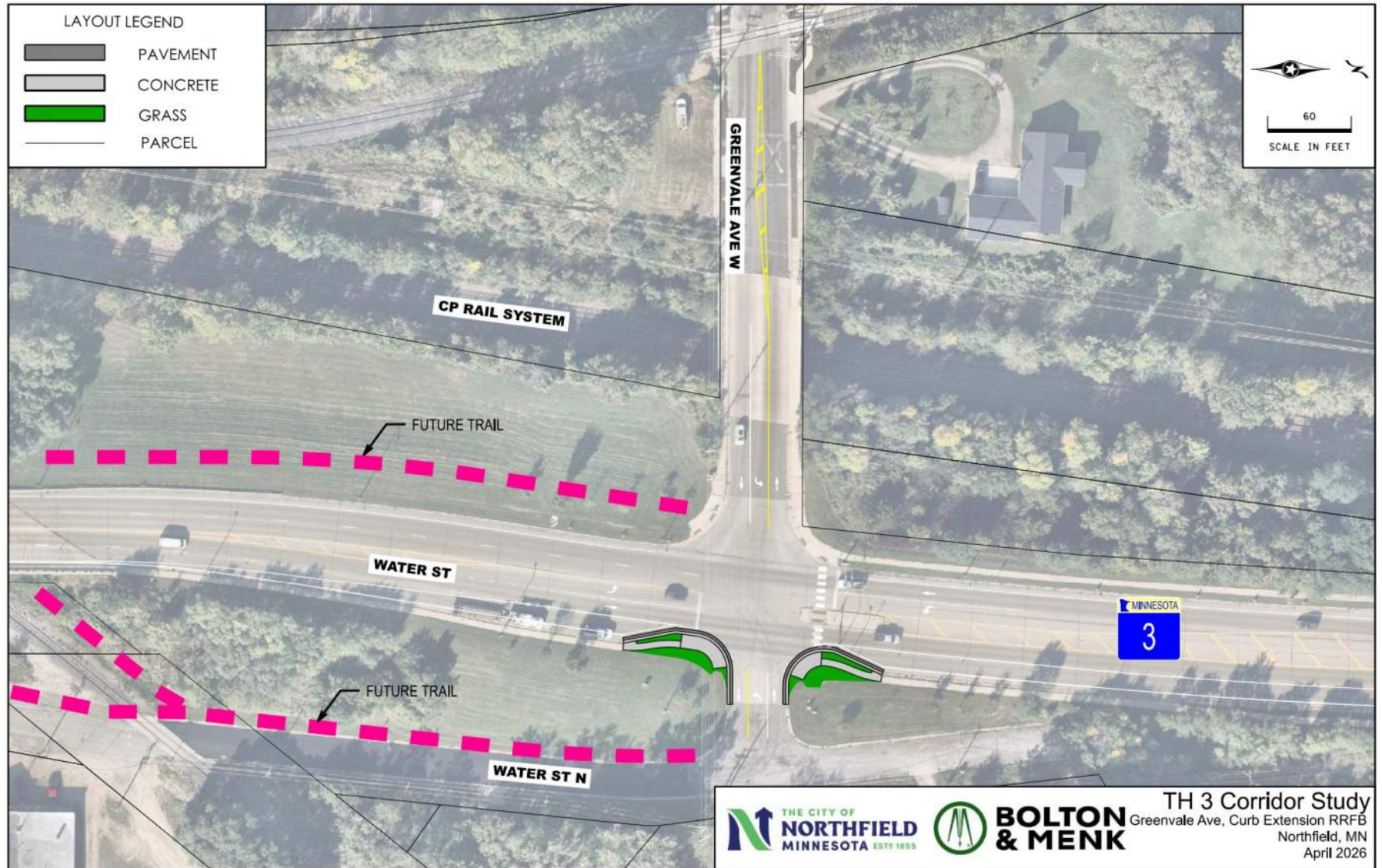
- A drawing showing this concept is provided in **Figure 8**.
- This option would maintain the existing overhead rectangular rapid flashing beacon (RRFB).
- This option has the same geometric features as Option 1, but maintains existing side street stop control rather than adding a traffic signal.
 - The northbound approach is converted to have a dedicated left turn lane and a shared through/right turn lane (current configuration has two northbound through lanes and a dedicated left turn lane)
 - Assumes curb extensions on the east side of the intersection
 - Further study and design should assess the viability of curb extensions on an arterial roadway that is part of the trunk highway system
 - Lane widths could also be narrowed (i.e. convert 12 foot lanes to 11 foot lanes)
- This option would not improve gap availability for side street movements nor would it mitigate southbound rear end crash trends observed in the crash data. It would however benefit pedestrians by reducing crossing distances. Curb extensions, reduced lane widths, and a reduced number of through lanes may also offer a traffic calming (vehicle speed reduction) benefit.
 - Nearly all eastbound approach traffic is making right turns (around 99% of daily traffic on the eastbound approach), therefore the through lane reduction for northbound traffic would not impact gap availability for the vast majority of side street movements

Table 6: Modeled 2025 AM/PM LOS at Greenvale Avenue – Curb Extensions With Side Street Stop Control

Scenario: 2025 - EB/WB Stop at Greenvale Ave West w/NBLT and one NB shared TH+RT		AM Peak										
		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/Water St & Greenvale Ave W	EB	50 - F	-	13 - B	17 - C	6 - A	50	125	75	150	75	150
	WB	-	-	5 - A	5 - A		-	-	25	25	25	25
	NB	7 - A	1 - A	-	3 - A		50	100	0	25	0	25
	SB	-	5 - A	0 - A	5 - A		-	-	25	125	25	125

Scenario: 2025 - EB/WB Stop at Greenvale Ave West w/NBLT and one NB shared TH+RT		PM Peak										
		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/Water St & Greenvale Ave W	EB	119 - F	-	6 - A	11 - B	6 - A	25	50	75	100	75	100
	WB	-	-	5 - A	5 - A		-	-	25	25	25	25
	NB	21 - C	1 - A	1 - A	8 - A		100	200	25	125	25	125
	SB	7 - A	2 - A	0 - A	2 - A		25	25	25	50	25	50

Figure 8: Curb Extensions with Side Street Stop Control Concept at Greenvale Avenue



Saint Olaf Avenue

At Saint Olaf Avenue, recorded crash history has been minimal, however side street movements experience significant delays during high traffic time periods. It is often observed that drivers accept more risky traffic gaps when delays are excessive, therefore improvements are being considered as a proactive safety measure.

Option 1 – $\frac{3}{4}$ Access (Maintain Side Street Stop Control)

- A drawing showing this concept is provided in **Figure 9**.
- This option revises intersection access to not permit left turn or through movements from St. Olaf Avenue to TH 3. Northbound and southbound left turns from TH 3 would remain permitted.
 - The eastbound left turn and through movements experience major delay under the existing configuration
 - Compared to existing conditions, the revised access configuration reduces the number of vehicle-to-vehicle conflict points from 32 to 10. It reduces the number of crossing conflict points (typically the most dangerous types of conflicts) from 16 to 2.
 - Restricted access also reduces number of conflict points for pedestrians. Pedestrians have fewer vehicle movements to monitor.
- This concept also includes an overhead rectangular rapid flashing beacon (RRFB), similar to what exists at Greenvale Avenue today. A crosswalk would be added, utilizing the proposed channelizing median as a refuge.
 - An enhanced pedestrian crossing is included in this concept due to the proximity to Saint Olaf College
 - A future study should assess the need for an RRFB at this location. Traffic data for this study was collected in November, which may impact observed walking and biking demand. The need for pedestrian enhancements may also be influenced by decisions made at Greenvale Avenue and elsewhere on the TH 3 corridor
 - FHWA considers RRFBs and refuge islands to be proven safety countermeasures.
 - FHWA data shows that RRFBs reduce pedestrian crash potential by 47% and typically result in vehicle yielding rates over 90%.
 - FHWA data shows that pedestrian refuge islands reduce pedestrian crash potential by 56%
- With a $\frac{3}{4}$ access configuration, all movements are expected to operate at LOS A during the AM and PM peak hours.

Table 7: Modeled 2025 AM/PM LOS at Saint Olaf Avenue – ¾ Access

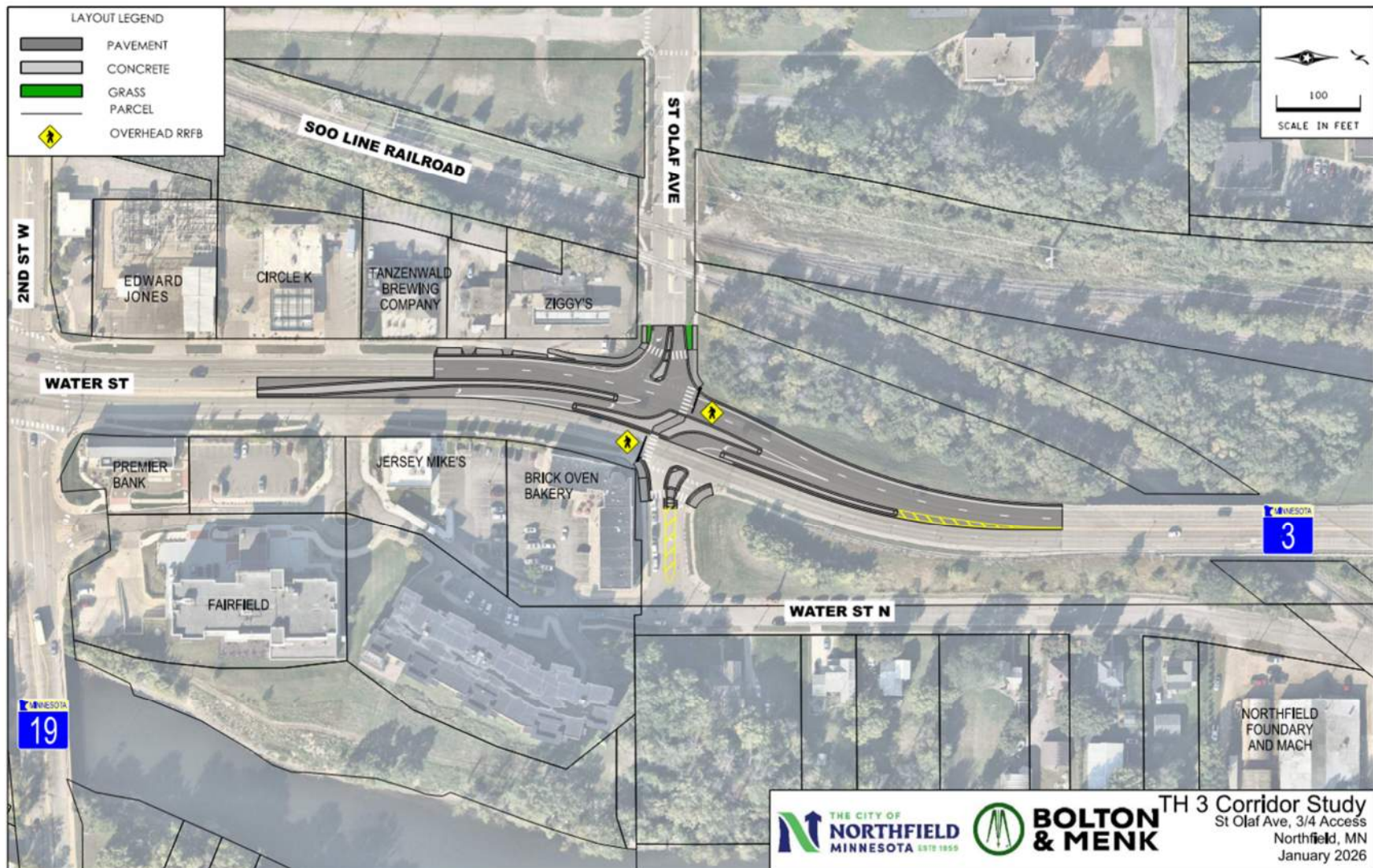
Scenario: 3/4 Access at Saint Olaf Ave W		AM Peak										
		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/Water St & Saint Olaf Ave W	EB	-	-	6 - A	6 - A	1 - A	-	-	-	-	50	75
	WB	-	-	4 - A	4 - A		-	-	-	-	25	50
	NB	5 - A	0 - A	0 - A	1 - A		25	50	0	25	0	25
	SB	5 - A	0 - A	0 - A	1 - A		25	25	0	25	0	25

Scenario: 3/4 Access at Saint Olaf Ave W		PM Peak										
		Traffic Delay (sec/veh)					Trafic Queuing (feet)					
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/Water St & Saint Olaf Ave W	EB	-	-	8 - A	8 - A	1 - A	-	-	-	-	50	75
	WB	-	-	6 - A	6 - A		-	-	-	-	25	25
	NB	7 - A	0 - A	0 - A	1 - A		25	50	0	25	-	-
	SB	8 - A	0 - A	0 - A	1 - A		25	25	25	25	-	-

- With access restrictions at Saint Olaf Avenue, some traffic would shift to other intersections, including Greenvale Avenue. High-level analysis at Greenvale Avenue did not find significant operations impacts as a result of these traffic shifts away from Saint Olaf Avenue.
- **Access Impacts to Note** - While this option mitigates side street delays during peak traffic periods and reduces crash potential, impacts to property access may be unacceptable.

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Figure 9: ¾ Access Concept at Saint Olaf Avenue



Option 2 – Roundabout

- A drawing showing this concept is provided in **Figure 10**.
 - The roundabout is shown as a multilane roundabout due to the proximity of the signal at TH 3/TH 19/2nd St which complicates the ability to transition to a single lane roundabout at the intersection of TH 3/St Olaf Ave. The signal includes two through lanes on northbound TH 3 and two through lanes on southbound TH 3 to the south of St Olaf Ave. The ability to taper to one through lane in each direction and provide the necessary queue storage may not be possible in the approximately 625 feet available between the two intersections. This will need to be verified with forecast volumes at both intersections
 - The roundabout may be possible but there are design concerns related to safety that are apparent, especially when attempting to avoid significant right-of-way takes
 - Pedestrian safety when crossing the south leg is potentially compromised due to the space for vehicles between the pedestrian crossing and the roundabout circulating lanes
 - Pedestrian safety when crossing the south leg is potentially compromised given the high volume of eastbound right turns and skew angle
 - Motorist safety is potentially compromised due to the unusual skew, circulating lane design, and fastest path for the southbound to westbound and southbound through movements
- This option could mitigate impacts to property access associated with Option 1.
- MnDOT typically considers a roundabout justified if signal warrants are met.
 - No signal warrants are met with existing traffic volumes, but a roundabout could potentially be considered justified due to property access needs and safety benefits
- Roundabouts are considered a proven safety measure by the Federal Highway Administration (FHWA).
- Roundabouts typically force vehicle speed reductions to traverse the intersection (typical circulating speeds are between 15 and 20 mph). This is not attainable on the northwest corner.
- Traffic operations analysis shows acceptable operations with a single lane roundabout with 2025 traffic demands (LOS C or better throughout the day).
 - Modeling shows acceptable delays but some longer queues on the northbound and southbound approaches. Analysis with future traffic volumes may reveal a 2x1 roundabout is required to accommodate anticipated traffic demand queues though a single lane would be preferred
 - The multi-lane roundabout as shown in the concept is anticipated to provide similar or improved traffic operations when compared to the single lane roundabout
 - With the excess capacity available with a multi-lane roundabout there may be concern with traffic speeds, lane keeping, and safety until volumes are higher to necessitate the multi-lane design

Table 8: Modeled 2025 AM/PM LOS at Saint Olaf Avenue – Single Lane Roundabout

Scenario: 2025 Single-Lane RAB		AM Peak		
		Traffic Delay (sec/veh)		Traffic Queueing (feet)
Intersection	Approach	Approach (Delay - LOS)	Intersection (Delay - LOS)	95th
TH 3/Water St & Saint Olaf Ave W	EB	9 - A	16 - C	25
	WB	8 - A		25
	NB	17 - C		250
	SB	15 - C		200

Scenario: 2025 Single-Lane RAB		PM Peak		
		Traffic Delay (sec/veh)		Traffic Queueing (feet)
Intersection	Approach	Approach (Delay - LOS)	Intersection (Delay - LOS)	95th
TH 3/Water St & Saint Olaf Ave W	EB	13 - B	23 - C	50
	WB	9 - A		25
	NB	22 - C		325
	SB	27 - D		375

Roundabout Items to Consider in Future Analysis

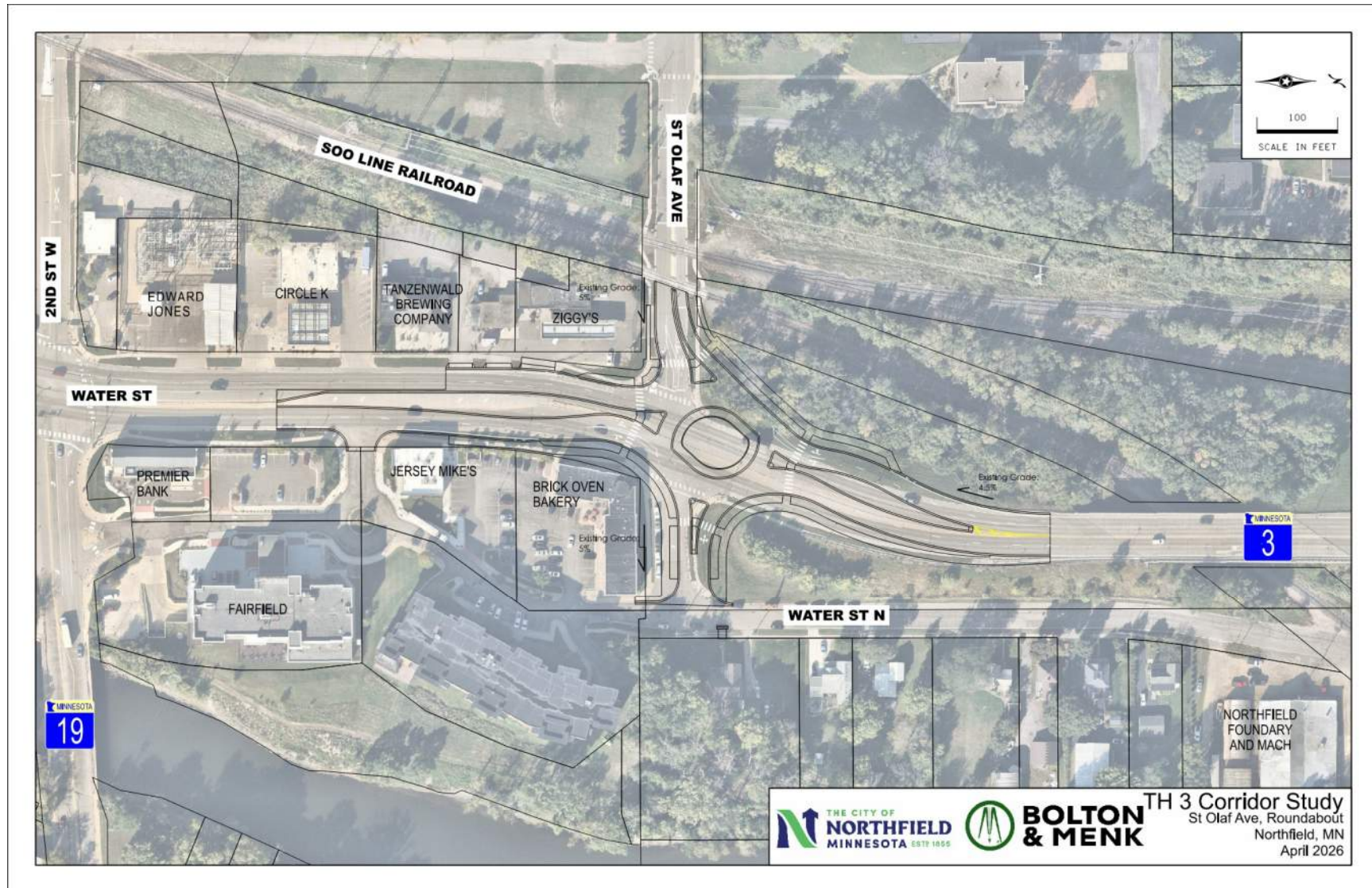
As part of a more detailed future corridor analysis, the following should be considered:

- **Roundabout Sizing:** Since TH 3 is a MnDOT route, a minimum inscribed circle diameter of 150 feet is proposed. This may need to be adjusted based on design vehicles, fastest paths, and updated guidance from MnDOT. A single lane or smaller sized roundabout may work better with the surrounding area.
- **Roundabout Shape:** Additional refinement of the central island and approaches should be considered such as whether an oval or peanut design that may be possible with additional right-of-way. The grades and proximity to the bridge complicate moving the east leg further north as would be preferred for a peanut shaped roundabout.
- **Intersection Skew:** The existing intersection skew is in the opposite direction than is usually conducive for roundabouts, so designing for optimal fastest paths is challenging.
- **Fastest Paths:** The southbound approach has numerous fastest path concerns, specifically the southbound to westbound movement and the southbound through movements. A closer look at grades, right-of-way, and other site constraints is required that is beyond the scope of this study.

- **Queues Near Railroad Crossing:** The potential for queue spillback across the railroad tracks on the west approach should be studied in more detail. A roundabout would however likely reduce queue issues compared to the existing side street stop control.
- **Eastbound Approach:** The intersection skew requires a wide eastbound approach to accommodate trucks. Vehicles larger than a school bus would need use of both eastbound approach lanes to head south on TH 3. A free right movement was considered but removed due to the impacts to pedestrian safety and sight lines.
- **Pedestrian Crossing:** A mid-block pedestrian crossing south of the roundabout or elimination of the south side crossing would be preferred, though removal of it would be in opposition to improved pedestrian access across TH 3.
- **Grades:** A roundabout may need to be shifted to the north, closer to the bridge, making grades for the east approach steeper.
- **Traffic volumes:** A review of projected growth on TH 3 will impact the design need.
- **TH 19/2nd St:** Due to the complexities of a multilane roundabout at TH 3 and St Olaf Ave, and the access concerns, a roundabout should be considered and evaluated at the intersection of TH 3/TH 19/2nd St. This could replace the currently signalized intersection.

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Figure 10: Roundabout Concept at Saint Olaf Avenue



Heritage Drive/Cannon Lane

At Heritage Drive/Cannon Lane, the crash rate exceeds the critical crash rate, with angle crashes being the most common crash type. Five crashes occurred in 2025 alone, with three of these being angle crashes. Improvement options below are intended to reduce crash potential.

Option 1 – Traffic Signal

- A drawing showing this concept is shown in **Figure 11**.
- A traffic signal is warranted with existing traffic volumes.
 - A signal at Heritage Drive/Cannon Lane would be around 0.22 miles from the adjacent signal at Honeylocust Drive. MnDOT signal spacing standards for TH 3 states that signals should be spaced at least 0.25 miles from one another. Since signal spacing standards would nearly be met, MnDOT could potentially approve of a signal at this location. This should be assessed further with MnDOT since TH 3 is their roadway.
- This concept would also extend medians to provide median refuges on both approaches of TH 3.
 - FHWA data shows that pedestrian refuge islands reduce pedestrian crash potential by 56%
- The concept also includes curb extensions on the northeast and southwest quadrants of the intersection to reduce crossing distances.
 - MnDOT will need to be coordinated with to assess the viability of curb extensions on an arterial roadway that is part of the trunk highway system
- Based on safety research, a traffic signal is estimated to reduce crash potential by around 39% (CMF 7848 from the Crash Modification Factors Clearinghouse).
 - With proper signal design and signal timing, traffic signals can substantially reduce angle crash potential. CMF 7849 estimates a 54% reduction in angle crash potential after signal installation. It is assumed that a signal would also be justified by signal warrants in order to provide this safety improvement.
- A traffic signal is expected to result in efficient traffic flow, with AM and PM peak hour LOS A anticipated under 2025 traffic conditions.

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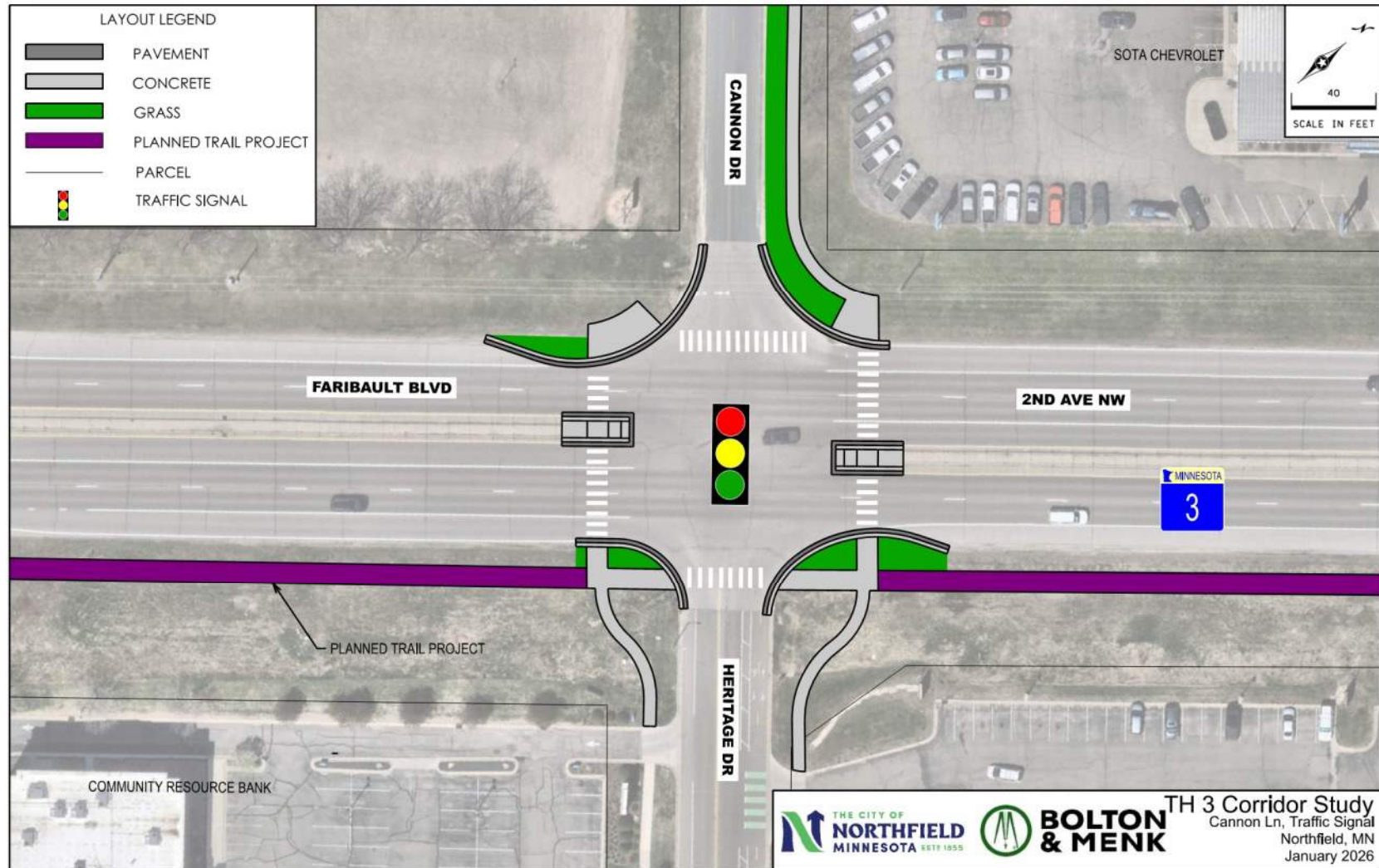
Table 9: Modeled 2025 AM/PM LOS at Heritage Drive/Cannon Lane – Traffic Signal

Scenario: 2025 - Signal at Heritage Dr/Cannon Ln		AM Peak										
Ln		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/2nd Ave NW & Heritage Dr/Cannon Ln	NEB	20 - C	9 - A	2 - A	9 - A	8 - A	25	50	100	150	25	50
	NWB	16 - B	16 - B	6 - A	8 - A		50	75	50	75	50	75
	SEB	20 - C	9 - A	2 - A	10 - B		25	50	25	50	25	50
	SWB	16 - B	16 - B	6 - A	7 - A		50	75	50	100	25	50

Scenario: 2025 - Signal at Heritage Dr/Cannon Ln		PM Peak										
Ln		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/2nd Ave NW & Heritage Dr/Cannon Ln	NEB	26 - C	11 - B	3 - A	11 - B	8 - A	25	25	125	175	25	50
	NWB	14 - B	10 - B	6 - A	8 - A		50	75	50	75	50	75
	SEB	18 - B	18 - B	6 - A	13 - B		25	50	25	50	25	50
	SWB	22 - C	4 - A	1 - A	7 - A		75	125	75	125	25	25

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Figure 11: Traffic Signal Concept at Heritage Drive/Cannon Lane



Option 2 – ¾ Access (Maintain Side Street Stop Control)

- A drawing showing this concept is shown in **Figure 12**
- This option revises intersection access to not permit left turn or through movements from Heritage Drive/Cannon Lane to TH 3. Northbound and southbound left turns from TH 3 would remain permitted.
 - Compared to existing conditions, the revised access configuration reduces the number of vehicle-to-vehicle conflict points from 32 to 10. It reduces the number of crossing conflict points (typically the most dangerous types of conflicts) from 16 to 2.
 - Restricted access also reduces number of conflict points for pedestrians. Pedestrians have fewer vehicle movements to monitor.
- No marked crosswalks are anticipated to be provided across TH 3 in this option.
- Traffic operations analysis shows all intersection movements are expected to operate at LOS A under 2025 AM and PM peak hour traffic volumes.

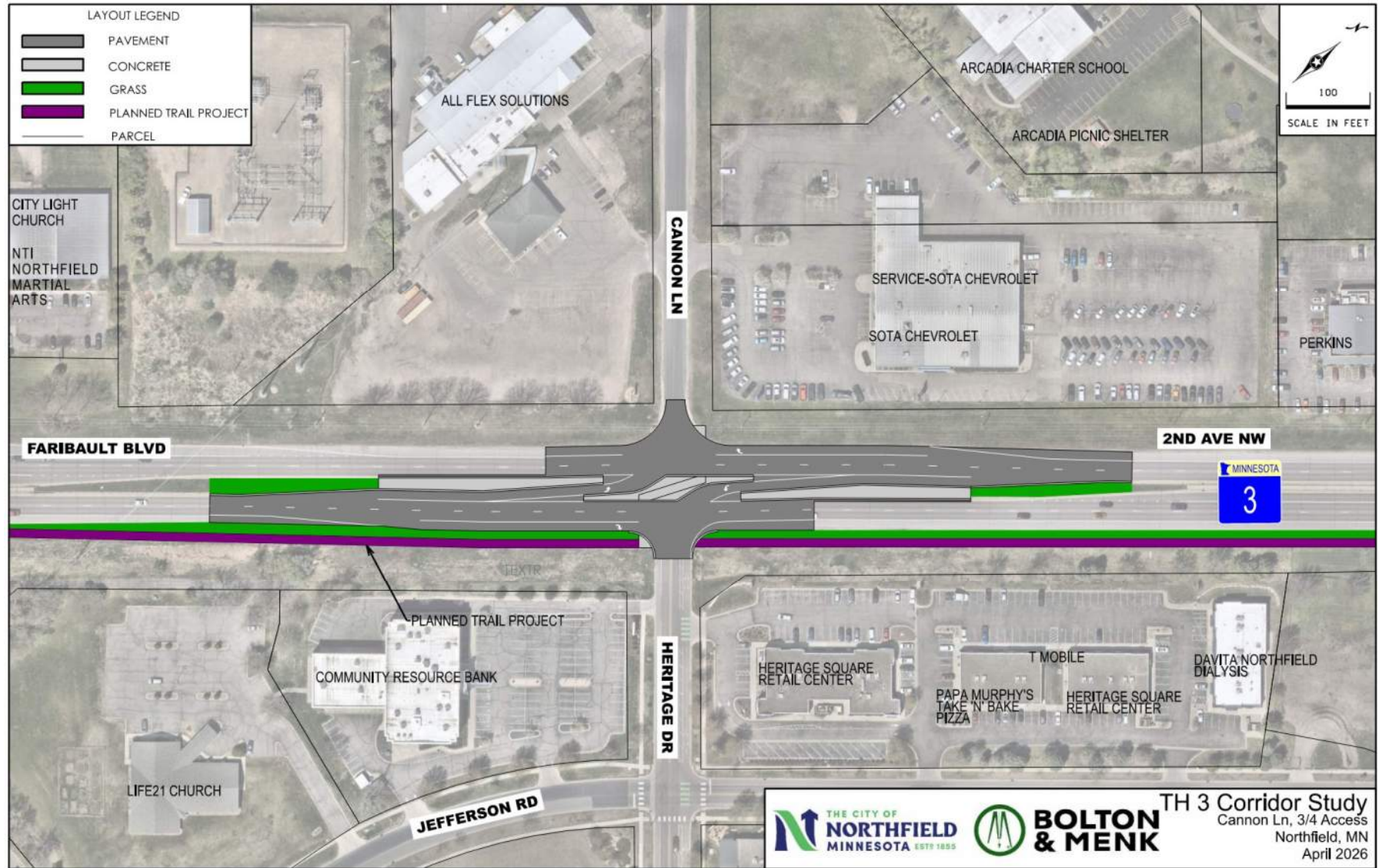
Table 10: Modeled 2025 AM/PM LOS at Heritage Drive/Cannon Lane – ¾ Access

Scenario: 3/4 Access at Heritage Dr/Cannon Ln		AM Peak										
		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/2nd Ave NW & Heritage Dr/Cannon Ln	NEB	2 - A	0 - A	0 - A	1 - A	2 - A	25	50	-	-	0	25
	NWB	-	-	4 - A	4 - A		-	-	-	-	50	50
	SEB	-	-	2 - A	2 - A		-	-	-	-	25	50
	SWB	6 - A	3 - A	2 - A	4 - A		25	50	-	-	-	-

Scenario: 3/4 Access at Heritage Dr/Cannon Ln		PM Peak										
		Traffic Delay (sec/veh)					Traffic Queuing (feet)					
Intersection	Approach	Movement			Approach	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R	(Delay - LOS)		Avg	95th	Avg	95th	Avg	95th
TH 3/2nd Ave NW & Heritage Dr/Cannon Ln	NEB	5 - A	1 - A	0 - A	1 - A	2 - A	25	25	-	-	0	25
	NWB	-	-	4 - A	4 - A		-	-	-	-	50	50
	SEB	-	-	5 - A	5 - A		-	-	-	-	25	50
	SWB	8 - A	3 - A	2 - A	4 - A		50	75	0	25	-	-

- If Heritage Drive/Cannon Lane is converted to a ¾ access, minor street left turns and through movements will need to reroute to adjacent intersections. Analysis based on November 2025 turning movement data suggests a signal would be warranted at Riverview Drive in this scenario.

Figure 12: ¾ Access Concept at Heritage Drive/Cannon Lane



Riverview Drive

At Riverview Drive, side street movements experience some delays during high traffic time periods. The crash rate is not excessive, however all three reported crashes since 2021 were angle crashes, indicating some gap acceptance challenges at this location.

Option 1 – Emergency Vehicle Hybrid Beacon

- This option would add a beacon that is activated by emergency vehicles leaving the nearby Northfield Police Station.
 - A similar beacon is in Cottage Grove on 80th Street S near the Cottage Grove Fire Station #2 (<https://maps.app.goo.gl/S3G6j2sMtN2KDQff8>)
- The primary goal of this alternative is to improve emergency vehicle response times, especially during higher traffic time periods.
- As proposed, an emergency vehicle hybrid beacon would function similarly to a pedestrian hybrid beacon. Hybrid beacons remain dark until actuated, then cycling through flashing yellow, solid yellow, solid red, and flashing red indications. This sequence warns drivers, stops traffic, then allows vehicles to proceed once the intersection is clear.

Figure 13: Emergency Vehicle Hybrid Beacon in Cottage Grove



- Depending on pedestrian accommodations decisions made at nearby adjacent intersections, pedestrian actuation may potentially be integrated into the beacon for it to also serve as a pedestrian beacon.
 - A more in-depth assessment of corridor-wide pedestrian needs should be taken into consideration with MnDOT input
 - If pedestrian actuation is incorporated into the beacon, additional pedestrian enhancements at the intersection should be considered. Such enhancements include extending medians to provide pedestrian refuges and curb extensions. Such a concept is shown in **Figure 14**
 - MnDOT will need to be coordinated with to assess the viability of curb extensions on an arterial roadway that is part of the trunk highway system

Figure 14: Combined Emergency and Pedestrian Hybrid Beacon Concept at Riverview Drive



Option 2 – Traffic Signal

- A drawing showing this concept is shown in **Figure 15**.
- A traffic signal may be warranted at Riverview Drive if access restrictions are implemented at adjacent intersections with backage connectivity.
 - Based on November 2025 traffic data, a signal is warranted if left turn movements from Cannon Lane move to Riverview Drive
- If a signal was added at Riverview Drive, added elements would be desirable to enhance multimodal accessibility and comfort. The concept presented here includes extended medians to serve as refuges and curb extensions.
 - MnDOT will need to be coordinated with to assess the viability of curb extensions on an arterial roadway that is part of the trunk highway system
- A signal is expected to operate at LOS A during both the AM and PM peak hours under 2025 traffic volumes.

Table 11: Modeled 2025 AM/PM LOS at Riverview Drive – Traffic Signal

Scenario: 3/4 Access at Heritage Dr/Cannon Ln & Signal at Riverview		AM Peak										
		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/2nd Ave NW & Riverview Dr	NEB	17 - B	4 - A	-	5 - A	5 - A	25	50	50	100	-	-
	SEB	12 - B	-	3 - A	9 - A		25	75	-	-	25	50
	SWB	-	7 - A	2 - A	7 - A		-	-	75	125	25	75

Scenario: 3/4 Access at Heritage Dr/Cannon Ln & Signal at Riverview		PM Peak										
		Traffic Delay (sec/veh)				Traffic Queuing (feet)						
Intersection	Approach	Movement			Approach (Delay - LOS)	Intersection (Delay - LOS)	Left Turn		Through		Right Turn	
		L	T	R			Avg	95th	Avg	95th	Avg	95th
TH 3/2nd Ave NW & Riverview Dr	NEB	20 - C	4 - A	-	5 - A	5 - A	25	50	50	75	-	-
	SEB	16 - B	-	5 - A	10 - B		25	75	-	-	25	75
	SWB	-	6 - A	1 - A	6 - A		-	-	100	150	25	50

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Figure 15: Traffic Signal Concept at Riverview Drive



Summary

A matrix summarizing traffic analysis and features associated with different intersection improvement options is provided in **Table 12**. Note that cost estimates assume improvements occur in isolation at each intersection (2031 dollars), therefore actual implementation costs may be lower if incorporated into a larger project on Highway 3.

A pedestrian and bicyclist focused evaluation matrix and consistency with strategic plan goals is provided in **Table 13**.

The options are also compared to consistency with pedestrian toolbox tools in **Table 14**.

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Table 12: Intersection Improvement Summary Matrix

Intersection	Option	MnMUTCD Warrant Analysis	Multimodal Accommodations	Vehicle Traffic (2025 Traffic Conditions)	Estimated Cost (2031 dollars)	Items to Verify in Future MnDOT Corridor Study
TH 3 & Greenvale Ave	Existing (Two-Way Stop Control)	Meets signal warrants with existing lane configuration	Existing RRFB with median refuge on north approach	Crash rate (2021-2025) exceeds the critical crash rate, suggesting opportunities for safety improvements Poor eastbound left turn operations during peak periods (AM peak LOS E/PM peak LOS F)	-	-
	Traffic Signal		Added traffic control for TH 3 movements Also adds curb extensions and reduces number of northbound through lanes, reducing pedestrian crossing distances across TH 3 Improves east-west connection with signal-controlled crossing	Estimated 39% reduction in crash potential with traffic signal Acceptable operations (AM peak LOS A, PM peak LOS B) Long modeled NB/SB queues	\$960,000	Future conditions operations analysis to verify lane configuration needs Assess the viability of curb extensions on an arterial roadway that is part of the trunk highway system
	Roundabout		Traffic calming benefit Pedestrian refuges provided on all approaches (on splitter islands) Improves east-west connection with two-stage one-lane low-speed crossings	Estimated 62% to 82% reducing in fatal/serious injury crash potential Acceptable operations (AM peak LOS B, PM peak LOS C) Long modeled NB/SB queues	\$4.2 million	Future conditions operations analysis to verify roundabout sizing (single lane vs. 2x1)
	Curb Extensions with Two Way Stop Control		Adds curb extensions and reduces number of northbound through lanes, reducing pedestrian crossing distances across TH 3	Does not mitigate predominant crash types (southbound rear end crashes) Poor eastbound left turn operations during peak periods (AM peak LOS E/PM peak LOS F)	\$90,000	Assess the viability of curb extensions on an arterial roadway that is part of the trunk highway system
TH 3 & St. Olaf Ave	Existing (Two-Way Stop Control)	Signal warrants not met	Crosswalks present parallel to TH 3, but no other accommodations	Poor eastbound/westbound approach LOS in PM peak hour (EB LOS F, WB LOS E). Significant delays for side street left turns in AM peak hour as well.	-	-
	3/4 Access		Median refuge + RRFB reduce crossing distances and ped/bike crash potential. FHWA data shows median refuges reduce pedestrian crash potential by 23% and RRFBs reduce pedestrian crash potential by 47% Fewer vehicle movements that conflict with pedestrians/bikes Improves east-west connection with two-stage crossing and RRFB	Reduces conflict points from 32 (existing) to 10 (proposed) Efficient traffic flow - AM/PM peak hour LOS A Property access impacts	\$1.7 million	Assess corridor-wide ped/bike demand to determine need for RRFB
	Roundabout		Traffic calming benefit Pedestrian refuges provided on all approaches (on splitter islands) Improves east-west connection with two-stage one-lane low-speed crossings	Estimated 62% to 82% reducing in fatal/serious injury crash potential Acceptable operations (AM and PM peak LOS C) Long modeled NB/SB queues	\$4.5 million	Future conditions operations analysis with the signal at 2 nd St and survey to verify roundabout sizing and site constraints (single lane vs. 2x1)
TH 3 & Riverview Dr	Existing (Two-Way Stop Control)	Signal warrants not met with existing configuration Signal may be warranted if access revisions are made at adjacent intersections	None	Acceptable operations, but some PM peak delays for left turning vehicles on minor approach (LOS D)	-	-
	Emergency Vehicle Hybrid Beacon		Potential to integrate pedestrian pushbuttons into emergency vehicle hybrid beacon Can extend medians to provide refuge islands and add curb extensions to enhance pedestrian crossing and reduce ped/bike crash potential. FHWA data shows median refuges reduce pedestrian crash potential by 23% and RRFBs reduce pedestrian crash potential by 47% Improves east-west connection with two-stage crossing and RRFB	Minimal impacts	\$420,000	Assess corridor-wide ped/bike demand to determine need for pedestrian integration into hybrid beacon Assess the viability of curb extensions on an arterial roadway that is part of the trunk highway system
	Traffic Signal		Added traffic control for TH 3 movements, adds curb extensions and provides median refuges, reducing pedestrian crossing distances across TH 3. FHWA data shows median refuges reduce pedestrian crash potential by 23%. Improves east-west connection with signal-controlled crossing	Efficient traffic flow - AM/PM peak hour LOS A	\$1.2 million	Assess the viability of curb extensions on an arterial roadway that is part of the trunk highway system
TH 3 & Heritage Dr/Cannon Ln	Existing (Two-Way Stop Control)	Meets signal warrants with existing lane configuration	2-way bike lane present on east approach (Heritage Drive), but no other accommodations	Acceptable operations, but some PM peak delays for left turning vehicles on minor approaches (LOS D/E)	-	-
	Traffic Signal		Added traffic control for TH 3 movements, adds curb extensions and provides median refuges, reducing pedestrian crossing distances across TH 3. FHWA data shows median refuges reduce pedestrian crash potential by 23%. Improves east-west connection with signal-controlled crossing	Efficient traffic flow - AM/PM peak hour LOS A	\$1.3 million	Assess signal spacing needs – this intersection is around 0.22 miles from an existing signal at Honeylocust Dr Assess the viability of curb extensions on an arterial roadway that is part of the trunk highway system
	3/4 Access		¾ channelizing island could serve as a pedestrian refuge	Reduces conflict points from 32 (existing) to 10 (proposed) Efficient traffic flow - AM/PM peak hour LOS A	\$2.3 million	-

Table 13: Intersection Improvement Pedestrian/Bicyclist Evaluation Matrix

Intersection	Option	Pedestrian/Bicyclist Factors				Strategic Plan Goals	
		Increased Safety	Reduced Exposure	Improved Connections	Increased Comfort	Upgraded Crossings	Consistency with Plan Improvements
TH 3 & Greenvale Ave	Existing (Two-Way Stop Control)	0	0	0	0	0	0
	Traffic Signal	-	+	+	++	4	+
	Roundabout	+	++	+	+	4	+
	Curb Extensions (Two-Way Stop Control)	+	+	+	+	2	+
TH 3 & St. Olaf Ave	Existing (Two-Way Stop Control)	0	0	0	0	0	0
	3/4 Access	+	+	+	+	1	+
	Roundabout	0	+	+	+	4	+
TH 3 & Riverview Dr	Existing (Two-Way Stop Control)	0	0	0	0	0	0
	Emergency Vehicle Hybrid Beacon	+	+	+	+	2	+
	Traffic Signal	-	+	+	++	3	+
TH 3 & Heritage Dr/Cannon Ln	Existing (Two-Way Stop Control)	0	0	0	0	0	0
	Traffic Signal	-	+	+	++	4	+
	3/4 Access	0	+	+	0	0	0

Table 14: Intersection Improvement Pedestrian Toolbox Matrix

Intersection	Option	Pedestrian Toolbox tools					
		Curb Ramps	Corner Treatments	Crosswalks	Median Refuge Islands	RRFBs	Roundabouts
TH 3 & Greenvale Ave	Existing (Two-Way Stop Control)	X		X	X	X	
	Traffic Signal	X	X	X		Traffic Signal	
	Roundabout	X		X	X	Potential RRFB	X
	Curb Extensions (Two-Way Stop Control)	X	X	X	X	X	
TH 3 & St. Olaf Ave	Existing (Two-Way Stop Control)						
	3/4 Access	X		X	X	Potential RRFB	
	Roundabout	X		X	X		X
TH 3 & Riverview Dr	Existing (Two-Way Stop Control)						
	Emergency Vehicle Hybrid Beacon	X	X	X	X	Hybrid Beacon	
	Traffic Signal	X	X	X	X	Traffic Signal	
TH 3 & Heritage Dr/Cannon Ln	Existing (Two-Way Stop Control)						
	Traffic Signal	X		X		Traffic Signal	
	3/4 Access	X			X		