TRUNK HIGHWAY 29 CORRIDOR STUDY

FINAL REPORT

May 2019

KLJ

ENGINEERING, REIMAGINED

TABLE OF CONTENTS

CHAPTER 1

CHAPTER 2

CHAPTER 3

CHAPTER 4

LIST OF FIGURES

CHAPTER 1

CHAPTER 2

CHAPTER 3

CHAPTER 4

LIST OF TABLES

CHAPTER 1

CHAPTER 2

CHAPTER 3

CHAPTER 4

TRUNK HIGHWAY 29 CORRIDOR STUDY

CHAPTER 1 – EXECUTIVE SUMMARY

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TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

BACKGROUND

This Corridor Study evaluated a 2.9-mile segment of the Trunk Highway (TH) 29 in Alexandria, Minnesota. The study extents are between 3rd Avenue East and County Road (CR) 73 (see Figure 1.2).

Within the study area, the corridor connects downtown Alexandria with the northern outskirts of Alexandria and surrounding communities, serving as an important route for both local traffic and commuters from outside of Alexandria. Speed limits range from 30 miles per hour in the urban section between 3rd Avenue and Nokomis Street and 55 miles per hour in the transitioning and rural sections between Nokomis Street and CR 73.

The corridor has limited pedestrian and bicycle connectivity and accessibility, highlighted by frequent gaps in sidewalks, shared use paths, and shoulder widths. These gaps coupled with traffic volumes over 15,000 vehicles per day in some sections result in uncomfortable conditions for pedestrian and bicyclists.

Beyond multimodal facility gaps, other issues in the study area include anticipated future traffic growth, high access point density, and ROW challenges in the urban core segment. This study is an opportunity to identify and recommend improvements for automobiles, trucks, pedestrians, and bicyclists.

Approach

The approach to the TH 29 Corridor Study included four phases, as shown in Figure 1.1. The study spanned approximately 12 months from beginning to end. It kicked off in April 2018 and concluded in March 2019.

Figure 1.1: Study Approach

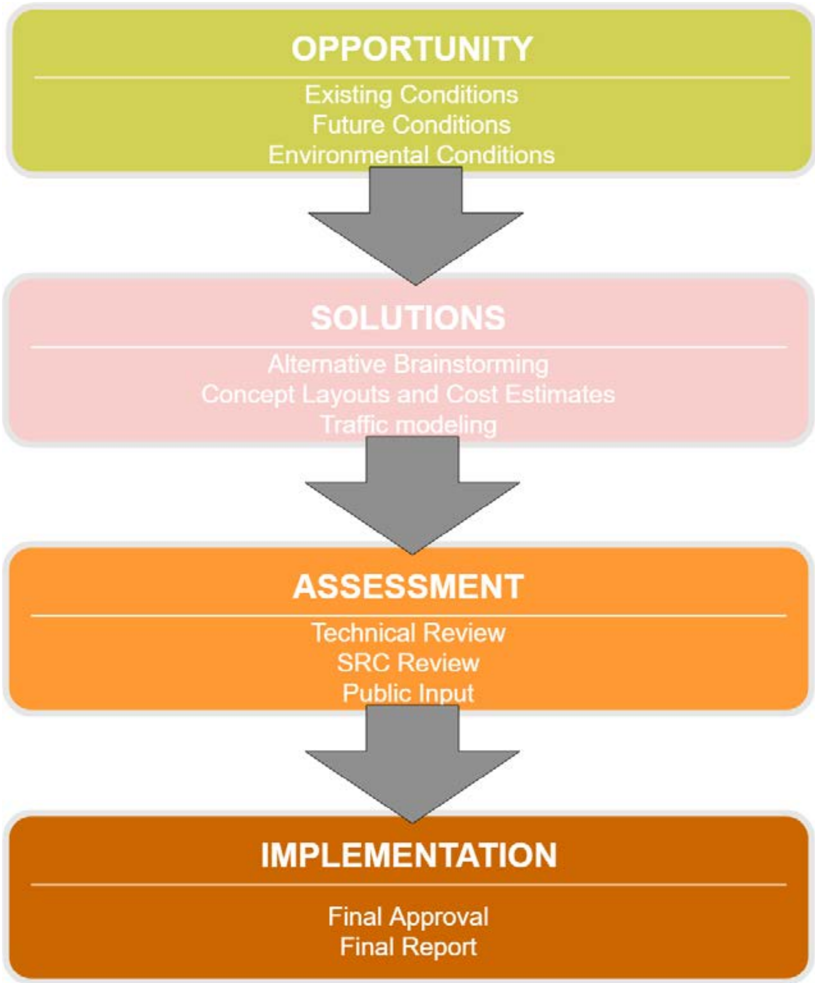

Figure 1.2: Study Area

Public and Stakeholder Involvement

Public and stakeholder involvement occurred regularly throughout the study process and brought together a diverse set of stakeholders and opinions. The following includes a summary of the different stakeholders, process, and marketing plan used.

Timeline and Process

MONTHLY STATUS REPORT

During the study process, the project team briefed the Minnesota Department of Transportation (MnDOT) with monthly progress report.

STUDY REVIEW COMMITTEE (SRC) MEETINGS

Five times throughout the process, the project's Study Review Committee (SRC) met to discuss, review, and refine methods, assumptions, and technical analysis. Members of the Steering Committee included officials from MnDOT, Douglas County, and City of Alexandria. The three meetings covered various topics, discussed below.

- SRC Meeting #1 – the purpose of this meeting was to evaluate and vet traffic growth assumptions and vet traffic projections. This meeting only included SRC members from MnDOT.
- SRC Meeting # 2 – the purpose of this meeting was to discuss the findings from existing and future conditions analysis, including and environmental analysis. The meeting also included a brainstorming workshop to identify potential alternatives to mitigate vetted issues.
- SRC Meeting # 3 – the purpose of this meeting was to presentation of the alternatives and allowed the SRC to review, refine, and rank the alternatives.
- SRC Meeting #4 – the purpose of this meeting was to review the summarized feedback found during SRC Meeting #4, identify which alternatives should be screened out and prepare for the public input meeting.
- SRC Meeting # 5 the purpose of this meeting was to summarize the public comments, collaboratively developed an implementation plan and prepare for final presentations to MnDOT, City of Alexandria City Council and Douglas County Commission.

COMMUNITY ENGAGEMENT MEETINGS

The community engagement process included an open house and formal presentation of issues and potential alternatives to mitigate issues. More than 50 members of the community attended the meeting.

Survey

During the public meeting, the community was shown alternative concepts on large display boards. The attendees were requested to use stickers to identify their most preferred alternative for each part of the study area. The votes collected at the meeting were compiled to develop the community preferred alternative.

Using the first-choice selection, the results were incorporated into the overall score, which averaged the Technical Score, SRC Support Score, and Community Support Score. The full results are included in Appendix A.

Final Presentations

The findings of the report were presented to MnDOT, City of Alexandria City Council and Douglas County Commission for review, comment and approval. This also served as a last opportunity for formal public comments on the study.

Improvements

The following improvement alternatives were selected based on the overall score that is an average of three scores: Technical Score, SRC Score, and Community Score, all weighted equally. Detailed information regarding the scores can be found in the Alternatives Analysis Plan and Implementation Plan Chapter.

Intersection Alternatives: 3rd Avenue and Nokomis Street

Issues include the westbound approach of the intersection currently operating at unacceptable delay, with further deterioration expected by

2045. The overall intersection is expected to operate with unacceptable delays by 2045.

For the intersection of 3rd Avenue and Nokomis Street, a **two-by-two roundabout** received the highest overall score, being the highest ranked option by SRC and the community, and the second highest ranked option (tied with Do Nothing) in terms of technical score. This alternative significantly improves traffic flow and reduces delays by over 50 percent. The splitter islands also reduce the number of conflict points on nearby accesses and serve as pedestrian refuge island.

Table 1.1 - Summary of Intersection Alternatives- 3rd Avenue & Nokomis Street

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
Two-by-two Roundabout	7.4	8.8	5.2	7.1
Major Intersection Improvements	8.1	8.6	1.6	6.1
Do Nothing	7.4	2.0	3.2	4.2

Segment Alternatives: 3rd Avenue to Nokomis Street

The segment between 3rd Avenue and Nokomis Street is an urban segment that experiences the highest volumes of through traffic as well as business traffic, with unacceptable operations expected in the near future. Existing multimodal facility gaps also present a challenge to nonmotorized users, especially those with disabilities.

For the segment between 3rd Avenue and Nokomis Street, **a five-lane section with a shared-use path** received the highest overall score, being the highest ranked option by the SRC and the community, and the second highest ranked option by the SRC and technical score. This alternative increase capacity and improves gap selection for side street movements, and there is a strong community support for improved non-motorized mobility along this segment. Access management associated with this alternative will potentially also reduce the number of conflicts between motorized and non-motorized traffic. It is important to note that spot access management solutions (access removal, consolidation, etc.) are typically more challenging to implement than access management via raised medians due to the required right-of-way negotiation necessary.

Although a five-lane section with shared-use path received the highest overall score, the **Four-lane section with raised median** option was deemed to be the best alternative, contrary to public feedback for the following reasons:

- It was deemed that the access management plan, which is imperative to meet the high standard of safety suggested, would require a raised median. The number of on-site reconfigurations was deemed a major challenge to the project and potentially render the final solution with far less benefits then the raised median option.
- Given the number of crossings currently occurring midblock the raised median option provides a safe pedestrian refuge island option that the TWLTL option did not.
- The raised median increases the utilization at key crossing points making the utilization and success of a roundabout at Lake Street more likely under this alternative. Specifically, the medians would convert most driveways and streets to right-in/right-outs. This would funnel more traffic to the roundabout increasing its utilization. Additionally, the presence of roundabouts at Lake Street and Nokomis means drivers with limited left-turn movements could take a right-turn and make a U-turn at the closest roundabout.

Traffic control opportunities at Lakeview Avenue intersection may be added as part of the project for this segment.

Table 1.2- Summary of Segment Alternatives- 3rd Avenue to Nokomis Street

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
5-Lane Section with Access Management	5.8	8.6	7	7.1
4-Lane Section with Raised Median	6.3	8.4	2.4	5.7
Do Nothing	3.4	2.2	0.6	2.1

Table 1.3- Summary of Intersection Alternatives- TH 29 & Nokomis Street

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
Continuous Roundabout	6.6	9.8	8.4	8.3
Continuous Green-T Intersection	8.7	6.6	1.3	5.5
Do Nothing	4.7	1.0	0.3	2.0

Intersection Alternatives: TH 29 and Nokomis Street

Northbound left turn movements at the intersection currently experience unacceptable delays during the existing PM peak with the drivers finding limited acceptable gaps to make turns due to the uninterrupted flow of traffic travelling southbound. There is also a merging conflict between southbound through vehicles and eastbound right turning vehicles that creates queues extending to Robert Street.

For the intersection alternative, a **continuous roundabout** received the highest overall score, being the highest ranked option by SRC and the community, and the second highest ranked option per the technical score. This alternative significantly improves traffic flow and will reduce injury crash potential. This alternative also serves as a natural traffic calming device in an area where speed differential is a predominant crash trend.

Segment Alternatives: Nokomis Street to McKay Avenue

The segment between Nokomis Street and McKay Avenue is a non-traditional 3 lane section with single southbound and two northbound lanes. The northbound lanes drop to single lane between Northside Drive NE and McKay Avenue. The segment currently operates acceptably but lacks bicycle and pedestrian facilities. The community indicated strong interest for bicycle and pedestrian facility along this segment.

For the segment, the **four-lane section with shared use trail and access management** received the highest overall score, being the highest ranked option in all three categories. The widening of the road coupled with access management improvements will improve traffic operations and safety and supports a low-stress pedestrian and bicycle facility. The alternative also fits well with the alternatives preferred for the rest of the network.

It is important to note that deficient operations are not expected until sometime in the future. Phasing of improvements (i.e. short-term, long-term) will be considered in the next chapter of the report.

Table 1.4- Summary of Segment Alternatives- Nokomis Street to McKay Avenue

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
Four-lane section with shared use trail and access management	7.1	9.0	8.8	8.3
Frontage Road and Shared Use Trail	5.2	7.2	0.8	4.4
Do Nothing	4.3	2.0	0.4	2.2

Segment Alternatives: McKay Avenue to CR 73

The segment between McKay Avenue and CR 74 is a two-lane rural section. The segment currently operates at an acceptable condition but lacks bicycle and pedestrian facilities.

For the segment, a **four-lane section with shared use trail and access management** received the highest overall score, being the highest ranked option in all three categories. The widening of road coupled with access management improvements will improve traffic operations and safety. It also creates low stress pedestrian and bicycle facility. The alternative also fits well with the alternatives preferred for the rest of the network. Project phasing will be considered in the next chapter of the report.

Table 1.5- Summary of Segment Alternative- McKay Avenue to CR 73

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
Four-lane section with shared use trail and access management	6.3	9	9.4	8.2
Frontage Road and Shared Use Trail	6	6.7	0.3	4.3
Do Nothing	4.3	2.3	0.3	2.3

Intersection Alternatives: TH 29 and County Road 73

The intersection is located near an at-grade rail crossing with its westbound approach about 95-feet between the railroad tracks and roadway edge. The intersection is currently stop controlled at CR 73 and experiences long delays and queues because of high vehicular volumes on TH 29. The long queues extend past the railroad tracks during the peak traffic condition, creating a safety concern.

For the intersection, the **continuous T-intersection** received the highest overall score, being the highest ranked option in all three categories. The alternative is expected to reduce the side street vehicular delay, minimizing potential conflicts with the adjacent railroad crossing. Potential conflicts however remain with the railroad crossing due to minor approach stop control. The alternative is also expected to reduce crash potential by eliminating angle crashes. The alternative has no property or right-of-way impacts.

Table 1.6-Summary of Intersection Alternatives- TH 29 & CR 73

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
Contunuous T-Intersection (Unsignalized)	6.4	10.0	9.6	8.7
Do nothing	0	0	0.4	0.1

Implementation Strategies

The SRC and other stakeholders reviewed the alternatives and selected the most preferred alternatives based on the timing of needs. Improvements were divided into three priority categories: Short-term, Mid-term and Long-Term.

Short-Term Improvements

Short-term improvements are intended to mitigate existing deficiencies in the study area. Not that the prioritization of these improvements does not consider funding availability. The following improvements should be made in the short term, or as soon as feasible:

- Intersection of Third Avenue and Nokomis Street
  - Construct multilane roundabout
- Segment between Third Avenue and Nokomis Street
  - Construct four-lane median-divided section
- Intersection of TH 29 and Nokomis Street
  - Construct continuous roundabout
- Intersection of TH 29 and CR 73
  - Construct unsignalized continuous T intersection
- Construct shared-use path on segment between Nokomis Street and CR 73
- Access and turn-lane improvements on segment between Nokomis Street and CR 73

Detailed information regarding the short-term priority can be found in the *Implementation Plan* Chapter.

- The estimated cost for all short-term improvements is $5.9 million

Mid-Term Improvements

Mid-term improvements are short-term projects that provide immediate benefits but because they aren't resolving major deficiencies under existing conditions, could be delayed if funding limitations arise.

The intersection of Third Avenue and Nokomis Street which was included in the short-term improvement projects can also be considered for mid-term improvement given that it is not imperative under existing operations. However, combining this projects with the larger short-term project package has the potential to lead to economy of scales and reduce overall cost of the improvements.

Long-Term Improvements

The long-term improvements are not required for existing or imminent issues, however should be planned and later programmed to mitigate issues that are expected in the future. Traffic and safety conditions should be monitored to determine when these improvements become more urgent. The widening of TH 29 segment from Nokomis Street to CR 73 can be selected as long-term priority since the segment is currently operating at an acceptable condition and mitigation can be delayed until traffic forecasts indicate the need for capacity increase.

- The estimated cost for the widening of TH 29 between Nokomis Street and CR 73 is $7.2 million.

Next Steps

With the completion of this document, the next steps in the improvement process will be preliminary design layout. This would then be followed by final design and construction provided funding is obtained. Construction would likely occur based on need and corridor development.

Figure 1.3: Short-Term Improvement Plan (1 of 2)

Figure 1.4: Short-Term Improvement Plan (2 of 2)

Table 1.7: Planning Level Cost Estimates - Short-Term Plan

ESTIMATE OF QUANTITIES						
Short Term Improvements						
TH 29 Corridor Study						
SPEC	CODE	ITEM DESCRIPTION		QUANTITY	UNIT COST	TOTAL COST
2104	504/00120	REMOVE BITUMINOUS PAVEMENT	SY	5,198.021	$ 3.30	$ 17,153.47
2104	503/00205	SAWING BITUMINOUS PAVEMENT (FULL DEPTH)	LF	1,036.500	$ 1.37	$ 1,420.01
2211	507/00170	AGGREGATE BASE (CV) CLASS 5	CY	16,821.514	$ 30.00	$ 504,645.43
2357	506/00010	BITUMINOUS MATERIAL FOR TACK COAT	GAL	2,523.227	$ 1.06	$ 2,674.62
2360	501/23300	TYPE SP Wearing Course Mixture	TON	19,625.100	$ 55.00	$ 1,079,380.50
2521	518/00030	3" CONCRETE WALK	SF	46,782.189	$ 6.00	$ 280,693.13
2521	518/00040	4" CONCRETE WALK	SF	142,898.058	$ 7.00	$ 1,000,286.40
2531	503/18120	CONCRETE CURB & GUTTER	LF	16,882.647	$ 25.00	$ 422,066.17
		Subtotal	-	-	-	**$ 3,308,319.73**
		20% Earthwork	LS	1.000	$ 661,663.95	$ 661,663.95
		15% Drainage	LS	1.000	$ 496,247.96	$ 496,247.96
		5% Traffic Control	LS	1.000	$ 165,415.99	$ 165,415.99
		3% Signing and Striping	LS	1.000	$ 99,249.59	$ 99,249.59
		2% Turf	LS	1.000	$ 66,166.39	$ 66,166.39
		3% Lighting	LS	1.000	$ 99,249.59	$ 99,249.59
					Total =	$ 4,896,313
					+ 10% Contingency =	$ 5,385,945
					+ 10% Mobilization =	$ 5,924,539

NOTE: Cost Estimates do not include right-of-way costs or city utility costs.

Figure 1.5: Long-Term Improvement Plan

TRUNK HIGHWAY 29 CORRIDOR STUDY

CHAPTER 2 – EXISTING AND FUTURE CONDITIONS

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Table of Contents

List of Figures

List of Tables

Introduction

The purpose of the existing and future conditions report is to evaluate the existing and future conditions of the segment of Trunk Highway (TH) 29 from County Road (CR) 82 (Third Avenue East) to CR 73 in Alexandria, Minnesota. Issues and opportunities identified in this report will be used to develop solutions to improve safety and mitigate traffic deficiencies.

Study Area

The TH 29 study corridor (**Figure 2.1**) is a 2.9-mile corridor between CR 82/ Third Avenue East and CR 73 in Alexandria, Minnesota. The corridor connects Alexandria downtown to the northern outskirts of Alexandria and serves as an important route for local traffic and commuters. Key intersections were identified based on existing daily traffic volumes. Intersections that were identified for analysis are listed below.

- CR 82 (Third Avenue East) - Signalized Control Intersection
- CSAH 42 (Nokomis Street) - Two-way Stop Controlled Intersection
- CSAH 46 (McKay Avenue) - Signalized Control Intersection
- CR 73 - Two-Way Stop Controlled Intersection

Study Background

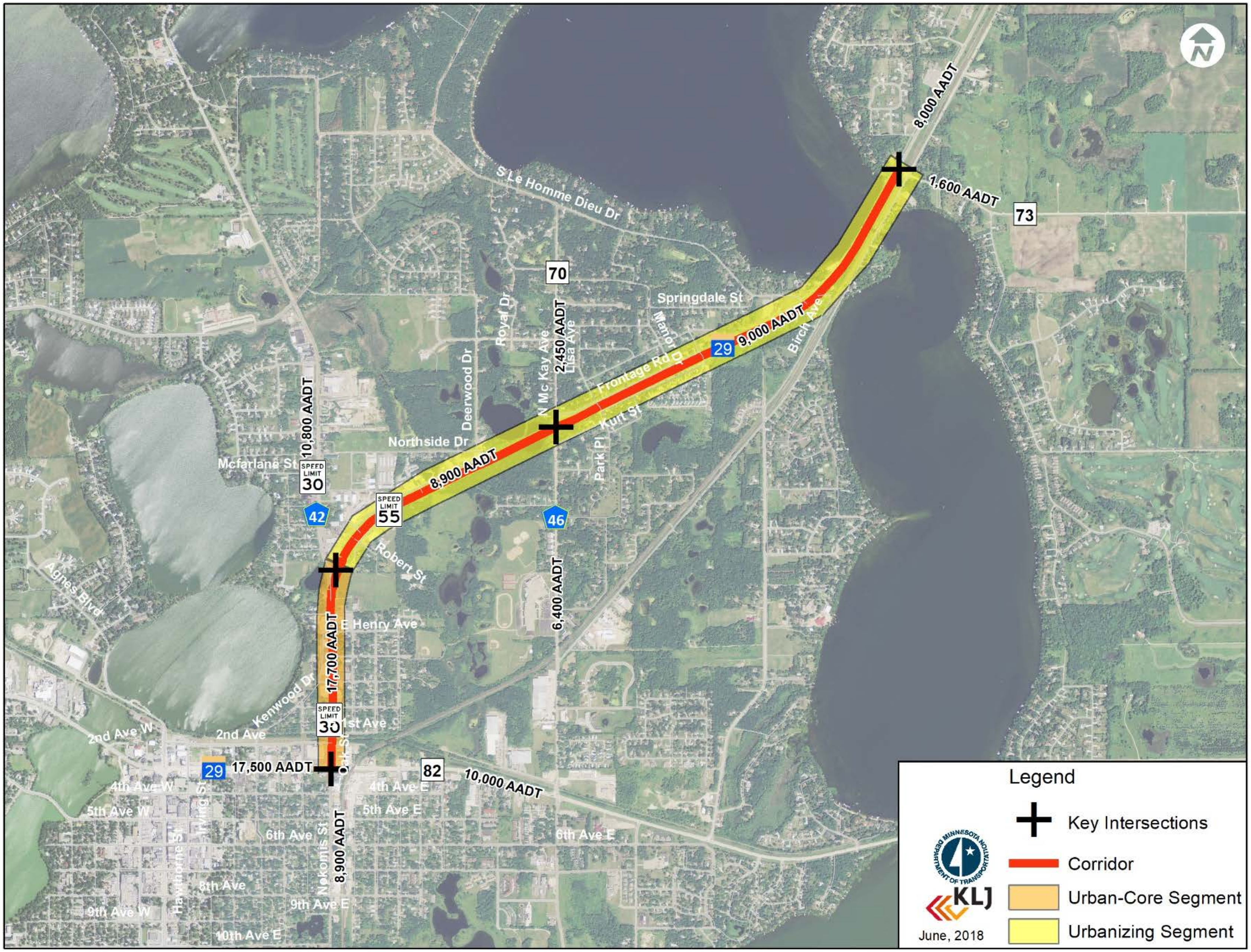
The corridor segment between CR 82/Third Avenue East and CSAH 42 is an urban core segment in this corridor that is fully developed with frequent local streets crossings and access points. The rest of the corridor is an urbanizing corridor.

The urban core segment experiences high volumes of through traffic as well as business traffic. The segment was milled, overlayed, and restriped in 2011 to help improve the traffic flow and decrease the congestion in this area for a short-term traffic improvement. The narrow right-of-way (ROW) widths between CR 82/Third Avenue East and CSAH 42 makes it challenging to balance all the needs for traffic flow, traffic safety, pedestrians, bikers, and businesses. The corridor north of CSAH 42 is a developing area with the potential of about 150-acres of new residential developments along the segment. The developments would generate added traffic to the corridor. Within the anticipated growth in the area, congestion is expected to increase, especially along the southbound lane of the corridor.

The corridor has limited pedestrian and bicycle connectivity and accessibility, highlighted by frequent gaps in sidewalks, shared use paths, and wide shoulders. The corridor's speed limit variation between 30 miles per hour and 55 miles per hour coupled with traffic volumes over 15,000 AADT makes this corridor uncomfortable for pedestrian and bicyclists.

The anticipated future traffic growth and the existing high-density access points coupled with ROW challenges in the urban core segment, and the lack of pedestrian and bicycle connectivity for most of the urbanizing corridor make this corridor a candidate for improvements. These improvements are intended to address and balance the needs of all travel modes: automobiles, trucks, pedestrians, and bicyclists.

Figure 2.1: Study Area



Previous Planning Efforts

TH 29 has been studied as part of larger regional or state planning efforts.

ALEXANDRIA COMPREHENSIVE PLAN

In 2007, the City of Alexandria completed its comprehensive plan, which included a transportation component. There were specific recommendations for TH 29 that acknowledged the need for access management and improved pedestrian facilities. This plan is currently being updated.

Key Takeaway: While outdated, the key recommendations for TH 29 are consistent with other planning studies highlighting the longevity of the key issues along the corridor.

MANUFACTURER'S PERSPECTIVES ON MINNESOTA'S TRANSPORTATION SYSTEM FOR DISTRICT 4

Minnesota Department of Transportation's (MnDOT's) pilot program to learn more about freight transportation resulted in the development of the *Manufacturer's Perspectives on Minnesota's Transportation System for District 4*. Through interviews with freight intensive industries within the District, MnDOT was able to build key relationships to improve stakeholder engagement. They were also able to distill what is most important to manufacturers when it comes to their use of the transportation network. These industries value safety, ease of use, and fewer stops, which are mostly compatible with the intent of this corridor study – to improve safety and operations along TH 29.

Key Takeaway: Manufacturers want to be engaged in future transportation efforts and should be considered during the development of this study.

ALEXANDRIA 2030 TRANSPORTATION STUDY

The *Alexandria 2030 Transportation Study* was completed in 2011 to assist the City of Alexandria, Douglas County and the MnDOT to plan future year transportation decisions and improvements within the greater Alexandria area. While this study is seven years old, it remains the most comprehensive and recent evaluation of transportation issues in the Alexandria area.

This study identified capacity constraints, access management, and speed limit transition areas as the most significant needs along the TH 29 corridor. It found future traffic growth would likely require increased capacity, especially between CSAH 42 and CR 73. The study did not project significant traffic growth along TH 29 with a new I-94 interchange at either CR 106 or CSAH 17 location.

Key Takeaway: The Alexandria 2030 Transportation Study laid the framework for the most significant issues that will be evaluated in this corridor study.

Existing Conditions

Cross Sections

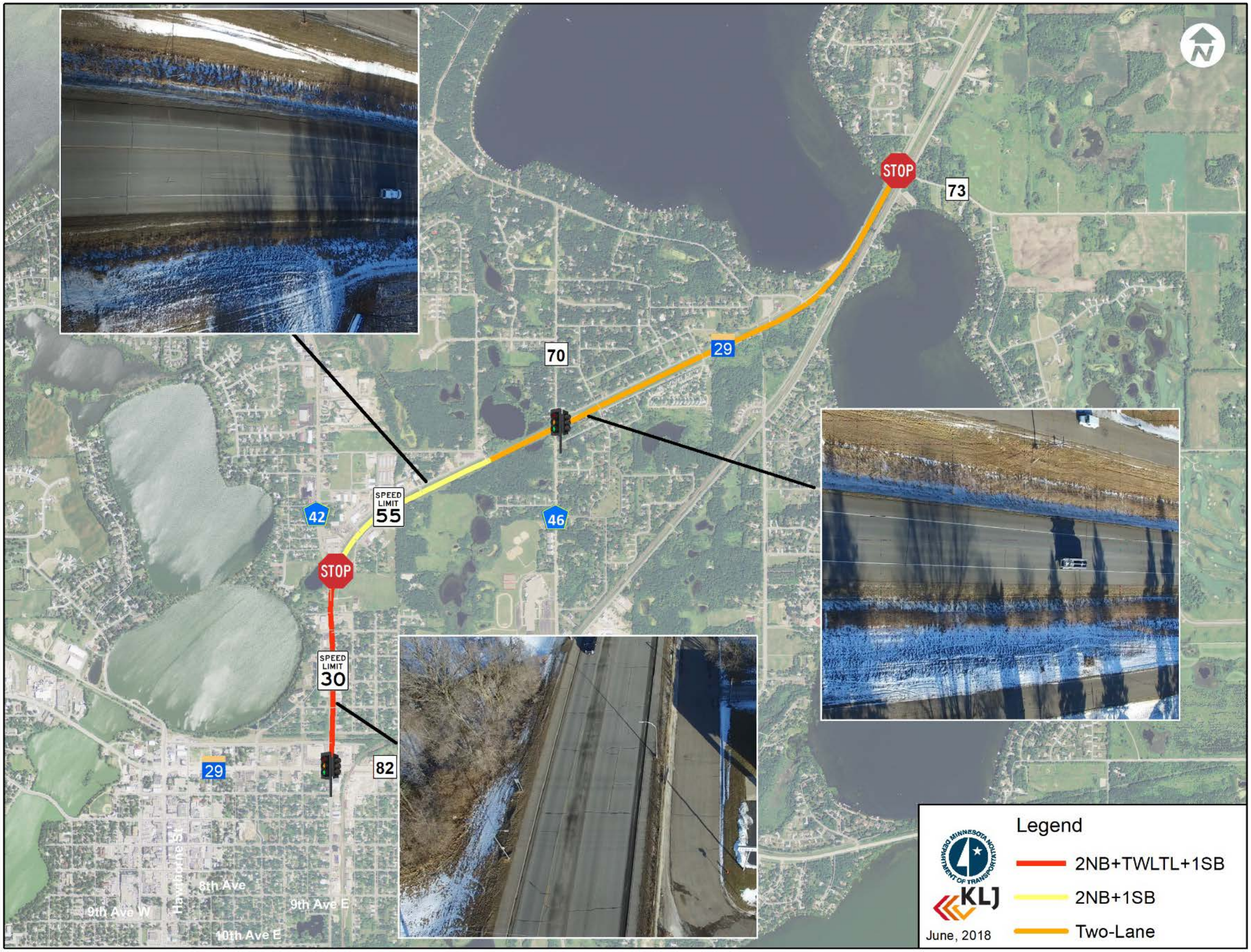
The TH 29 corridor has varying cross sections throughout the corridor (Figure 2.2).

- The segment between CR 82/ Third Avenue East and CSAH 42 consists of a single southbound lane, a two-way left turn lane (TWLTL), and two northbound lanes.
- The segment between CSAH 42 and Northside Drive NE consists of single southbound, and two northbound lanes.
- The rest of the corridor is a 2-lane undivided roadway with turn lanes or bypass lanes at intersections.

Traffic Control

All the intersections of the TH 29 corridor are currently two-way stop controlled, except for Third Avenue/TH 29 and CSAH 46/TH 29 intersection that are currently signalized. The intersection of Third Avenue/TH 29 has pedestrian accommodations consisting of painted crosswalks, pedestrian signal heads, curb ramps, pedestrian-controlled push buttons, and advanced pedestrian signals.

Figure 2.2: Typical Sections Along TH 29



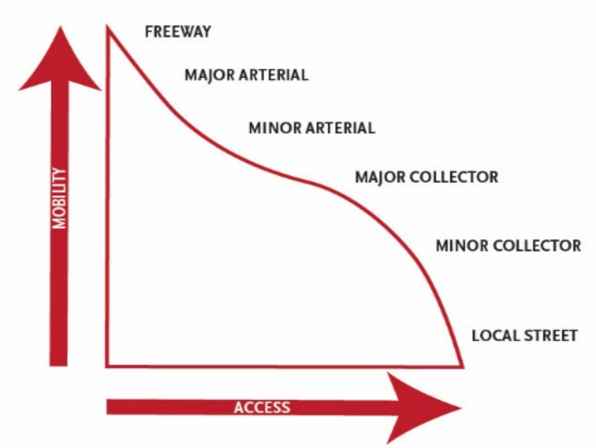
Speeds

The corridor transitions from a rural section with posted speeds of 55 miles per hour to an urban section with posted speeds of 30 miles per hour. This quick transition has been identified in previous studies as a safety concern.

Functional Classification

Roadways must balance access and mobility. The function of the roadway is dependent on its classification; an interstate or freeway prioritizes mobility and has very strict access controls allowing for high speed, while a local road prioritizes access over mobility. Roadways that have a functional classification are tied to the Federal Aid and State Aid highway system, making them eligible for funding from federal and state governments. Figure 2.3 shows the functional classification of the roadways around the corridor.

- TH 29 between CR 82/Third Avenue and CR 73 is classified as a principal arterial that connect large activity centers and attract long trips.
- CSAH 42, north of TH 29 is classified as major collector while CR 73, east of TH 29 is classified as minor collector roadway.
- CR 70, north of TH 29 is classified as major collector and CSAH 46, south of TH 29 is classified as minor arterial.



These classifications will help recommend access reconfigurations and spacings as part of alternative development.

Access Management

Access management is the process of balancing the competing needs of traffic movement and land access. Accesses introduce conflict and friction into the traffic stream. Allowing dense, uncontrolled access spacing results in safety, operational and aesthetic deficiencies for all users.

- According to NCHRP Report 420: Impact of Access Management Techniques, every unsignalized driveway increases the corridor crash rate by approximately two percent and decreases corridor travel speeds by 0.25 miles per hour.
- Research included in the Highway Capacity Manual found that roadway speeds were reduced an average of 2.5 miles per hours for every ten accesses per mile.
- The safety and operational issues caused by dense access spacing potentially makes an area less attractive to developers and the general traveling public. Multiple national studies have shown most people have no problem making a slightly longer trip, including U-turns, to access destination businesses so long as the ride is pleasant and congestion free.

The recommended access management guidelines for this corridor follow MnDOT guidelines. Within the corridor area, the segment between CR 82/Third Avenue East and Carlos Avenue is considered as “Urban Core”. The public street spacing is based on block length and recommended minimum spacing is 440 feet, or 12 access points per mile. The rest of the corridor is considered “Urbanizing” and recommended spacing guideline is 1/2-mile for primary full-movement intersection, and 1/4-mile for secondary intersection for principal arterials.

There were 51 accesses inventoried in the TH 29 corridor. Figure 2.4 is a summary of the accesses within the study area. The accesses were classified based on roadway classification they are located on.

Figure 2.3: Functional Classification

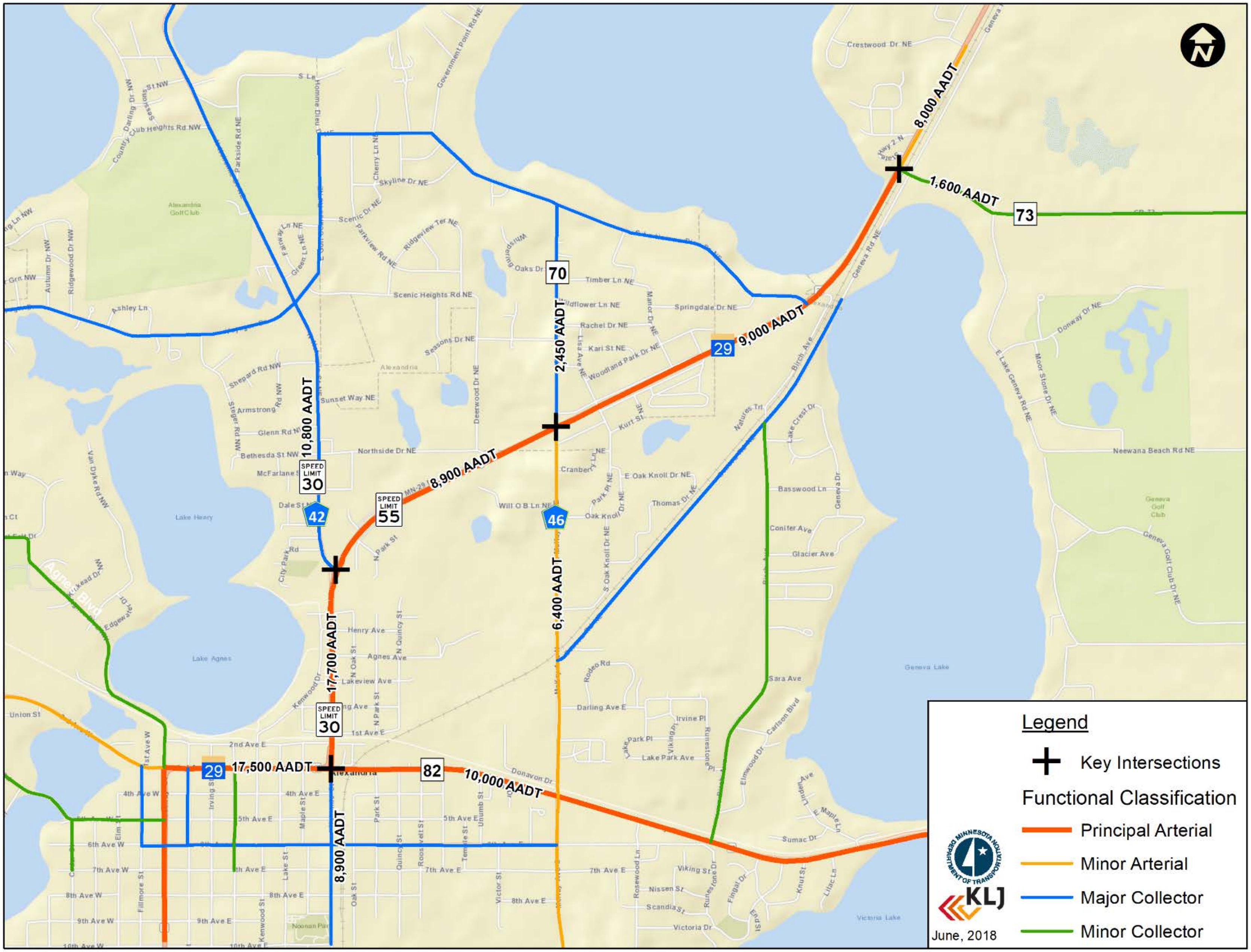


Figure 2.4: Access Locations on TH 29

The access points were aggregated to the roadway segment to identify the most significant needs for access management, most of which are on the urban core of the corridor. The urban core segment from CR 83/Third Avenue East to Carlos Avenue equates to 69 access points per mile. This is more than five times the recommended MnDOT spacings of 12 access per mile for urban core segments. Reducing the number of accesses to MnDOT recommended spacing may reduce crash potential by 50 percent and improve corridor travel speeds by 14-miles per hour according to the study in NCHRP Report 420.

Businesses with redundant driveway access on TH 29 (example, Figure 2.6) can likely be consolidated or better managed by providing access on side street instead of TH 29 if they do not have it already.

Figure 2.6: Redundant driveway access (TH 29 / Lakeview Ave Intersection)

The Elden's Fresh Food grocery store and Super America gas station driveway accesses on TH 29 are 150-foot north of Third Avenue (Figure 2.5). The proximity to a major signalized intersection is a safety risk given queuing and motorist expectance at major signalized intersection and may need to be closed to restrict left turns into and out of the site.

Figure 2.5: Business Driveway proximity to TH 29 / Third Avenue Signalized Intersection

Existing Right-of-Way (ROW)

Douglas County roadway geometric design standards are consistent with MnDOT State Aid design requirements. Compliance with these standards enable roads to perform their intended functions. Roadway and travel lane widths are directly associated with a roadway's ability to carry vehicular traffic. For arterials, a 12-foot travel lane is required for each direction of travel. Roadway widths not meeting design standards may result in decreased performance of a network and additional travel demand on the adjacent roadway network. ROW width includes the minimum property necessary for the recommended roadway design under normal conditions.

The minimum ROW provides sufficient space for the roadway itself, traffic control devices, snow storage, and other maintenance activities. Additional ROW and/or easements may be necessary to accommodate elevation changes as well as turn lanes at intersections, sidewalks and trails, and private utilities.

Along the entire TH 29 corridor, current ROW varies between 66 feet and 150 feet in width. The urban core segment has a ROW between 66 feet and 80 feet. The easement spacings for utilities vary throughout the urban core segment (6 feet to 14 feet between CR 82/Third Avenue East and Second Avenue; 26 feet on west side and 40 feet on east side between First Avenue and Darling Avenue; and 6 feet to 8 feet between Darling Avenue and Carlos Avenue). The corridor north of CSAH 42 intersection is 150-foot wide and adequately accommodates the existing two-lane roadway in this segment.

Figure 2.7: Narrow ROW Width along Urban Core segment of TH 29

Existing Corridor Traffic Capacity and Demand

The roadway capacity is defined as the maximum number of vehicles a street segment can accommodate. Existing traffic capacity and demands were analyzed along the corridor.

The segment between CR 82/Third Avenue East and CSAH 42 is a non-traditional four-lane section with single northbound lane, a TWLTL, and two northbound lanes. The unbalanced lane assignment is not conducive to directional traffic fluctuations throughout the day. Around 65 percent of traffic is travelling southbound in the morning using a single lane, while there are two northbound lanes that are underutilized. The uninterrupted peak hour vehicular flow on TH 29 limits the number of acceptable gaps for minor intersection approaches within the segment.

EXISTING TRAFFIC VOLUMES

To analyze existing and proposed conditions, 12-hour turning movement counts were collected at the four key intersections of TH 29 corridor on a weekday in May 2018. A video detection system was used to capture traffic volume data. The video was reviewed manually to determine turning movement counts. The existing average annual daily traffic (AADT) was collected from Minnesota Department of Transportation (MnDOT) Traffic Data for the intersection approaches and corridor segments based on the most recent counts in 2015. The AM Peak was identified between 7:15 AM and 8:15 AM, while the PM peak was identified between 4:30 PM and 5:30 PM. The turning movements at the key intersection and existing AADT are displayed in Figure 2.8.

The urban core segment of the TH 29 corridor experiences the highest volumes. This is attributed to the connection to Alexandria's downtown and access to businesses and employment areas.

TH 29 serves thousands of additional travelers during peak recreation periods during the summer. Recreation peak periods generally occur between Friday and Sunday resulting in congestion. Since these peak period primarily occur during the summer weekends, significant upgrades to serve recreation peak may not be cost effective since the facility would operate substantially below the capacity for the majority of the year.

The corridor has generally seen more traffic in the southbound direction, especially during the AM peak hour as vehicles are entering Alexandria downtown (Figure 2.9 and Figure 2.10). The dual northbound lane of the corridors urban core segment relieves congestion for northbound traffic. However, the single southbound lane is expected to reach maximum capacity.

Figure 2.8: Existing Turning Movement Counts

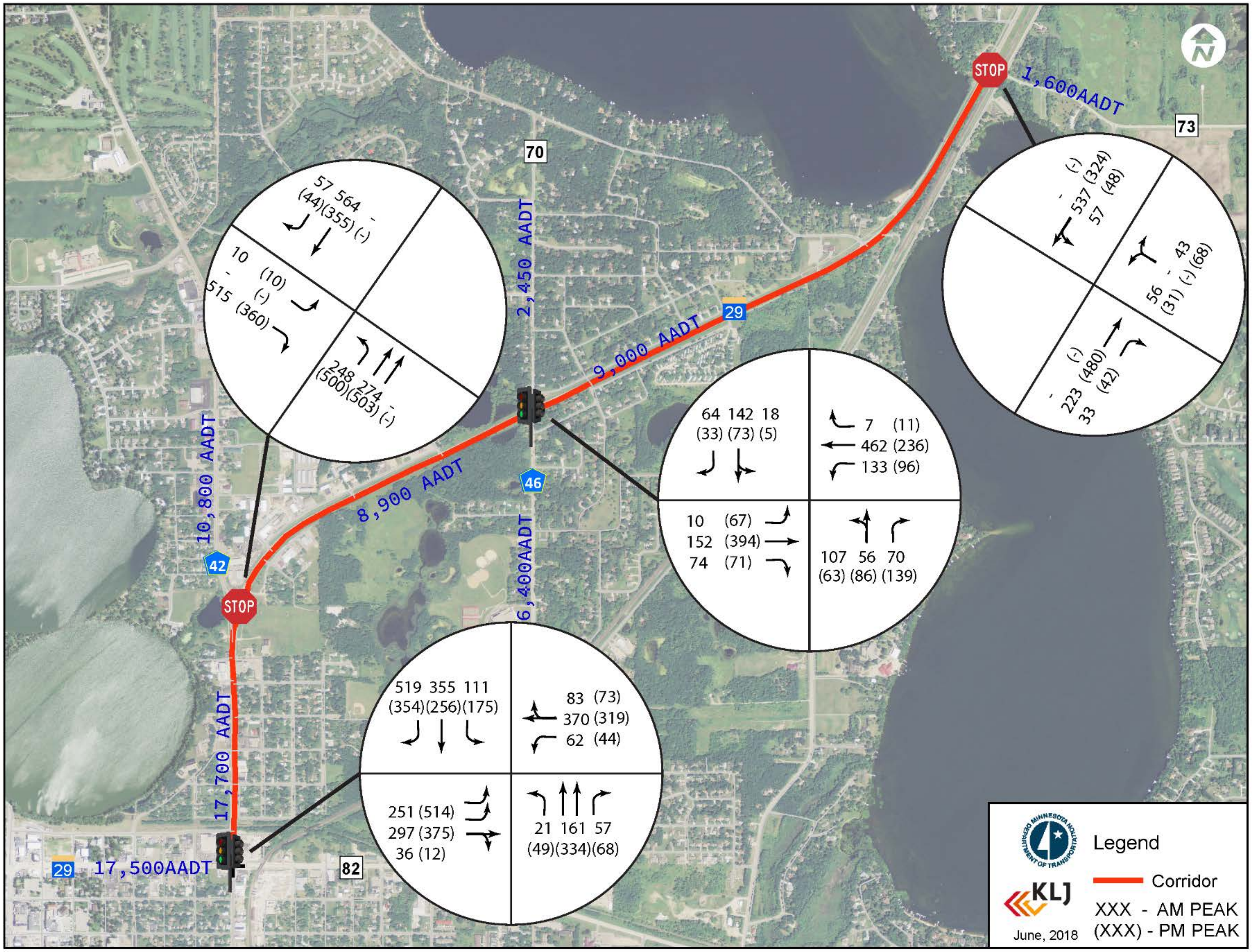


Figure 2.9: Traffic Volumes Along Urban-Core Segment of TH 29

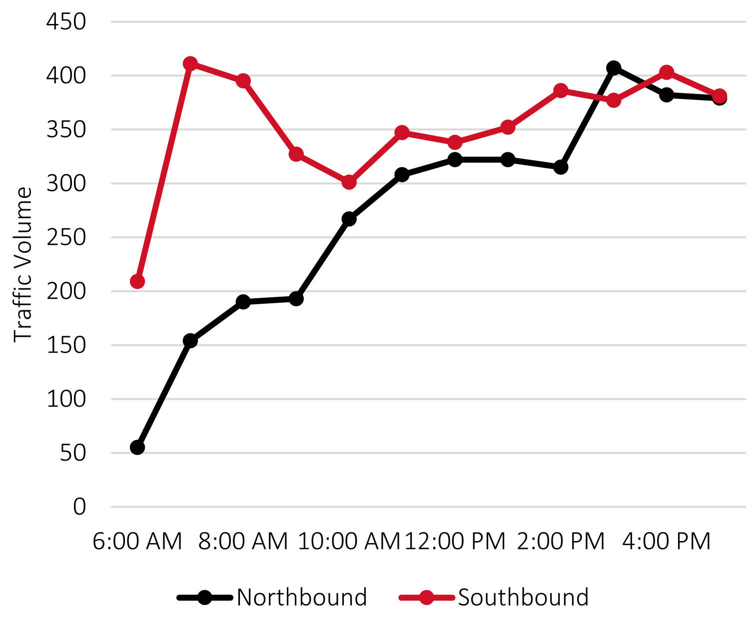
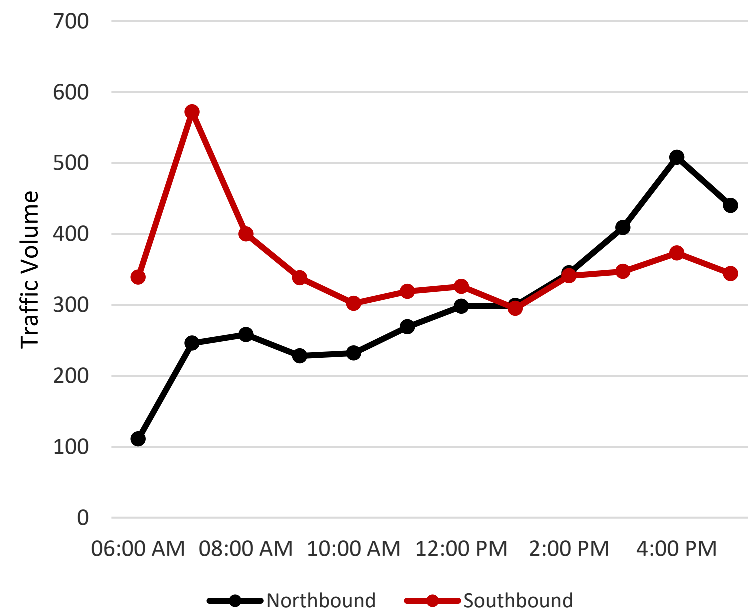


Figure 2.10: Traffic Volumes Along Urbanizing Segment of TH 29



CSAH 42 serves as a major collector route for motorists travelling to and from several business and recreational destinations along the roadway and an alternate route to and from the town of Carlos and Belle River. Almost 50 percent of the northbound traffic on TH 29 turns into CSAH 42 during the PM peak. he south approach of the CSAH 46/TH 29 intersection has seen increased connectivity to major destinations including two new schools and is often seen as a cut-through segment for drivers avoiding the TH 29 corridor.

EXISTING TRUCK VOLUMES

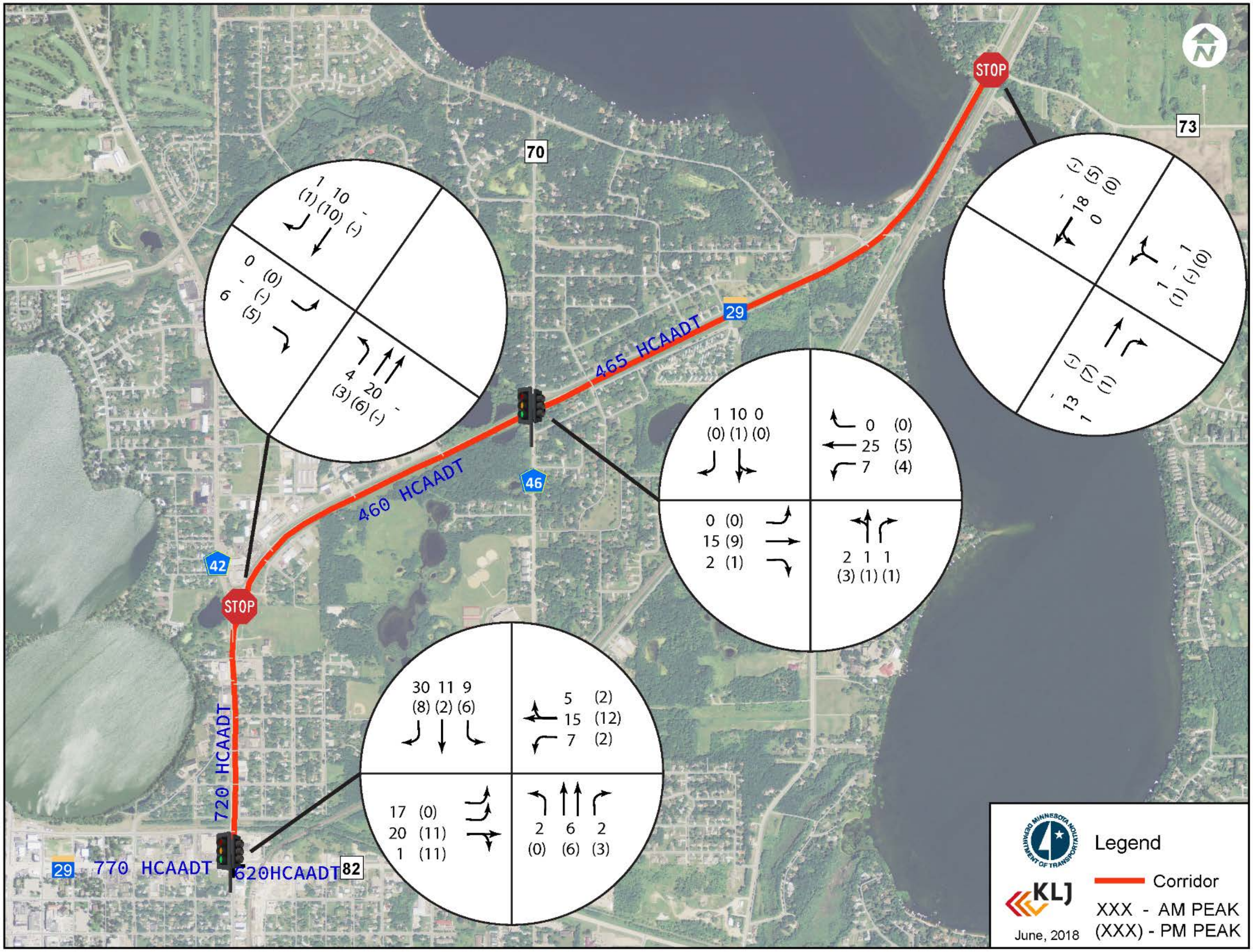
The TH 29 corridor is a designated truck route. On average, the TH 29 corridor truck traffic ranges from four percent in the urban-core segment to five percent along the urbanizing section. Typical urban corridors experience two percent truck traffic. High truck traffic can conflict with the ability to provide pedestrian and bicyclist comfortability. The truck turning movements at the key intersections and existing Heavy Commercial Annual Average Daily Traffic (AADT) are displayed in **Figure 2.11.**

TRAFFIC MODEL DEVELOPMENT

A traffic model was created and analyzed for the traffic operations using Synchro/SimTraffic (V9), which included geometry such as number of lanes, storage lanes, link distances, speed limits, and optimized signal timing parameters. Following the creation of models in Synchro, the files were output to SimTraffic for further analysis.

SimTraffic is a microsimulation software that is a companion to Synchro that uses network seeding and microsimulation to predict and analyze traffic operations. Analysis results are generally based on actual observations of the modeled conditions, not on calculated values based on Highway Capacity Manual (HCM) formulas. The results of the analysis are displayed as measures of effectiveness (MOE). The primary MOEs that are used in the study are delay, level of service (LOS), and queue lengths. For its robust features that includes measuring the full impact of queuing and blocking, SimTraffic was used for reporting the MOE's of the four key intersections in the corridor.

Figure 2.11: Existing Truck Turning Movement Counts



TRAFFIC OPERATIONS AND QUEUING ANALYSIS

The traffic operations and queuing analysis is based on methodologies documented in the Highway Capacity Manual (HCM).

Traffic Operations

Operational analysis results are described in terms of Level of Service (LOS) ranging from "A" to "F" with "A" operating with the least delay and "F" operating with the most delay. At intersections, LOS is based on control delay, or the delay experienced by vehicles slowing down an intersection plus the stop time and the time for a vehicle to speed up and traverse the intersection control into the traffic stream. The average intersection control delay is a volume weighted average of delay experienced by all motorists entering the intersections on all approaches for a signalized, all-way stop intersection, or worst approach for two-way stop control.

Intersection delay and corresponding LOS for signalized and unsignalized all-way stop intersections, as defined by HCM are presented in **Table 2.1** In accordance with MnDOT, the threshold for acceptable level of intersection operations is LOS "D" or better.

Table 2.1: Intersection Control Delay and Level of Service

Level of Service	Average Delay (Seconds/Vehicle)	
	Signalized Intersection	Unsignalized Intersection
A	≤ 10	≤ 10
B	> 10 and ≤ 20	> 10 and ≤ 15
C	> 20 and ≤ 35	> 15 and ≤ 25
D	> 35 and ≤ 55	> 25 and ≤ 35
E	> 55 and ≤ 80	> 35 and ≤ 50
F	> 80	> 50

Queuing Analysis

Queuing of vehicles at intersections can have serious traffic safety implications if expected queues exceed available storage. For example, if projected queuing for a left turning movement exceeds available storage in the turn lane, the queue can extend into the through lane and cause safety concerns with potential rear end crashes. Excessive queuing can also impede business, other private, or public access to and from the road. Queuing analyses can determine whether queues are expected to dissipate during a signal cycle or on stop condition approaches, which can inform on the potential need for additional through lanes or other improvements. The following criteria was used to identify "queuing issues" for movements. A queueing issue was identified if any of the five conditions were met:

» Condition 1: 95th percentile queue length exceeds storage length and the movements operate worse than LOS D.
» Condition 2: Average queue length exceeds storage length.
» Condition 3: 95th percentile queue length blocks upstream full access intersection.
» Condition 4: 95th percentile queue length exceeds 500 feet on a stop-controlled approach.
» Condition 5: 95th percentile through lane queue blocks access to the turn lane bay.

EXISTING TRAFFIC OPERATION RESULT AND SUMMARY

Figure 2.12 shows the summary of AM and PM peak hour intersection delay by intersection and approach, as well as their respective LOS. The reported approach and intersection delay was taken from SimTraffic and is based on the average of five 60-minute simulation runs. See **Appendix A** for Synchro/SimTraffic operations analysis result.

All intersections operate at LOS C or better during AM and PM peak. All approaches of the intersections operate at LOS D or better during the peak periods. However, the westbound approach of TH 29 and CR 82/ Third Avenue experiences a delay nearing LOS E. The intersection of CR 82/ Third Avenue and TH 29 is an important intersection of the corridor because of the multimodal traffic activities at this intersection.

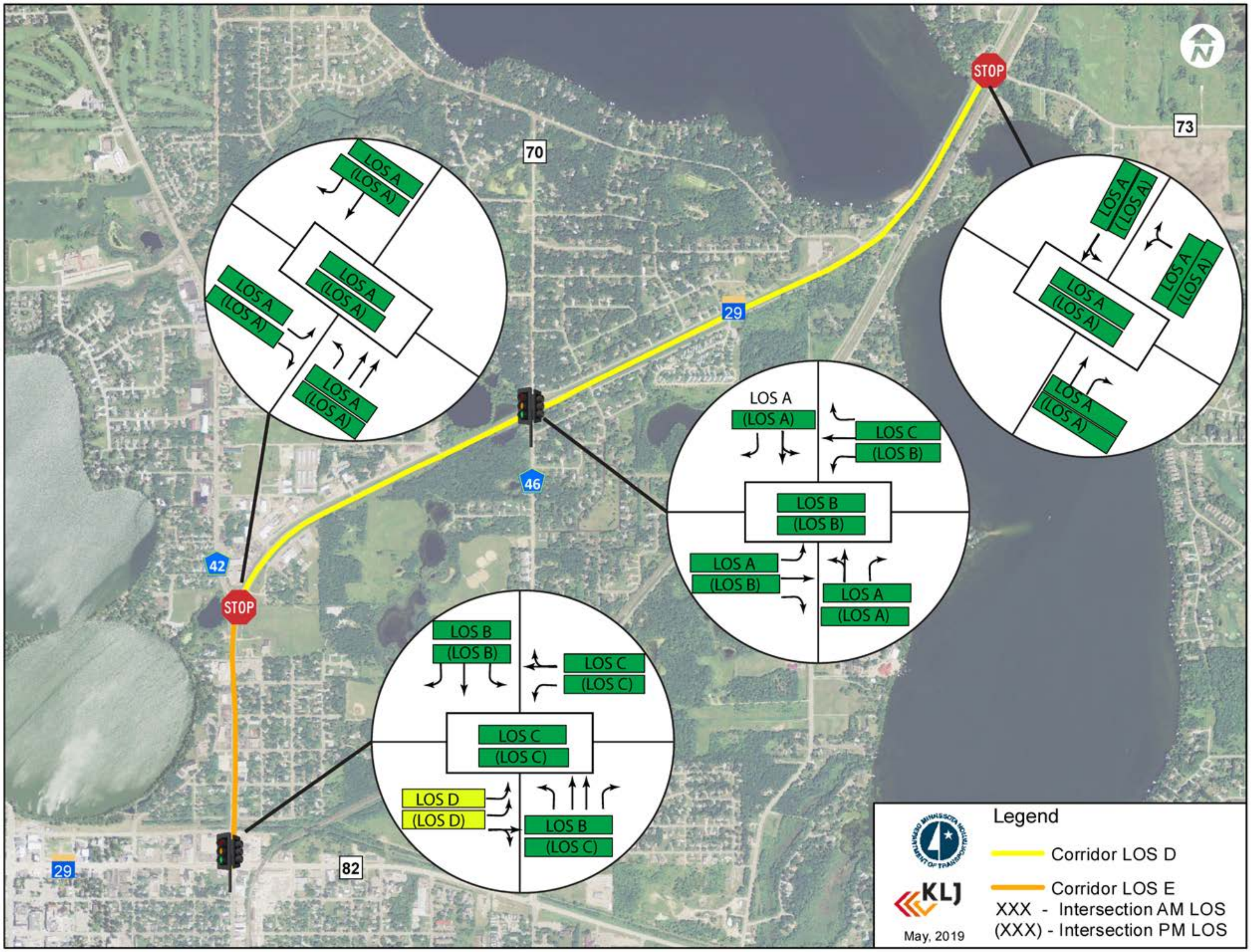
The urban segment from Third Avenue to Nokomis Street consists of unbalanced lane configuration with two northbound lanes and a single southbound lane. The unbalanced lane assignment is not conducive to directional traffic fluctuations throughout the day. Around 65% of traffic is travelling southbound in the morning using a single lane, while the two northbound lanes are underutilized. Due to the unbalanced lane configuration, corridor LOS E occurs on the urban segment in peak conditions and is expected to reach capacity soon. The segments from Nokomis Street to McKay Avenue and McKay Avenue to CR 73 currently operate at corridor LOS D in peak conditions.

EXISTING QUEUING ANALYSIS RESULT AND SUMMARY

Based on queuing analysis methodology previously identified, no significant queuing issues were identified in the existing conditions. The queue length on the northbound left turn approach of CSAH 42 and TH 29 intersection exceeds the available storage length by 32 feet during the PM peak. However, the northbound left turn movements experience an acceptable LOS. The westbound through/right approach queue length is just 12 feet short of exceeding the available storage.

See **Appendix A** for complete Synchro/SimTraffic queuing analysis result.

Figure 2.12: Existing Level of Service by Approach and Intersection



Safety Analysis

Safety is of utmost importance when evaluating the transportation network. Reviewing historic crash information is vital to identifying deficiencies. Crash and traffic volume data between 2012 and 2017 were collected and analyzed for study intersections, as well as for the corridor. The crash data between 2012 and 2015 were collected from Minnesota Crash Mapping Analysis Tool (MnCMAT), and data between 2016 and 2017 were provided by MnDOT. The data was queried to investigate the existing safety analysis of the corridor. Table 2.2 displays the distribution of crash data for the study intersections and segments for the TH 29 corridor. Crash trends are also identified in Figure 2.13.

CRASH SUMMARY

The corridor experienced 70 crashes between 2012 and 2017. Out of 70 crashes, 22 crashes occurred at the key intersections. There were 26 crashes resulting in injury (6 non-incapacitating injury, and 20 possible injury) within the corridor.

Figure 2.14 shows the crash frequencies at the key intersections and segments of the TH 29 corridor. Detailed crash information can be found in Appendix B.

Figure 2.13: Crash Type Summary on TH 29 segments

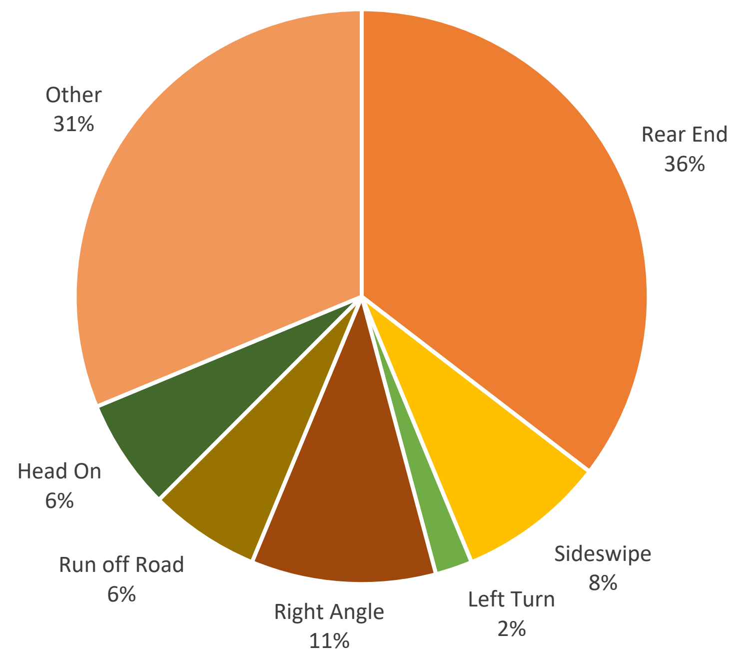


Table 2.2: Intersection and Segment Crash Summary

	Intersection/Segment	Classification	Total Crashes	Injury Crashes	Statewide/ Critical CR	Observed CR
Intersections	CR 82/ Third Avenue East	Signal	11	4	0.70/ 1.02	0.22
	CSAH 42	Urban 2-Way Stop	2	1	0.18/ 0.39	0.06
	CSAH 46	Signal	4	1	0.52/ 0.91	0.16
	CR 73	Rural 2-Way Stop	5	2	0.25/ 0.61	0.31
Segments	Third Avenue East to CSAH 42	Urban 4-Lane Undivided	21	7	0.86/ 1.41	1.03
	CSAH 42 to 1,500 Feet North of Robert Street	Rural 3-Lane Undivided	9	5	0.56/ 1.41	1.44
	1,500 Feet North of Robert Street to CR 73	Rural 2-Lane	18	6	0.35/ 0.64	0.58

Figure 2.14: Crash Frequencies Along TH 29

The crash analysis showed a high number of rear end (24) and right-angle (9) crashes. About 90 percent of the crashes occurred during daylight which indicate that lighting is generally not a safety issue in this corridor.

The National Safety Council (NSC) estimates the economic impact of crashes based on wage and productivity losses, medical and administrative expenses, motor vehicle damage, and employer costs due to injuries. Based on this data, the total costs associated with crashes in the study area were $625,000 annually.

KEY INTERSECTION CRASH TRENDS

CR 82/ Third Avenue

The CR 82/Third Avenue and TH 29 intersection experienced 11 crashes in the 5-year analysis period between 2013 and 2017 of which four crashes resulted in possible injury. The crash rate observed during this period was less than the statewide average for similar type of intersection. Rear-end (4) crashes were the most common type of crashes at this intersection.

CSAH 42

The CSAH 42/TH 29 intersection experienced two crashes in the 5-year analysis period between 2013 and 2017 of which one crash resulted in possible injury. The crash rate observed during this period was less than the statewide average for similar types of intersection.

CSAH 46

The CSAH 46/TH 29 intersection experienced four crashes in the 5-year analysis period between 2012 and 2017 of which one crash resulted in possible injury. The crash rate observed during this period was less than the statewide average for similar types of intersection.

CR 73

The CR 73/TH 29 intersection experienced five crashes in the 5-year analysis period between 2012 and 2017 of which two were possible injury related. The crash rate observed during this period was greater than the statewide average but less than critical crash rate for similar type of intersection. Rear-end (2), and sideswipe (2), and run off road (1) were the different type of crashes at this intersection.

SEGMENT CRASH TRENDS

Third Avenue East to CSAH 42

There were 21 crashes in the urban core segment of TH 29 between CR 82/Third Avenue East and CSAH 42 during the 5-year analysis period. The segment experiences crash rates greater than the statewide average but less than critical crash rates for similar types of segment. Analysis of crash data shows that the most frequent type of crashes in this segment are rear-end (9) and right angle (4). The segment comprises of full access (two-way stops with stops on minor approach) to most of the side street intersections and private driveways along the corridor. The full access intersections and private driveways are in close proximity (well below standard spacing guidelines) and are a safety concern because of the overlapping conflict points.

Figure 2.15: Dense Access Spacing along TH 29 between Third Avenue East and CSAH 42

CSAH 42 to 1,500 feet north of Robert Street

There were nine crashes, including four non-incapacitating injury crashes in the short segment between CSAH 42 and 1,500 feet north of Robert Street during the 5-year analysis period. The segment experiences crash rates greater than critical crash rates for similar type of segment. The analysis did not indicate any trends of the contributing factors for these crashes. However, this is a speed transition segment. The speed limit abruptly transitions to 30 miles per hour from 55 miles per hour just north of CSAH 42. This abrupt change in speed creates potential high deceleration rates among drivers that may contribute to crashes.

1,500 feet north of Robert Street and CR 73

There were 18 crashes, including seven rear-end, three sideswipes and two run off road crashes in this segment during the 5-year analysis period. The segment experiences crash rates greater than average statewide crash rate but less than critical crash rate for similar types of segments. The analysis did not indicate any trends of the contributing factors for these crashes.

Existing Traffic Control

Selecting the appropriate traffic control device requires consideration of traffic patterns, volumes, roadway geometry, lane configurations, and multimodal aspects. The MUTCD provides guidance and standards on the installation of traffic control methods which considers vehicular volume, pedestrian volume, and crash frequency thresholds for multiple roadway contexts. Warrant analysis was completed for the study intersections.

Warrants were based on 14-hour turning movement counts in addition to approach volumes that were collected as part of the weekday tube counts. In accordance with MnDOT guidance for warrant analysis, minor right-turn volumes were excluded for dedicated right-turn lanes and included at 50 percent for shared right lanes. Table 2.3 shows a summary of the traffic control analysis under existing conditions and detailed information can be found in Appendix C.

Table 2.3: Existing Traffic Control Warrants

Intersection	Existing Traffic Control	Warrants Met (Hours Met/Required)					
		1A	1B	2	3	9	MWSA
Third Avenue	Signal	✓	0/8	✓	✓	N/A	✓
CSAH 42	Thru/Stop	0/8	0/8	0/4	0/1	N/A	0/8
CSAH 46	Signal	4/8	4/8	✓	0/1	N/A	4/8
CR 73	Thru/Stop	0/8	3/8	1/4	0/1	✓	0/8

1A: Minimum Vehicular Volume ; 1B: Interruption of Continuous Traffic ; 2: Four-Hour Vehicular Volume ; 3: Peak Hour ; MWSA: Multi-way Stop Application; 9:Intersection near a grade crossing.

Warrant 9 (Intersection Near a Grade Crossing) was considered for the intersection of CR 73/TH 29 since the minor approach of the intersection is in proximity from the railroad tracks. The grade crossing exists on the minor approach controlled by a stop sign and is about 90 feet from the rail road tracks. The peak hour volumes on the major street and the corresponding volumes of the minor street that crosses the railroad tracks suggests that the intersection meets Warrant 9 indicating that a traffic control signal with actuation on the minor street may be applicable.

The intersection of CSAH 42 experiences high northbound left-turn traffic that conflicts with high volume southbound through traffic. Additional warrant analysis was considered using the southbound through and northbound left turn volumes. The analysis showed that the intersection does not meet any warrants for the existing condition.

Warrant analysis for existing conditions show that the existing signal control at the CR 82/Third Ave East and TH 29 and CSAH 46/TH 29 intersections are justifiable. The CSAH 42/TH 29 intersection does not meet signal warrants.

Existing Lighting

The general purpose of roadway lighting is to improve safety, security, and aesthetics for roadway users and associated facilities. Lighting alerts drivers to recognize the roadway geometry and the upstream roadway conditions, especially during dark conditions. This, in turn, increases driver visual comfort and reduces driver fatigue, which contributes measurably to highway safety. The lighting study assists designers in evaluating locations for lighting needs and selecting locations for installing lighting. Lighting warrants give conditions that should be satisfied to justify the installation of lighting. Meeting these warrants does not obligate the State to provide lighting. Local information in addition to that reflected by the warrants, such as roadway geometry, ambient lighting, sight distance, signing, crash rates, or frequent occurrences of fog, ice, or snow, may influence the decision to install lighting.

The lighting warrants used by MnDOT are primarily from American Association of State Highway Transportation Official's (AASHTO's) design guideline in addition to few modifications and additions. The *AASHTO Roadway Lighting Design Guide* gives no specific warrants for continuous lighting of roadways other than freeways but does suggests some general criteria that may apply when considering the installation of lighting. Lighting of at-grade intersections are warranted if the geometric conditions mentioned in the *AASHTO Roadway Design Guide* exist or if one or more conditions found in the *Minnesota Traffic Engineering Manual* exists.

The key intersections currently have lightings installed. Based on the MnDOT design guidelines, CR 82/Third Avenue East and TH 29 and CSAH 46/TH 29 intersections met lighting warrants since they are signalized. The intersection of CSAH 42/TH 29 and CR 73/TH 29 do not meet lighting warrants currently.

Multimodal Facilities

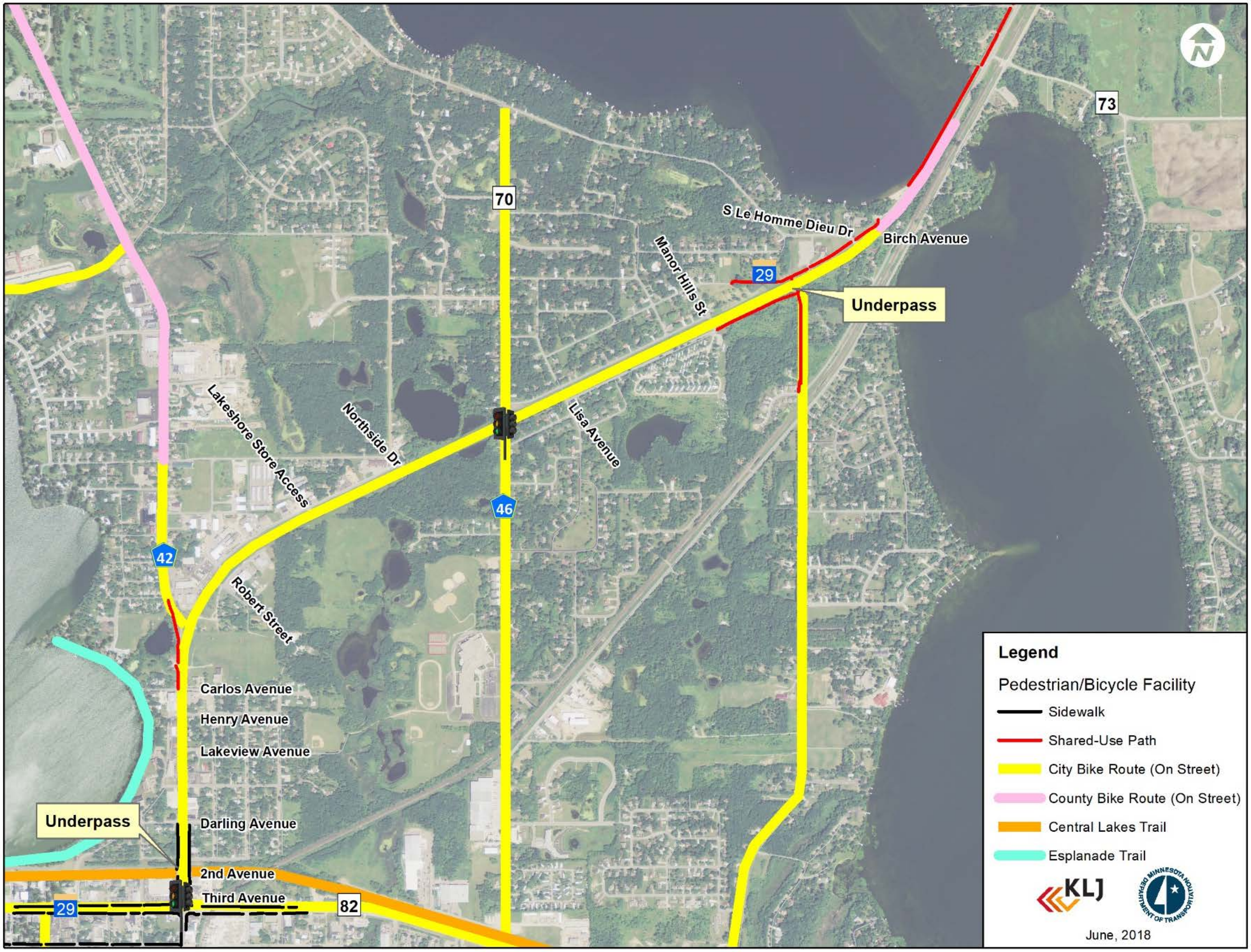
Alternative modes of transportation are important components of the transportation system. Sidewalks are the most fundamental element of the walking network, as they provide an area for pedestrian travel that is separated from vehicle traffic. Enhancing the ability of people to walk or bike involves providing adequate infrastructure and linking urban design, streetscapes and land use to encourage walking and biking. **Figure 2.16** displays the existing pedestrian and bicycle facilities within the corridor.

Complete Streets

In urban areas, walking and biking are important components of the transportation system. Enhancing the ability of travelers to walk or bike involves providing adequate infrastructure and linking urban design, streetscapes, and land use to encourage walking and biking. Designing roadways to accommodate all types of users is commonly termed as "Complete Streets". This type of roadway design offers many benefits:

- Streets designed with sidewalks, raised medians, traffic-calming measures and treatments for travelers with disabilities improves pedestrian safety. Research has shown that sidewalks alone reduce vehicle-pedestrian crashes by 88 percent.
- Multiple studies have found a direct correlation between the availability of walking and biking options and obesity rates. The Centers for Disease Control and Prevention recently named adoption of complete streets policies as a recommended strategy to prevent obesity.
- Complete streets offer inexpensive transportation alternatives to roadways. A recent study found that most facilities spend far more on transportation than food.
- Research has found that people who live in walkable communities are more likely to be socially engaged and trusting than residents living in less walkable communities.

Figure 2.16: Existing Pedestrian and Bicycle Facilities



Walkability

Walkability refers to the attractiveness of an area for pedestrians. Factors that may impact walkability include pedestrian generators and land use diversity; sidewalk presence, quality and width; and the built and natural environment.

PEDESTRIAN AND BICYCLE GENERATORS

Pedestrian and bicycle generators are types of land uses or attractions that people are inclined to walk or bike to access such as a school, park, coffee shop or restaurant. Accessibility to community resources such as schools, colleges, libraries, and parks is an important aspect of any pedestrian and bicycle network. The locations of pedestrian/bicycle generators and pedestrian data are displayed in **Figure 2.17**.

Figure 2.17: Locations of Pedestrian/Bicycle Generators and Counts

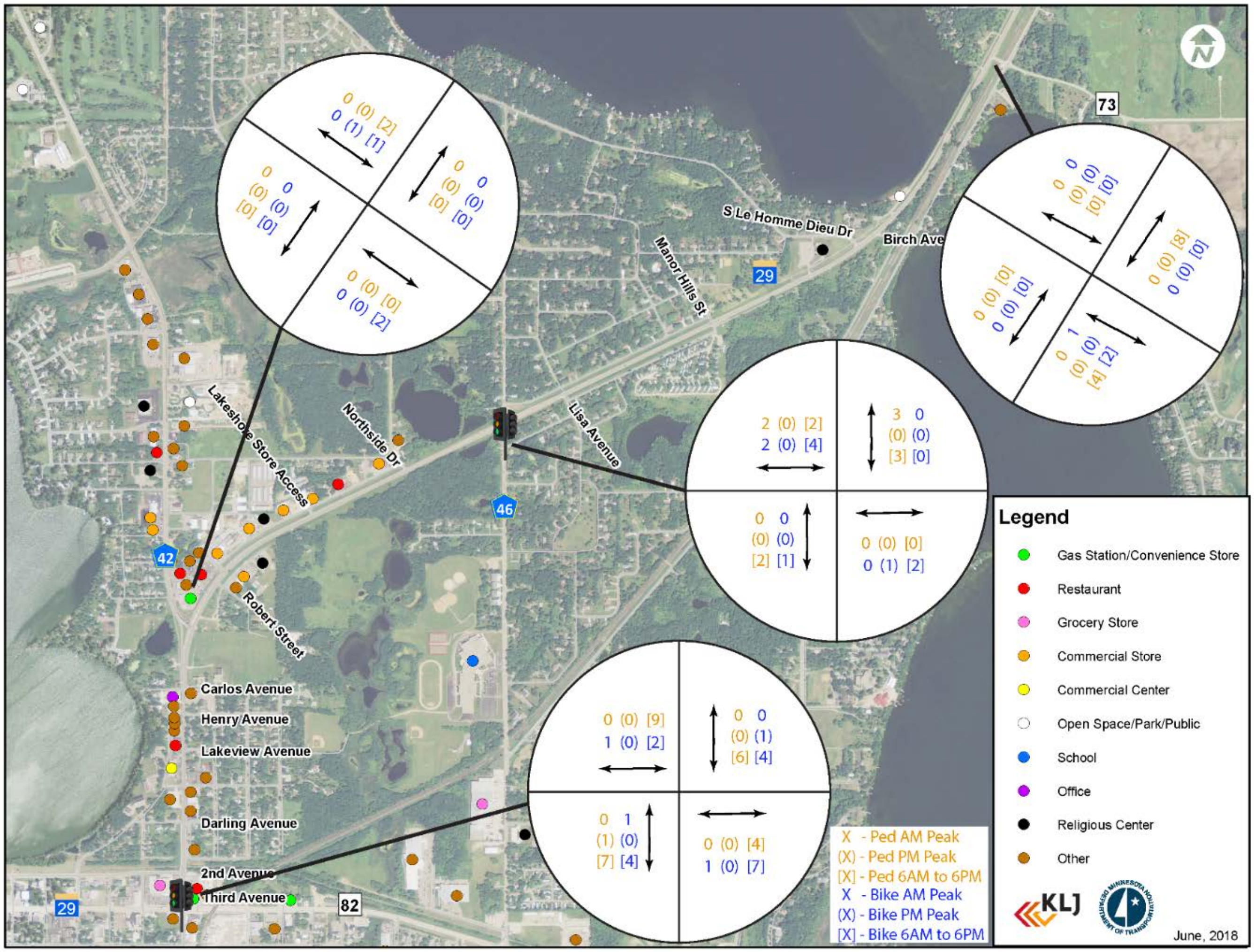
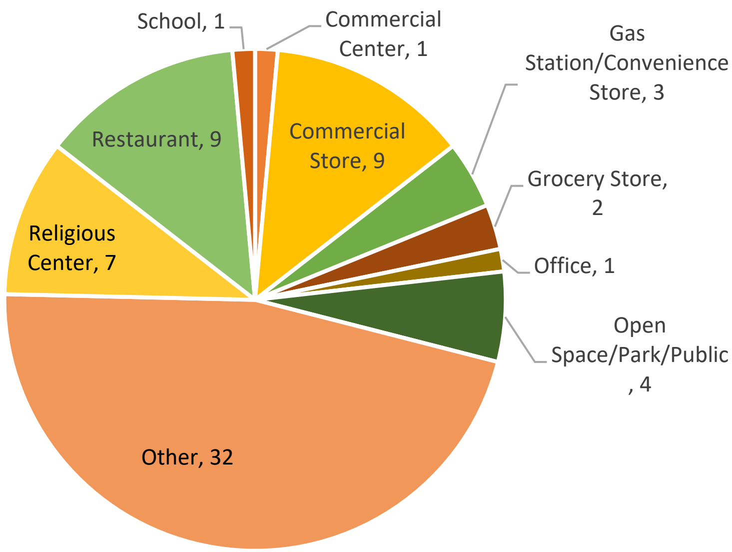


Figure 2.19: Pedestrian and Bicycle Generators by Type



Pedestrian data collected indicates moderate activity along the corridor. 69 generators were identified in and around the corridor. The pedestrian and bicycle network should provide continuous direct routes and convenient connections between destinations such as homes, schools, shopping areas, public services, recreational opportunities and transit. A complete network of on-street bicycling facilities should connect seamlessly to existing and proposed multi-use trails to complete recreational and commuting routes. The existing multimodal network currently has little consistency, with many gaps in some areas of the sidewalk network, and a complete absence of facilities in other areas.

PEDESTRIAN FACILITIES

TH 29 between CR 82/Third Avenue East and Darling Avenue has off-street sidewalks adjacent to the curb line. The sidewalks vary between five and eight feet in width. There are gaps in the off-street pedestrian/bicycle network along the corridor from Darling Avenue to Carlos Avenue, and from CSAH 42 to Manor Hills Street. Barriers to on-street bicycle movement along the corridor include busy intersections, traffic congestion, and narrow or non-existent shoulders.

Figure 2.18: Sidewalks on TH 29 segment between Third Avenue East and Darling Avenue (Source: Google Earth)

While many gaps in the sidewalk network have surfaces on which pedestrians can travel without being on the roadway, these non-official sidewalks may not comply with ADA design standards and can be a physical obstruction for pedestrians with disabilities.

There is shared-use path from Carlos Avenue to CSAH 42 (west side). After a gap, the next shared-use path starts from Manor Hills Street to beyond CR 73 (east side for approximately 1,000 feet transitioning to west side at an underpass).

Americans with Disabilities Act Compliance

The Americans with Disabilities Act (ADA) provides design standards for pedestrian paths and curb ramps in the 2010 ADA Standards for Accessible Design. The basic requirements address width and condition, surfaces, curb ramps and flares, location and placement of pedestrian push buttons and slopes for pedestrian paths and curb ramps. Beyond the federal law that requires ADA compliance, meeting with standards improves accessibility and comfort for all users. A full evaluation of ADA compliance is outside the scope of this study. Based on the MnDOT's *ADA Compliance Checklist Guidance*, the following items were noticed during field review:

- Pedestrian Push Button Orientation – The push button face is not aligned with the direction of travel.
- Detectable warning panels (Truncated Domes) indicate to a pedestrian with visual impairments that a potential conflict area is approaching. Detectable warning panels are not present on the northwest quadrant of Carlos Avenue/TH 29 intersection.
- Broken or obstructed sidewalks are dangerous to pedestrians with visual impairments and can make traversing the sidewalk difficult for pedestrians in wheelchairs.

Pedestrian Access Route (PAR)

Research presented in the HCM found that pedestrians generally keep 18 inches between themselves and adjacent walls, curbs and other obstructions, resulting in sidewalks that have less usable space than their design space, also known as PAR. PAR is determined by deducting 18 inches next to walls and curbs, 12 inches next to all other obstructions and minimum four feet accessible walkway. There are no boulevards between the sidewalk and roadway of TH 29 corridor. The light poles are installed in the boulevard (Figure 2.20) between sidewalk and ROW leaving at least 4-foot width for sidewalk.

Figure 2.20: Light Poles Installed in Boulevard (Google Earth)

Crossing Locations

While a pedestrian can cross the roadway at any intersection, marked and traffic-controlled intersections are more desirable and increase safety. Marked crosswalks alone do not improve pedestrian safety and should be used with other safety strategies, like refuge islands, curb extensions and appropriate signage.

Figure 2.22: Crossing at CR 82/Third Avenue East and TH 29 Intersection

- There are two signalized intersections along the TH 29 corridor in the study area. However, only CR 82/Third Avenue East and TH 29 intersection have pedestrian and bicycle connections, including marked crosswalks and pedestrian phase on all its quadrants.
- There are marked crosswalks on Second Street approach of the intersection with TH 29, and on south approach of TH 29/Darling Avenue Intersection. Both these intersections are controlled by two-way stop on city streets.
- There are two underpass crossings on TH 29 corridor.

Figure 2.21: Underpass Crossing at north approach of TH 29/Second Avenue Intersection

Figure 2.23: Underpass Crossing at 1,000 feet east of TH 29/Manor Hills Intersection

BICYCLE FACILITIES

Bicycle facilities and trail systems are valuable community assets and are an important transportation mode for recreational and other trip purposes. There is a network of shared-use paths and trails around the area of the TH 29 corridor. The area has few designated bicycle facilities, with the primary trail being the Central Lakes Trail and Esplanade Trail. Central Lakes Trail is a state trail running from Fergus Falls to Osakis, intersecting the TH 29 corridor with an underpass between Second Avenue and First Avenue. Esplanade Trail is city owned and runs along Lake Agnes that also serves as permanent route for snowmobiling in the winter. Currently, there are no striped bicycle lanes within Alexandria. Well-planned and designed multi-use trails/paths can provide good pedestrian and bicycle mobility. The trails/paths can serve both commuter and recreational cyclists.

There are shared-use paths along west side from Carlos Avenue to CSAH 42, and from Manor Hills Street to beyond CR 73 (east side for approximately 1,000 feet transitioning to west side at an underpass). The existing sidewalks do not serve as a shared-use facility for bicycles and pedestrians. The rest of the corridor is designated as a City or County Bike Route (on-street, no striping). The corridor's speed limit variation between 30 miles per hour and 55 miles per hour coupled with traffic volumes over 15,000 AADT can make it uncomfortable for many on street cyclists.

PEDESTRIAN AND BICYCLE LEVEL OF SERVICE

Pedestrian Level of Service (PLOS) and Bicycle Level of Service (BLOS) are commonly used measures of user comfort level as a function of a road corridor's geometry and traffic conditions. The PLOS and BLOS methodology is based on variables such as: presence of sidewalk, paved shoulders; lateral separation from motorized vehicles; motorized vehicle speed limits and volumes; pavement conditions; number of lanes; and buffers among other variables.

The methodology factors paved shoulders as pedestrian and bicycle route. The discontinuities in shoulders because of the conversion of the shoulders into turn lane approaches on intersections for motorized vehicles are also factored.

Table 2.4 presents the existing PLOS and BLOS on TH 29 corridor.

Table 2.4: Existing PLOS and BLOS

From	Direction	Sidewalk	Shoulder	Shared – Use Path	PLOS	BLOS
Third Avenue E to Darling Avenue	Both	✓	X	X	C	E
Darling Avenue to Carlos Avenue	Both	X	X	X	F	F
Carlos Avenue to CSAH 42	West Side	X	X	✓	D	E
	East Side	X	✓	X	D	A
CSAH 42 to Manor Hills St	Both	X	✓	X	E	D
Manor Hills St to CR 73	Both	X	✓	✓	A	A

The poor PLOS and BLOS in some segments were expected given the lack of existing bicycle facilities and the sporadic presence of sidewalks on the corridor.

Figure 2.24: Railroad Crossing at TH 29/ CR 73 Intersection

Figure 2.25: Railroad Crossing- facing TH 29 roadway (Google Earth)

Railroad Crossings

The Canadian Pacific Railway's Detroit Lakes subdivision runs parallel to TH 29 north of Birch Avenue. On an average day, there are six through trains with typical speeds between 10 and 40 miles per hour.

CR 73 crosses this railway with an at-grade crossing. There are pavement markings, crossbuck assemblies, and two-quad gates. The crossing is less than 90 feet east of TH 29.

The existing 95th percentile queue length on the east approach of this intersection was found to be around 50 feet and is 40 feet short of exceeding the available storage. The crash trends at this intersection did not show any crashes relating to railroad crossing.

Future Conditions

As Alexandria continues to grow and develop, vehicular traffic on TH 29 corridor will continue to increase.

Traffic Forecasts

Traffic projections were developed through an analysis of historic traffic patterns and demographic projections in the area to evaluate the future traffic operations along the corridor. This analysis identified AADT consistent with MnDOT published values.

ALEXANDRIA AREA 2030 TRANSPORTATION STUDY

Traffic projections developed for the *Alexandria Area 2030 Transportation Study* were reviewed to determine what information should be factored into traffic projections. One of the major items from the study that was assessed was traffic projections with and without the construction of a new interchange at I-94/County Road 106 or I-94/CSAH 17 (see **Figure 2.26**).

A review of traffic projections that consider a new interchange indicates minimal impacts to most of the TH 29 project corridor except for the southbound approach of TH 29/County Road 82 intersection. The south approach of the TH 29/County Road 82 intersection may see a reduction of 1,200 vehicles if the interchange is built on CSAH 17/I-94 and may see an increase of 400 vehicles if the interchange is constructed on County Road 106/I-94 by 2030. Other than evaluating impacts from a new interchange, the volumes projected in the previous study were not used in subsequent traffic projections since this previous study were completed in 2011.

HISTORIC TRAFFIC DATA

Historic MnDOT AADT data for locations in the project area were evaluated for the 20-year period between 1992 to 2016 and can be seen in **Table 2.5** AADT data on TH 29 was available on a two-year cycle while data on minor approaches was available on a four-year cycle. **Table 2.6** shows the calculated annual 20-year and 10-year growth rates along the corridor based on historic data.

Figure 2.26: Potential I-94 Interchange (Alexandria Area 2030 Transportation Study)

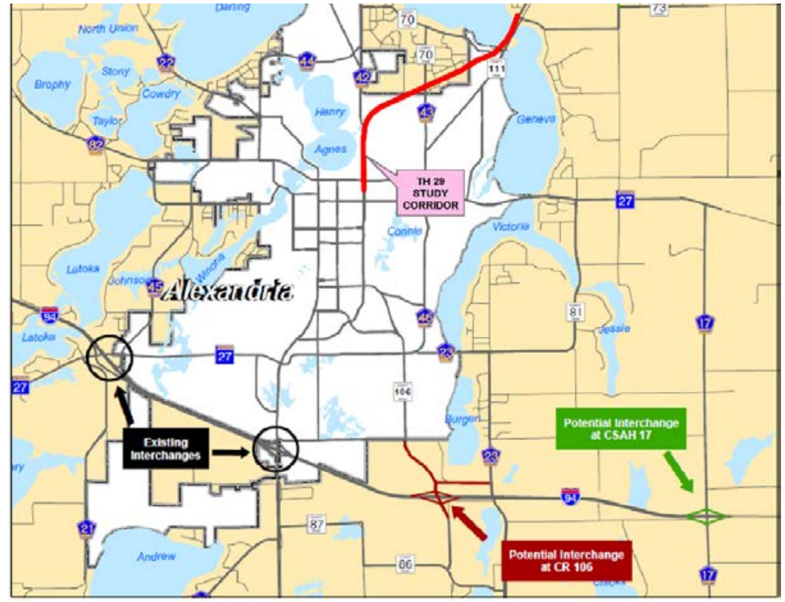


Table 2.5: Historic AADT

Intersection	Approach	Average Annual Daily Traffic by Year											
		1994	1996	1998	2000	2002	2004	2006	2008	2010	2012	2014	2016
TH 29 / CSAH 82	WEST*	15,600	16,500	15,800	15,800	17,700	17,100	16,200	16,500	17,800	18,300	17,200	17,500
	EAST	7,300	7,100	7,600	8,700	9,000	10,000	9,500	9,900	10,400	10,100	10,000	-
	SOUTH	6,900	-	7,100	-	8,500	-	8,100	-	8,500	-	8,900	-
	NORTH*	17,900	14,600	17,300	17,300	17,300	18,600	18,400	17,900	18,700	17,700	16,600	17,700
TH 29 / CSAH 42	WEST	5,300	-	5,900	-	12,200	-	12,200	-	11,800	-	10,800	-
	EAST	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	SOUTH*	17,900	14,600	17,300	17,300	17,300	18,600	18,400	17,900	18,700	17,700	16,600	17,700
	NORTH*	8,500	8,600	8,000	7,500	8,300	10,300	9,300	9,400	9,400	9,000	8,600	8,900
TH 29 / CSAH 46	WEST*	8,500	8,600	8,000	7,500	8,300	10,300	9,300	9,400	9,400	9,000	8,600	8,900
	EAST*	5,100	7,900	7,000	6,900	7,600	9,600	8,600	8,300	8,600	8,200	8,400	9,000
	SOUTH	2,750	-	3,550	-	3,500	-	4,450	-	6,500	-	6,400	-
	NORTH	-	-	-	-	1,100	-	2,350	-	2,450	-	-	-
TH 29/ County Road 73	WEST	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	EAST	730	-	820	-	1,200	-	1,400	-	1,600	-	-	-
	SOUTH*	5,100	7,900	7,000	6,900	7,600	9,600	8,600	8,300	8,600	8,200	8,400	9,000
	NORTH*	6,700	6,000	5,800	6,600	7,100	9,500	8,500	8,200	8,300	8,000	8,100	8,000

*TH 29 Approach

Table 2.6: Growth rates based on Historic AADT

Intersection	Approach	Year	Annual Growth Rate	Year	Annual Growth Rate
TH 29 / CSAH 82	WEST*	1994-2016	0.5%	2006-2016	0.7%
	EAST	1994-2014	1.7%	2006-2016	0.6%
	SOUTH	1994-2014	1.1%	2006-2016	1.1%
	NORTH*	1994-2016	0.3%	2006-2016	-0.7%
TH 29 / CSAH 42	WEST	1994-2014	2.2%	2006-2016	-1.6%
	EAST	N/A	N/A	N/A	N/A
	SOUTH*	1994-2016	0.3%	2006-2016	-0.7%
	NORTH*	1994-2016	0.5%	2006-2016	-0.8%
TH 29 / CSAH 46	WEST*	1994-2016	0.5%	2006-2016	-0.8%
	EAST*	1994-2016	1.3%	2006-2016	0.3%
	SOUTH	1994-2014	3.1%	2006-2016	3.8%
	NORTH	2004-2010	6.9%	2006-2016	1.0%
TH 29/ County Road 73	WEST	N/A	N/A	N/A	N/A
	EAST	1994-2010	3.6%	2006-2016	3.1%
	SOUTH*	1994-2016	1.3%	2006-2016	0.3%
	NORTH*	1994-2014	1.3%	2006-2016	-0.6%
Average		**All**	**1.7%**	**All**	**0.4%**
		TH Segments Only	**0.7%**	**TH Segments Only**	**-0.3%**

*TH 29 Approach

Potential Development

Based on a review of developable land and the City of Alexandria's existing zoning, there is a potential for new residential developments along the TH 29 corridor as displayed in Figure 2.27. As such, traffic volumes that could be generated were estimated if these areas were developed. However, an assumption was made that the new developments would be constructed after 2025.

Most of the identified developable area is zoned R-1 (low-density residential), therefore it is assumed only single-family homes would be constructed in these areas. Using information in the city zoning code, it is assumed each lot will be 12,000 square feet. Additionally, it is assumed that 25 percent of the footprint of new developments would be allocated to roadways or open spaces. With this information, the total number of daily trips was estimated using trip generation information from the Institute of Transportation Engineers' Trip Generation Manual (10th edition). Results from this analysis can be seen in Table 2.7.

Table 2.8: Expected Trip Generation from Potential Residential Development

Parcel Number	Acres	SF	DU	Daily Trips
1	65.4	2,848,824	178	1,681
2	39.9	1,738,044	109	1,025
3	43.4	1,890,504	118	1,115
Total	***148.7***	***6,477,372***	***405***	***3,822***

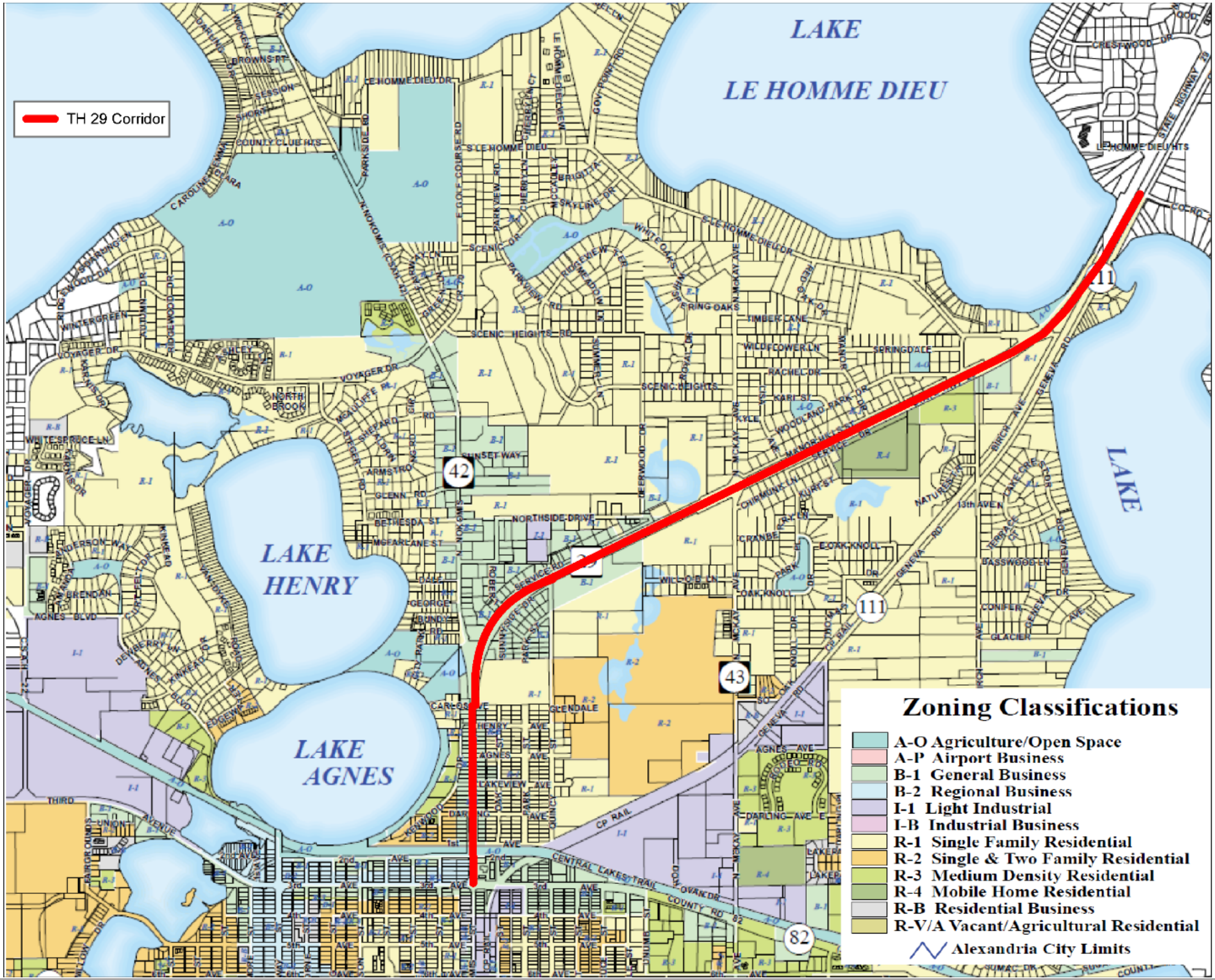
Assumptions:
1.) 25% of land is dedicated for roads/open spaces
2.) 12,000 square feet per dwelling unit (DU) – All single-family homes
3.) 9.44 daily trips per DU

It is estimated that potential residential development would generate 3,822 trips per day. Once daily development-related trip generation was estimated, the destinations of these trips were estimated. It is assumed that trips from new single-family homes would mainly be destined for the core of Alexandria, but it was also assumed some trips would travel toward Osakis on CSAH 82. The percentage of new trips travelling to each destination was calculated proportionally based on existing daily traffic volumes on these destination roadways. Note that a small number of trips may also travel north out of Alexandria, but for the purposes of this analysis none were assumed to do so due to the lack of travel destinations on a typical day. The total number of daily trips between developments parcels and each destination roadway (i.e. nodes) can be seen in Table 2.8.

Table 2.7: Origin-Destination of Matrix of Daily Trips Between Development Parcels and Local Roadways

Node	Parcel 1	Parcel 2	Parcel 3	Total	Percent of Traffic to:
A	730	445	484	**1660**	Node A: 43%
B	371	226	246	**844**	Node B: 22%
C	350	214	232	**797**	Node C: 21%
D	229	140	152	**522**	Node D: 14%
Total	**1681**	**1025**	**1115**	**3822**	**All Nodes: 100%**

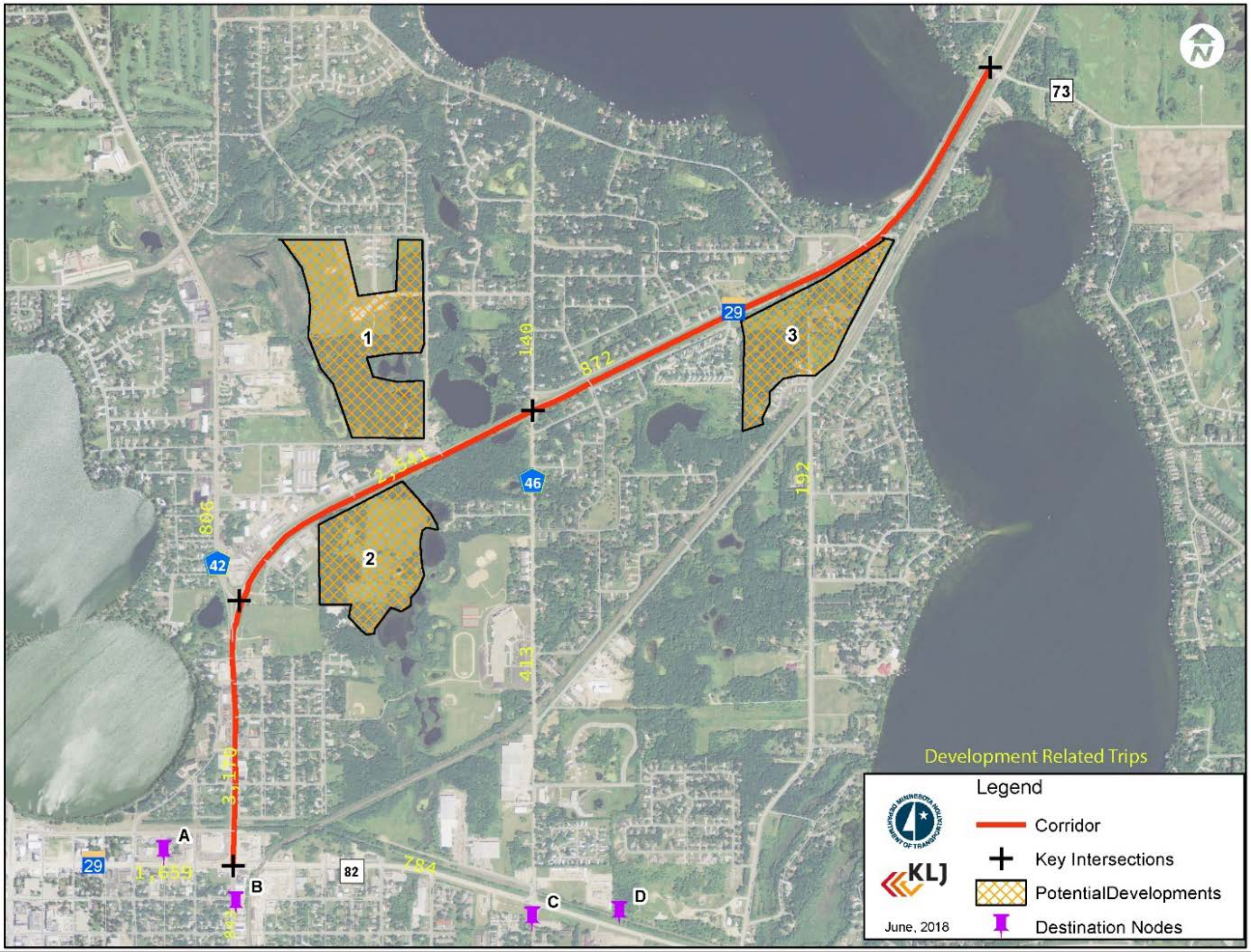
Figure 2.27: City of Alexandria Zoning Map (2016)



The final step for estimating development-related traffic growth was to estimate the routes that would be used to travel between origins and destinations. This was based on engineering judgement, considering access locations, existing traffic volumes on segments of the roadway network, and posted speed limits.

Using this analysis method, the number of trips added on key links of the study network can be seen in **Figure 2.28**.

Figure 2.28: Potential developments along the TH 29 Corridor



PROPOSED TRAFFIC PROJECTIONS SCENARIOS

Based on the expected timeline of improvements on TH 29, traffic forecasts were prepared for 2025 and 2045. Four separate traffic forecasting methodologies were developed and considered.

Method 1: Trendline Analysis Using Historic Data

This method uses available historic traffic data only to establish annual growth rates based on linear trendlines to estimate traffic volumes in 2025 and 2045.

Note that limited data was available for CSAH 46 (2004 to 2010), which equals a high annual growth rate of 6.89%. This annual growth rate applied over 20 years would increase traffic by a factor of 3.8, which is unreasonably high given the development potential in the area.

Method 2: Assume 2 Percent Annual Areawide Growth

Historically it has been common to assume a flat 2 percent annual growth rate on Minnesota Trunk Highways in the absence of detailed land use projections or travel demand models. Based on historic data for TH 29 (Table 2.7) this is likely a conservative forecasting method.

Method 3: Apply an Areawide Growth Factor Based on MnDOT State Aid Data

In fall 2016, MnDOT published 20-year traffic projection factors for County State-Aid Highways. The Douglas County projection factor is 1.4, however it is necessary to convert this to an annual growth rate of 1.7 percent to establish 2018, 2025 and 2045 traffic conditions. Based on historic data for TH 29 (see Table 2.7) this is likely a conservative forecasting method.

Method 4: Trendline Analysis Using Historic Data with Added Trips from Development

This method uses traffic projections developed in Method 1 to estimate traffic increases on TH 29 that are attribute to regional traffic growth, but also adds estimated traffic that would be generated from residential development in the area (see *Potential Development* section above).

RESULTS OF TRAFFIC PROJECTION SCENARIOS

The application of annual growth rates of 2% or 1.7% result in considerable growth since the area is mostly developed. There is however some potential new residential development along the TH 29 corridor that can generate new traffic in the area. Given the potential for some new development, Method 4 can be used to consider some local traffic growth from new developments and some regional traffic growth based on historic traffic patterns. For these reasons, the traffic projection results based on Method 4 analysis is most applicable to this segment.

CSAH 42 has experienced 2.2% growth over the past 20 years but the growth rate is 7% between 1994 and 2006 and a -1.6% growth between 2006 and 2016. Based on Alexandria's past and ongoing Comprehensive Planning efforts, it is not believed that this corridor will be a major growth corridor. Furthermore, this roadway provides minimal connectivity to other growth corridors to the north. As such, the study elected to use an annual growth rate of 1% to factor in potential reestablishment of past traffic volumes but also factor in the lack of growth and connectivity of the corridor.

CSAH 46 is a major growth corridor in Alexandria. Recently, two new schools have been built along the corridor and there are plans for a new interchange connection at Interstate 94. This corridor is already experiencing cut-through traffic that would normally use TH 29. Using historic growth rates would increase traffic volumes to levels like TH 29. The goal for this corridor is not to be a major thoroughfare within the study area and it is unlikely this corridor would be widened to support such substantial growth. Once this corridor starts to experience similar congestion to TH 29, it may be expected that the corridor traffic volumes would balance out. Considering the study is assuming all new growth along TH 29 within the study corridor, it is assumed that growth rate below historic values was most appropriate on this approach. As such, the study used an annual 1% growth rate to balance the potential increased demand with the lack of major thoroughfare infrastructure being available.

Given the lack of regional connectivity and minimal potential growth on the north approach of the CSAH 46/TH 29 intersection, no significant traffic growth is expected. The south approach of the intersection however has seen increased connectivity to major destinations including two new schools and has the potential to connect to a future interchange to the south. CSAH 46 is also often seen as a cut-through segment for drivers avoiding the TH 29 corridor. While there is potential for CSAH 46 to see a reduction in traffic volumes with the relief in congestion on TH 29 to the west of the intersection, the projections based on Method 4 is more applicable to CSAH 46 to be conservative.

For the County Road 73 approach on TH 29, using growth rates based on historic data results in considerable growth, however the area around this intersection is not expected to see significant growth. As such, using an annual growth rate of 1.7% rate may be most appropriate for this approach.

Figure 2.29 displays the projected 2025 and 2045 AADT for the corridor.

Future Turning Movement Volumes

Future AADT and turning movement volumes were developed from the forecasts for the future 2045 analysis. The existing balanced volumes were scaled up based on the future projection factors along the corridor by using the iterative directional volume estimation methodology developed and documented in NCHRP Report 255. Figure 2.30 shows the projected 2045 AM and PM turning movement counts, AADT, and lane-configuration of intersections along the study corridor.

Future Corridor Traffic Capacity and Demand

The unbalanced lane assignment in the segment between Third Avenue and CSAH 42 is not conducive to directional fluctuations throughout the day. Around 65 percent of traffic is travelling southbound in the morning using a single lane, while there are two northbound lanes that are underutilized. This is expected to result in corridor LOS “F” in the near future.

For the TH 29 segment from CSAH 42 to CR 73, the increased future traffic volumes on TH 29 will limit the number of acceptable gaps for minor approach vehicles turning onto TH 29, with peak hour minor approach LOS “F” expected at two-way stop-controlled intersections. It should however be noted that traffic flow on TH 29 is expected to remain adequate through 2045, operating at LOS “B” or better between intersections.

Future Traffic Control

Future warrants were analyzed using the traffic projections for year 2045 weekday traffic. Minor right-turn volumes were excluded for dedicated right-turn lanes and included at 50 percent for shared through/right lanes. *Table 2.9* shows a summary of the traffic control analysis under 2045 future no build conditions. Signal warrants were met for all intersections except for CSAH 42/TH 29 intersection in 2045. Signal warrants for CSAH 42/TH 29 intersection was not met in 2018 as well. The intersection of CR 73/TH 29 met Warrant 1B, 2, and 3, in addition of Warrant 9 that was met in 2018.

The overall intersection of CSAH 42 did not meet any warrants. However, the intersection experiences high northbound left-turn traffic that conflicts with high volume southbound through traffic. An additional warrant analysis was considered using the southbound through and northbound left turn volumes. The analysis indicated that the intersection of CSAH 42 meets warrant by 2045. Detailed information of future 2045 warrant can be found in Appendix D.

Table 2.9: 2045 No-Build Traffic Control Warrant

Intersection	Existing Traffic Control	Warrants Met (Hours Met/Required)					
		1A	1B	2	3	MWSA	9
3rd Avenue	Signal	✓	✓	✓	✓	✓	N/A
CSAH 42	Thru/Stop	2/8	0/8	✓	✓	✓	N/A
CSAH 46	Signal	5/8	✓	✓	✓	5/8	N/A
CR 73	Thru/Stop	2/8	✓	✓	✓	1/8	✓

1A: Minimum Vehicular Volume ; 1B: Interruption of Continuous Traffic ; 2: Four-Hour Vehicular Volume ; 3: Peak Hour ; MWSA: Multi-way Stop Application ; 9:Intersection near a grade crossing.

Figure 2.29: Projected 2025 and 2045 AADT

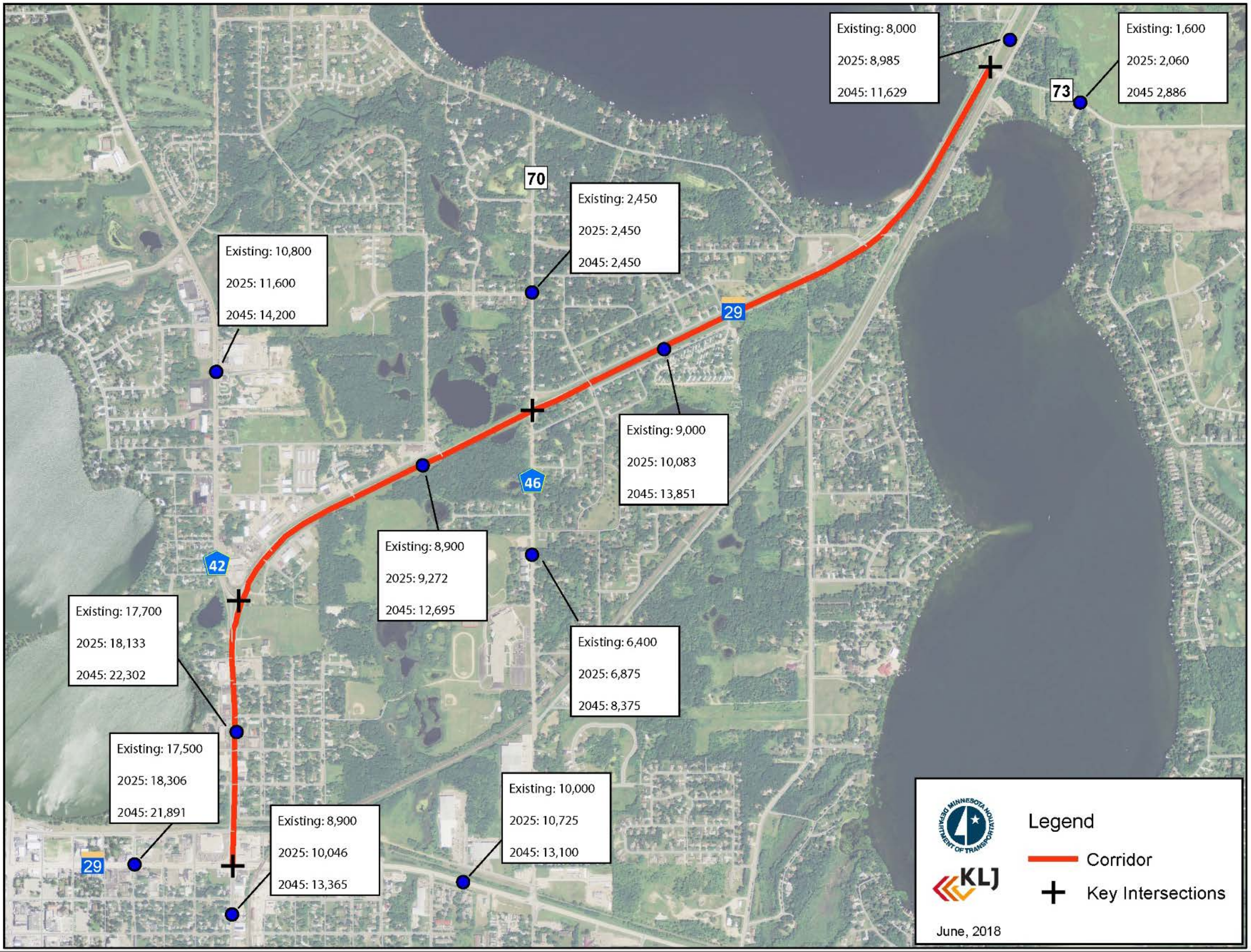
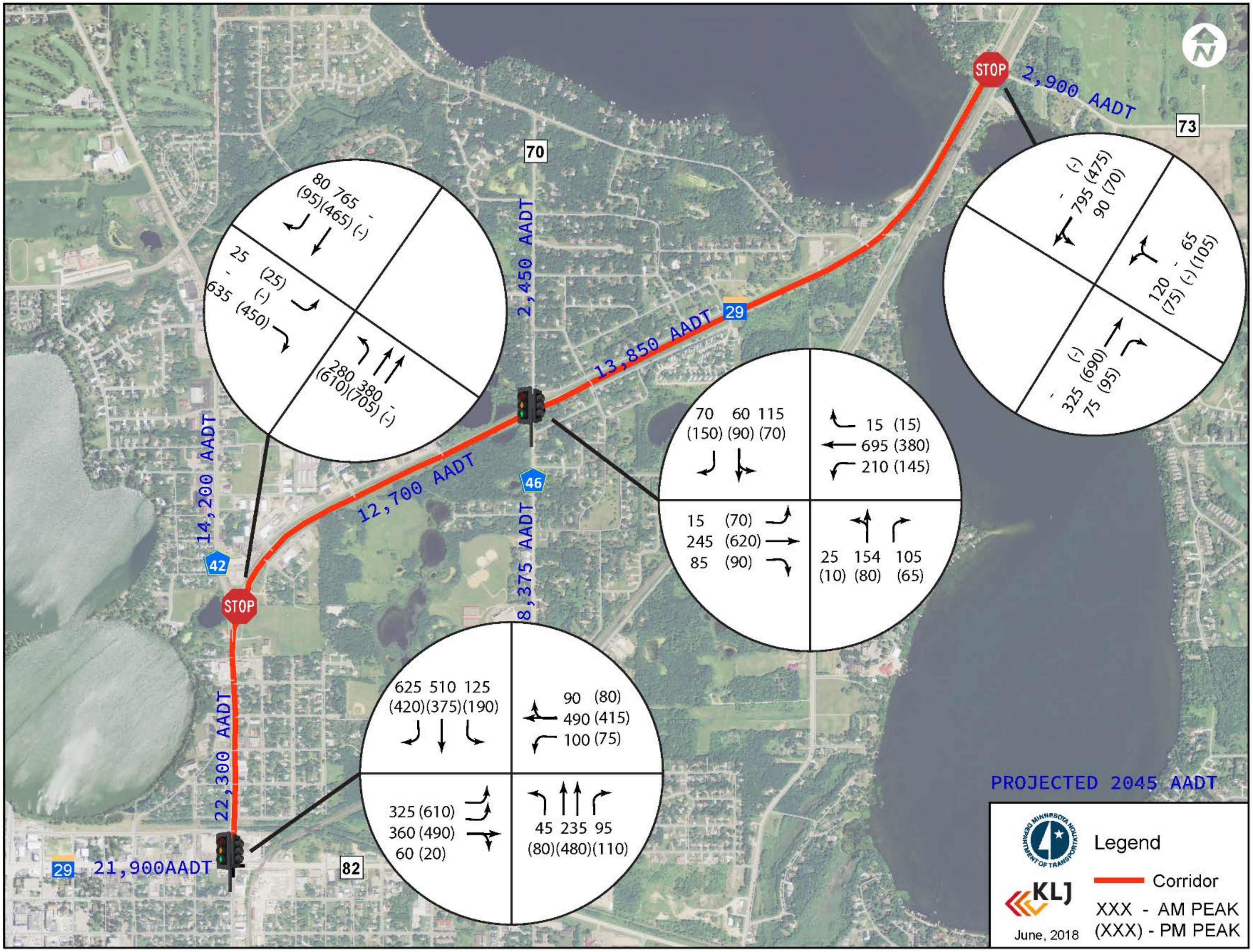


Figure 2.30: Projected 2045 Turning Movement Counts



Future 2045 Traffic Operations and Queuing

2045 traffic operations were evaluated using the Vissim simulation software. Vissim was used to better compare no-build conditions to conditions expected in various roadway or corridor reconfigurations. Roadway revisions, especially roundabouts and emerging innovative improvement types are much better analyzed using simulation compared to traditional Highway Capacity Manual-based methods.

The results of future no-build operations are displayed in **Figure 2.31**.

The following is a summary of projected conditions in the 2045 no-build scenario:

CR 82/ THIRD AVENUE EAST AND TH 29 INTERSECTION

- Increasing volumes and congestion results in 2045 intersection LOS “D” in the PM peak hour (LOS “C” in existing conditions)
- Queue spillback is expected to block business accesses on the southbound and westbound approaches

CSAH 42 AND TH 29 INTERSECTION

- Volume increases on TH 29 are expected to result in eastbound approach LOS “E” in 2045 peak conditions (LOS “A” in existing conditions)
- Major queuing issues on all approaches by 2045, with peak queues between 800 and 1250 feet in length on all approaches.

CSAH 46 AND TH 29 INTERSECTION

- The intersection is expected to operate at LOS “B” through 2045 with no queuing issues.

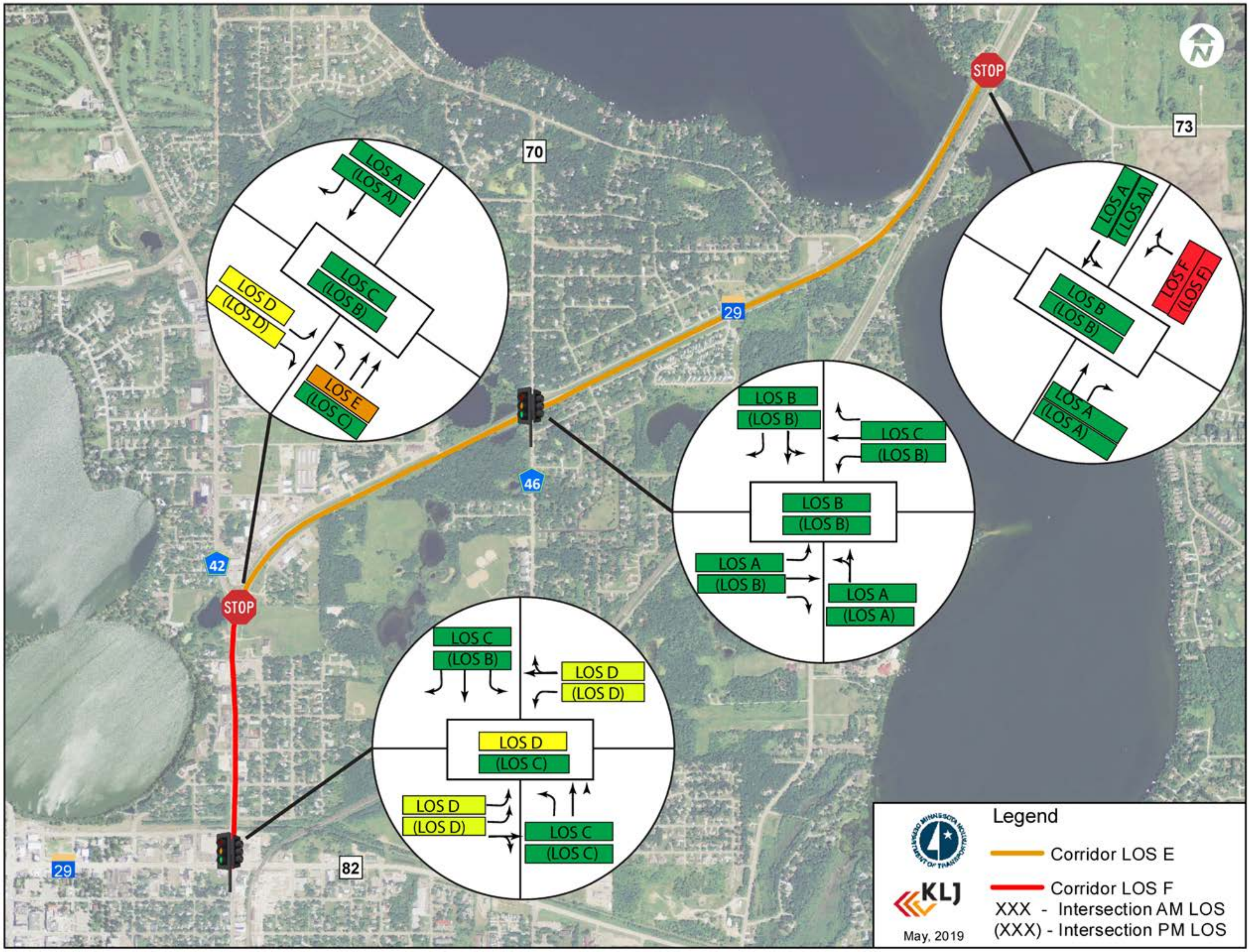
CR 73 AND TH 29

- The westbound approach is expected to operate at LOS “F” in 2045 peak conditions, with average queue lengths extending past the at-grade railroad crossing on this approach.

CORRIDOR OPERATIONS

The urban segment from Third Avenue to Nokomis Street is expected to operate at LOS F in the future due to the presence of only one southbound lane. The transitioning and rural segments of the corridor between CSAH 42 and CR 73 are expected to operate at corridor LOS E in 2045 due to higher vehicle density from increased traffic volumes. The future traffic volumes on the corridor will limit the number of acceptable gaps for minor approach vehicles turning onto TH 29, with peak hour minor approach LOS F expected at the two-way stop-controlled intersections in the corridor.

Figure 2.31: Projected 2045 Level of Service by Approach and Intersection



Environmental Conditions Assessment

Introduction

The existing environmental conditions, or affected environment, are the baseline conditions in a given area. Environmental conditions have the potential to constrain the development of build alternatives and/or be impacted by build alternatives. Development of build alternatives for a given project is based on the purpose and need for the project and environmental constraints associated with the alternatives. This section contains an overview of the purpose and need as well as pertinent environmental conditions that could affect alternatives development associated with the TH 29 corridor assessment.

For the purposes of this environmental conditions assessment, an assessment corridor has been defined. The corridor defines the extent within which project alternatives would be developed at the planning level and potentially transitioned into an environmental document pursuant to the National Environmental Policy Act (NEPA) (42 U.S.C. §4321 et seq. [1969]) and/or the Minnesota Environmental Policy Act (MEPA) (MS 116D [1973]), as applicable. The assessment corridor includes TH 29 and adjacent properties from Third Avenue East to CR 73, including associated sidewalks, shared-use paths, and intersections.

Purpose and Need

A purpose and need statement outlines the problem(s) that project alternatives are intended to solve. The assessment corridor is a heavily used roadway that passes through commercial/retail and residential areas, to the northern outskirts of Alexandria. The corridor is an important roadway for local traffic and commuters. In general, the needs associated with TH 29 in this area include:

- Capacity and transportation demand: From Third Avenue East to Northside Drive, the corridor consists of a typical section with two northbound lanes and one southbound lane. As a result, southbound traffic congestion occurs during the morning commute. As traffic volumes continue to increase into the future, congestion is expected to increase.
- Safety: The urbanized segment between Third Avenue East and CSAH 42 and the intersection of CR 73 is characterized by elevated crash rates.
- System linkage: There are gaps in the off-street pedestrian/bicycle network along the corridor from Darling Avenue to Carlos Avenue, and from CSAH 42 to Manor Hills Street. Barriers to on-street bicycle movement along the corridor include busy intersections, traffic congestion, and narrow or non-existent shoulders. For pedestrians, many intersections along the corridor are lacking crosswalks.

The purpose of alternatives developed along the corridor would be to address the needs identified above to facilitate the safe and efficient movement of people and goods along and through TH 29.

Affected Environment

The affected environment consists of the baseline resources that could constrain alternatives development or be impacted by a project. A field review and desktop assessment of the corridor was completed using a variety of federal, state, and local resources to identify potential environmental constraints and impacts that projects along the corridor could encounter. As project alternatives are developed and refined, this assessment of impacts will also become more refined.

LAND USE

Land use can have many implications on the characteristics of a neighborhood and the efficiency of its transportation network. For example, a neighborhood that is only residential requires commuting to work, resulting in unbalanced directional flows and strong peaking characteristics that reduces the roadway capacity. A neighborhood with only office uses means there will be few people in the neighborhood after work to support other types of businesses. However, a strong mix of residential, commercial, and office uses may support individuals working, shopping, and eating out closer to home, which minimizes the use of the transportation network and supports multimodal activity.

The corridor extends through several land uses: commercial, institutional, public/government facilities, residential (low to high density and manufactured homes), public parks, public open space/natural areas, vacant/agricultural, lakes/wetlands, rail, and roadway right-of-way. While some development and redevelopment are expected to occur along the corridor into the future, it is not anticipated that improvements to the corridor would induce land use changes.

SOILS

Soils support plant growth, store and filter water, contribute to the atmosphere, and provide habitat. Differences among soil types in terms of their structure, elasticity, strength, shrink-swell potential, and erosion potential affect their abilities to support certain applications or uses. Engineers must take into account the physical properties of soil and underlying geology when designing projects to ensure that conditions are suitable for building. Soil characteristics are also important considerations for preventing erosion of soil during and after construction projects.

Soil map units along the corridor largely consist of Waukon loam, two to six percent slopes; and Arvilla sandy loam, two to six percent slopes. These soils are classified by the American Association of State Highway and Transportation Officials Soil Classification System as fair to poor for use as a subgrade. According to the US Department of Agriculture Web Soil Survey, Waukon loam is very limited for local roads and streets based on low strength, frost action potential, and shrink-swell potential. This soil is moderately susceptible to erosion and has a high tolerance for soil loss in terms of capability to sustain vegetation. Arvilla sandy loam is not limited for local roads and streets. This soil is moderately susceptible to erosion and has a low tolerance for soil loss.

Roadway designers should obtain detailed soil and geology information prior to project design. Roadway projects that increase the amount of impervious surface area reduce the area where water can penetrate the soil, which could increase stormwater runoff and result in erosion. Increased stormwater runoff and resulting erosion could also result from soil compaction caused by construction activities. Vegetation removal during construction activities could also make soil more susceptible to erosion. Best management practices during construction activities to minimize erosion and sedimentation are typically required.

REGULATED MATERIALS/WASTE AND CONTAMINATED PROPERTIES

Regulated materials/waste include lead-based paint, asbestos, mercury, and hazardous waste. Contaminated properties include buried solid waste and contaminated soil and groundwater. Regulated materials/waste could be present along the corridor in buildings, culverts, or utilities. According to the Minnesota Pollution Control Agency (MPCA) *What's in My Neighborhood* data, there are several sites along the corridor where contaminated materials may be encountered. These sites are associated with the following activities: hazardous waste, minimal or very small quantity generator, petroleum remediation, leak site, underground tanks, and/or construction stormwater. There are no agricultural chemical sites along the corridor as reported by the Minnesota Department of Agriculture's Incident Response Unit. Please refer to Table 2.10 and Figure 2.32.

Improvements to the corridor would have the potential to encounter regulated materials/waste and/or contaminated properties. Surveys should be conducted to identify regulated materials/waste in structures that would be impacted so that any identified regulated materials/waste can be handled and disposed of according to state and federal law. Prior to right-of-way acquisition, large scale earthwork, groundwater dewatering, or work in commercial or industrial areas, surveys (e.g., Phase I and/or Phase II Environmental Site Assessment) should be conducted to identify contaminated properties so that liability and cost risk can be assessed.

Table 2.10: What's in My Neighborhood Sites Along the Corridor

From	Address	Activity	Active Site
Alex Glass & Glazing	321 Nokomis St	Hazardous Waste	No
Alex Sport and Tackle	507 N Nokomis St	Petroleum Remediation, Leak Site; Underground Tanks	Yes
Alexandria Auto Body	935 Highway 29 N	Hazardous Waste	No
Alexandria Tire & Auto	801 Third Ave E	Hazardous Waste, Minimal quantity generator; Petroleum Remediation, Leak Site; Underground Tanks	Yes
Central Auto	201 W Nokomis St	Hazardous Waste	No
Central Minnesota Endodontics PA	507 N Nokomis St Ste C	Hazardous Waste, Minimal quantity generator	Yes
Charter Communications - Alexandria	1111 Highway 29 N	Hazardous Waste	No
Crown Auto Alexandria	210 Nokomis St	Petroleum Remediation, Leak Site; Underground Tanks	No
Deluxe Oil	216 W Nokomis St	Hazardous Waste, Minimal quantity generator	Yes
Former Casey's General Store	217 N Nokomis	Underground Tanks	Yes
Geyer Rental Service	315 Nokomis St	Hazardous Waste; Petroleum Remediation, Leak Site; Underground Tanks	No
Holiday Food Store	707 Third Ave E	Petroleum Remediation, Leak Site	Yes
JV Schmidt Inc	317 Nokomis St	Hazardous Waste	No
Paul's Small Engine Sales & Service	1510 N Nokomis NE	Hazardous Waste, Minimal quantity generator	Yes
Randall's 66 Inc	201 W Nokomis St	Hazardous Waste	No
RK Transport	Highway 29 N	Hazardous Waste	No
Rob's Auto Body Inc	1006 Robert St	Hazardous Waste, Very small quantity generator	Yes
Sheldon Decorating	905 Highway 29 N	Hazardous Waste	No
Signery Sign Service	1002 Robert St	Hazardous Waste	No
SP 021-090-004	Unknown	Construction Stormwater	No
Star Amoco	302 Nokomis St N	Petroleum Remediation, Leak Site; Underground Tanks	Yes
SuperAmerica	211 Nokomis St	Petroleum Remediation, Leak Site; Underground Tanks	Yes
Vince's Taxidermy	1211 Highway 29 N	Hazardous Waste	No
Weber's Upholstery	911 Highway 29 N	Hazardous Waste	No
Yardworks	902 Highway 29 N	Hazardous Waste	No

Figure 2.32: Hazardous Materials Sites

SOCIAL/ECONOMIC

All transportation projects have some level of associated social and economic impacts. One of the primary needs identified at several locations throughout the corridor is the need for additional roadway capacity to accommodate existing and future traffic volumes. Under existing conditions, this growth is expected to overburden intersections along the corridor, resulting in deficient traffic operations. This breakdown in traffic operations would have associated social and economic impacts to the traveling public as well as businesses within the assessment corridor. Improving overall traffic operations would satisfy these social demands and accommodate economic development within the surrounding area. Positive social impacts could also be realized through the incorporation of additional pedestrian/bicyclist facilities along the corridor.

Existing roadway ROW varies along the corridor. The most constrained segment of the corridor occurs between CSAH 42 and Third Avenue East, where the existing ROW width varies between 66 and 80 feet. This segment of the project corridor is heavily developed, bordered by a mix of commercial and residential properties, with several buildings located near the existing ROW. Improvements along the corridor may require acquisition of ROW and/or temporary easements. Coordination with landowners and/or residents would be required for any acquisitions, access changes, or relocations in accordance with state and federal law, including the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970.

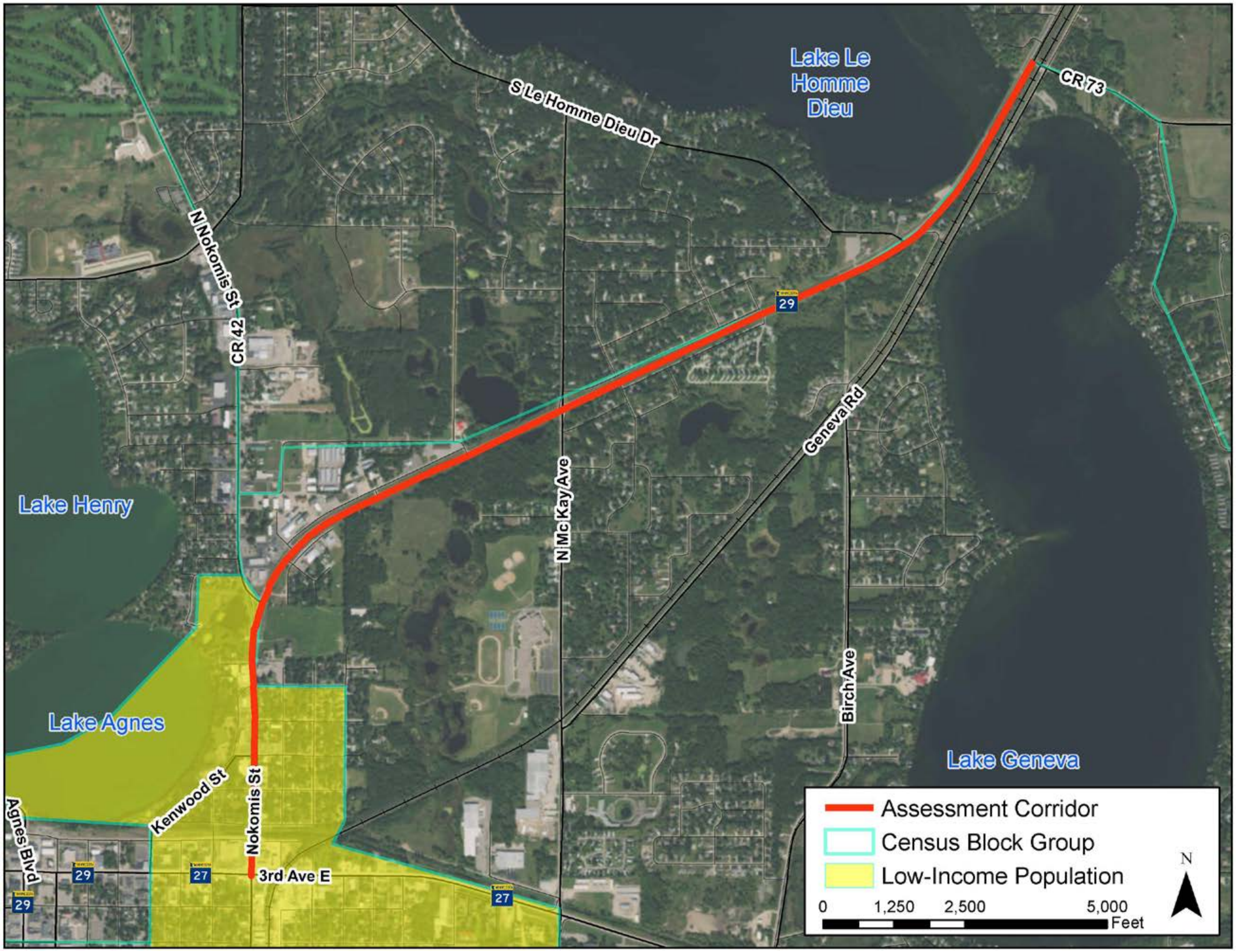
ENVIRONMENTAL JUSTICE

Executive Order (EO) 12898 - Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations requires federal agencies to identify and address "disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations," to the greatest extent practicable. Minority (i.e., American Indian or Alaskan Native; Asian or Pacific Islander; Black, not of Hispanic origin; or Hispanic) and low income (approximated by census reporting of individuals with income below the poverty level), populations, as defined by the US Department of Transportation (DOT) Order 5610.2(a), are "readily identifiable groups…who live in geographic proximity, and if circumstances warrant, geographically dispersed/transient persons…who will be similarly affected by a proposed DOT program, policy or activity." Environmental justice populations are those minority and/or low-income populations that are meaningfully greater than those of the general population.

According to the US Environmental Protection Agency's Environmental Justice Screening and Mapping Tool (Version 2017), the three census block groups along the corridor include minority populations ranging from 2 to 8 percent and low-income populations ranging from 15 to 69 percent. Two of the block groups have minority and low-income populations equal to or below those of the City of Alexandria and Douglas County; therefore, these are not considered environmental justice populations. The remaining block group has a low-income population 33 percent higher than the City of Alexandria (6 percent greater than Douglas County), with a minority population slightly greater than the City and County (4 and 1 percent, respectively). Due to the significantly greater low-income population compared to the general population of Alexandria, this census block group is considered an environmental justice population.

Should impacts during construction activities along the corridor happen to be limited to the area where the identified environmental justice population is located, this population has the potential to experience disproportional impacts on a temporary basis. However, non-environmental justice populations along the corridor would be subject to similar impacts during construction activities when construction occurs adjacent to those populations. Permanent impacts of projects along the corridor are intended to improve the transportation corridor for all users. Improvements along the corridor are not anticipated to split existing neighborhoods, promote social isolation of a particular population, reduce neighborhood community access or mobility, or promote the separation of residences or sections of a neighborhood from community facilities or services. Therefore, it is not anticipated that improvements to the corridor would disproportionately affect the identified environmental justice population on a permanent basis.

Figure 2.33: Environmental Justice Communities



PEDESTRIANS AND BICYCLISTS

The assessment corridor includes several pedestrian and bicyclist generators, such as parks, schools, commercial areas, and residential areas. Existing sidewalks along the corridor extend from Third Avenue East to Darling Avenue (both sides). Shared-use paths extend from Carlos Avenue to CSAH 42 (west side), and from Manor Hills Street to beyond CR 73 (east side for approximately 1,000 feet transitioning to the west at an underpass). The Central Lakes Trail crosses the corridor via an underpass north of Second Avenue East. At-grade crosswalks occur on all four legs of the intersection of the corridor with Third Avenue East, across Second Avenue East, and across the corridor at Darling Avenue. The portion of the corridor south of Lake Le Homme Dieu Beach is designated as a City or County Bike Route (on-street, no striping).

Improvements to the corridor would have the potential to improve the pedestrian and bicyclist network. Off-street pedestrian and/or bicyclist facilities could be added from Darling Avenue to Carlos Avenue, and from CR 42 to Manor Hills Street. Barriers to on-street bicycle movement along the corridor could be reduced and additional crosswalks could be incorporated.

WATER RESOURCES

Surface Water

Surface water resources generally include lakes, rivers, streams, and wetlands. These resources have the potential to be protected by several decrees, including Executive Order 11990, Protection of Wetlands; Sections 401, 402, and 404 of the Clean Water Act (US Army Corps of Engineers [USACE]); Section 10 of the Rivers and Harbors Appropriation Act (USACE); Minnesota Wetland Conservation Act (local government unit); the Shoreland Development section under Minnesota Statute 103F; Minnesota Statute 103G – Waters of the State, pertaining to public waters and public waters wetlands (MnDNR); and local watershed district rules.

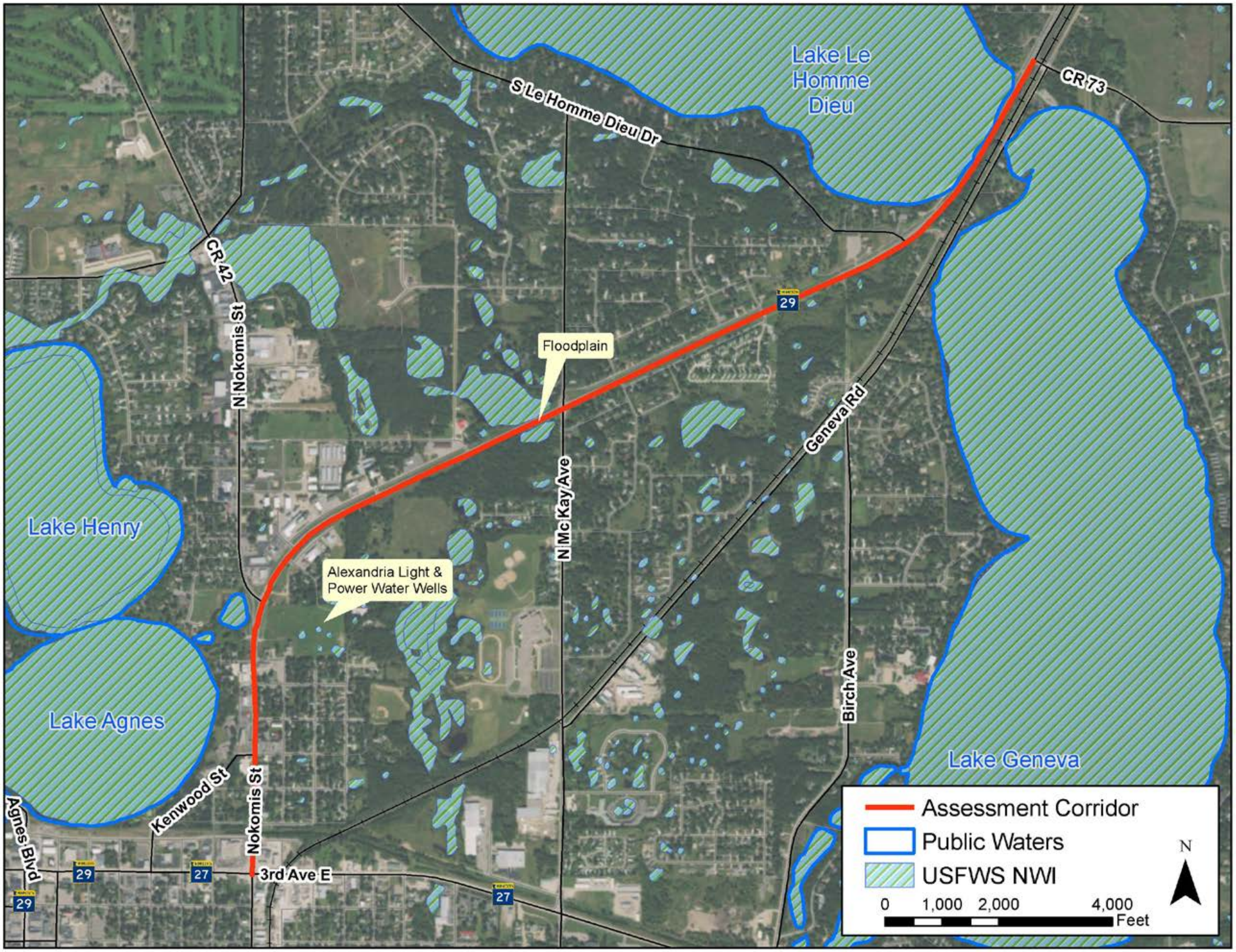
The corridor is located within the Long Prairie Watershed, where surface waters drain into the Long Prairie River; however, the corridor does not occur within a formal watershed district. Surface waters along the corridor identified on the US Fish and Wildlife Service's (USFWS) National Wetlands Inventory include Lake Le Homme Dieu, Lake Geneva, and several natural wetlands. The lakes and a large wetland are also designated as public waters. Please refer to **Figure 2.34.** Numerous artificial ditch wetlands were also noted during the field review. Lake Le Homme Dieu and Lake Geneva are listed as impaired for aquatic consumption due to mercury content in fish tissue. Shoreland areas (1,000-foot buffer) for these lakes and Lake Agnes also occur along the corridor.

A field aquatic resources delineation should be completed during the environmental review process for proposed improvements. Impacts to any of the identified surface water resources may require permits pursuant to the regulations above. In general, impacts to wetlands must be avoided, minimized, and mitigated in sequence. Increased impervious surface area may necessitate implementation of stormwater handling measures. Best management practices during construction activities to minimize erosion and sedimentation are typically required.

Floodplains

Floodplains are defined as areas along rivers and their tributaries that are subject to periodic inundation by regional floods (i.e., occurring on average once per 100 years) (MN Rule 6120.5000)). Executive Order 11988 – Floodplain Management (42 FR 26951, 3 CFR) requires federal agencies "to reduce the risk of flood loss, to minimize the impact of floods on human safety, health and welfare, and to restore and preserve the natural and beneficial values served by floodplains." As such, floodplains must be identified, and avoidance of adverse effects and incompatible development should be considered. If development within a floodplain must occur, harm to the floodplain shall be minimized. In accordance with the Floodplain Management section under Minnesota Statue 103F, flood prone communities are required to adopt floodplain management regulations and participate in the National Flood Insurance Program (NFIP). While the City of Alexandria does not participate in the NFIP based on lack of need and benefit (City is mapped as Zone X, Area of Minimal Flood Hazard by the Federal Emergency Management Agency), floodplains are regulated by city ordinance (City Code 10.10).

Figure 2.34: Water Resources



There is one floodplain identified in the City of Alexandria's Comprehensive Plan along the project corridor north of TH 29 near the intersection with McKay Avenue. Please refer to **Figure 2.34**. A permit may be required for roadway projects within this area. Development within the floodplain shall not reduce flood water storage capacity or increase flood heights, and roadways must be above the level of a regional flood.

Groundwater

Groundwater is water that exists in the saturated zones beneath the Earth's surface, such as underground streams and aquifers. Sole-source aquifers are groundwater supplies that provide the only source of drinking water for a particular area, which are afforded protection by Safe Drinking Water Act. In addition, wellhead protection areas and drinking water supply management areas are delineated to define and assess the source waters of public water systems in accordance with the Safe Drinking Water Act and Minnesota Administrative Rule 4720.

There are no sole-source aquifers near the corridor. The corridor occurs within the City of Alexandria's drinking water supply management area. The City's municipal water supply is sourced from groundwater. Alexandria Light & Power operates water wells along the corridor located east of TH 29, north of Carlos Avenue. Portions of the corridor occur within the 1-, 10-, and 20-year wellhead protection area associated with these wells. In addition, there are several other wells along the corridor, including domestic, monitoring, sealed, and unverified wells. Impacts to these wells would need to be coordinated with their owners during project development.

WILDLIFE AND VEGETATION

Wildlife and their habitat are protected by several laws, including the Migratory Bird Treaty Act, Bald and Golden Eagle Protection Act, Endangered Species Act and Minnesota's Endangered Species Statue. Plant species are also afforded protection under the federal and state Endangered Species laws. Most birds in Minnesota are protected as migratory species and the corridor occurs within the range of the bald eagle. The following species protected by the Endangered Species Act occur within Douglas County: northern long-eared bat, Dakota skipper and Poweshiek skipperling. Numerous additional species are protected by Minnesota's Endangered Species Statue, including spiders, insects, plants, birds, mussels, fish, amphibians, and mammals.

While the corridor is primarily developed, urban and undeveloped habitat are present. Improvements along the corridor that affect structures, waterbodies, grasslands, or trees have potential to impact wildlife and plants, including protected species. Field surveys and coordination with the MnDNR (e.g., Natural Heritage Information System Data Request) and USFWS for projects along the corridor should occur to identify wildlife and plants and to ensure compliance with applicable regulations. Avoidance and minimization may include timing restrictions or avoidance areas. Permits may be required for impacts on protected species.

NOISE

Noise is generally defined as unwanted sound, and can be intermittent or continuous, steady or impulsive, stationary or transient. Noise levels discernible by humans and animals are dependent on several variables, including distance and ground cover between the source and receiver, background noise levels, and atmospheric conditions. Perception of noise is affected by intensity, frequency, pitch, and duration. Noise levels are quantified using units of decibels (dBA).

Projects with FHWA involvement require a noise analysis in accordance with Procedures for Abatement of Highway Traffic Noise and Construction Noise (23 CFR 772) for "Type 1" projects. These projects include new construction, substantial alteration of horizontal and/or vertical alignment, addition of through-traffic lanes (including restriping). The first step in a noise analysis is assigning each land use an activity category and identifying sensitive noise receptors (i.e., areas of frequent human use). A computer model is then used to determine whether traffic noise impacts are anticipated and if noise abatement (e.g., implementation of noise barriers) is necessary.

Activity categories along the corridor include residential (Category B); non-residential land uses such as parks, places of worship, Section 4(f) sites, schools, trails, radio studio, etc. (Category C or D, depending on whether frequent human use occurs outside or inside, respectively); restaurants, offices, etc. (Category E); retail, utilities, etc. (Category F); and presumably undeveloped lands that are not permitted for development (Category G). If improvements to the corridor would be considered Type I projects, a noise analysis would be required during project development for areas with activity categories B through E, and potentially for activity category G.

HISTORIC AND ARCHAEOLOGICAL PRESERVATION

Section 106 of the National Historic Preservation Act of 1966 (54 U.S.C. § 306108) requires that federal agencies take into account the effects of their undertakings on historic properties. A historic property is any prehistoric or historic district, site, building, structure, or object included on, or eligible for inclusion on, the National Register of Historic Places (NRHP). The Section 106 review process is defined in regulations promulgated by the Advisory Council on Historic Preservation, "Protection of Historic Properties" (36 CFR Part 800). For projects without federal involvement, historic properties may be afforded protection under the Minnesota Historic Sites Act, Minnesota Private Cemeteries Act, and/or Minnesota Field Archaeology Act. Adverse effects to historic properties may occur when an undertaking may directly or indirectly alter characteristics of a historic property that qualify it for inclusion in the NRHP, such as physical alternation, relocation, neglect, change in use, or introduction of visual, atmospheric, or audible elements.

The corridor is located within the Central Lakes Deciduous archaeological region of Minnesota, which is characterized by a medium to high likelihood of archaeological sites. There are no historic properties along the corridor that are publicly listed on the NRHP; however, confidential historic properties or historic properties that have yet to be identified may be present along the corridor. As such, improvements to the corridor have the potential to impact unidentified and/or confidential historic properties. Projects along the corridor should include a records search at the State Historic Preservation Office (SHPO) records, field cultural resources inventory, and coordination with the SHPO to ensure all historic properties are identified and properly handled.

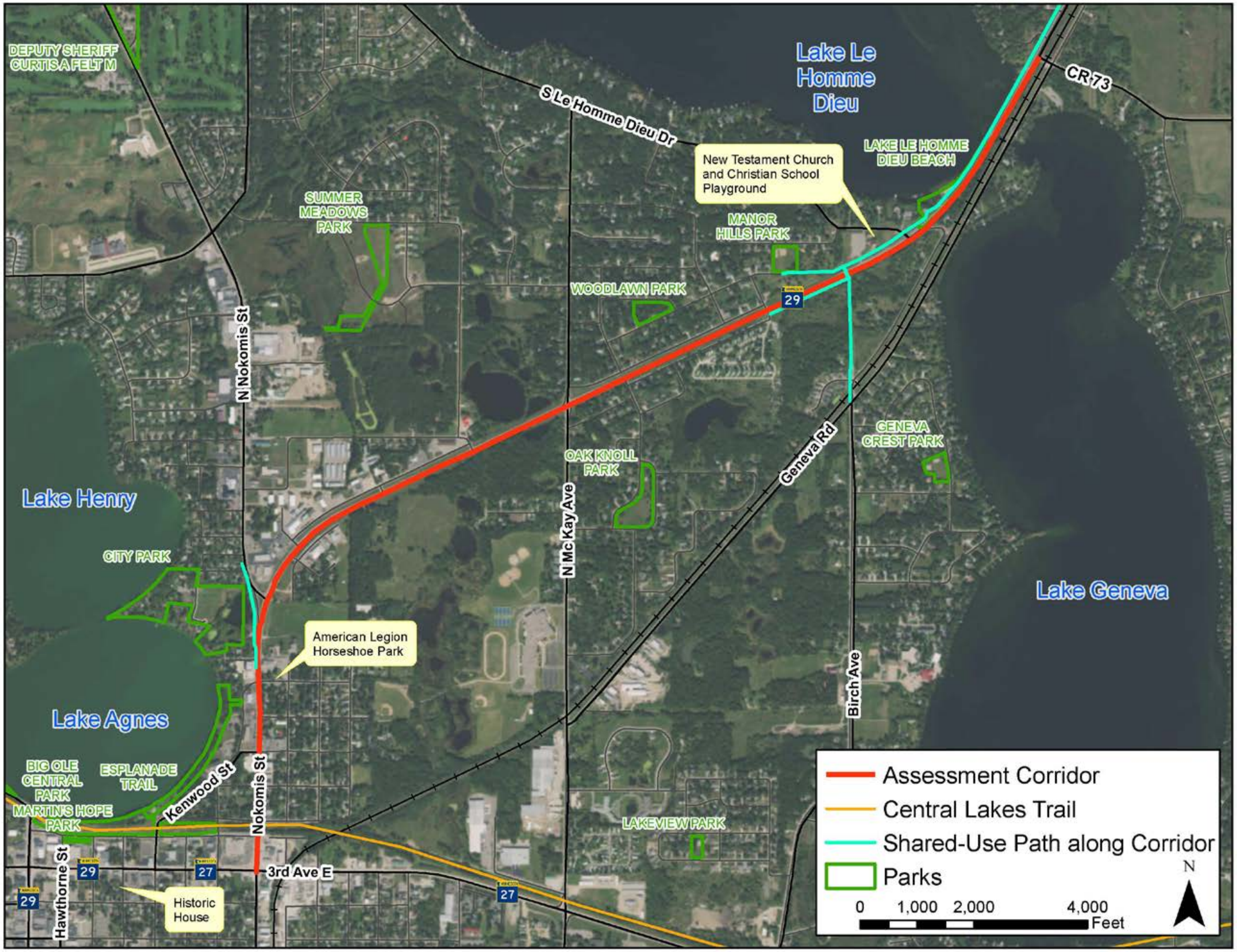
SECTION 4(F) RESOURCES

Section 4(f) of the Department of Transportation (DOT) Act of 1966 (Section 4(f)) (23 U.S.C. 138) prohibits federal transportation agencies (e.g., the Federal Highway Administration (FHWA) from approving a project that uses land from significant, publicly available parks, recreational areas, wildlife and waterfowl refuges, or public and private historical sites unless no feasible and practicable avoidance alternative exists. If such an avoidance alternative is not identified, only the alternative with the least harm, including all possible planning to minimize harm, can be approved.

Potential Section 4(f) resources along the corridor include the Central Lakes Trail, Esplanade Trail, shared-use paths, New Testament Church and Christian School playground, City Park, American Legion Horseshoe Park, Manor Hills Park, and Lake Le Homme Dieu Beach. Please refer to **Figure 2.35**. In addition, sites determined to be on or e*ligible* for listing on the NRHP that may be identified during project-specific surveys and coordination would be protected by Section 4(f).

Should Federal funding apply to projects along the corridor, the FHWA would need to determine which properties Section 4(f) applies to and can only approve the project alternative(s) that avoid Section 4(f) resources if any such alternatives exist. If no feasible and prudent avoidance alternative exists, coordination with the official(s) with jurisdiction would be required to minimize and mitigate for impacts and identify the alternative(s) with least harm to the affected Section 4(f) resource(s). Any Section 4(f) approval by the FHWA would require certain coordination and documentation (e.g., Section 4(f) evaluation) efforts.

Figure 2.35: Potential 4(f) Properties



Summary of the Existing and Future Conditions

The TH 29 study area is a 2.9-mile segment between CR 82/ Third Avenue East and CR 73 in Alexandria. This corridor is classified as a principal arterial, connecting Alexandria with Interstate 94 and other communities in the region. Beyond serving regional traffic, TH 29 also serves local traffic, connecting residential areas in the northern Alexandria to downtown and other commercial areas to the south.

The existing and future conditions report identified existing and future operations and safety deficiencies and documented environmental conditions in the area. Results from this analysis establish a baseline to evaluate the benefits of potential improvements.

The following is a summary of the corridor analysis completed as part of this report.

ACCESS

There are 51 access to TH 29 within the study area. From CR 83/Third Avenue East to Carlos Avenue, there are five times more accesses than recommended in the MnDOT access spacing guidelines.

RIGHT-OF-WAY

Throughout the TH 29 corridor, right-of-way (ROW) varies between 66 feet and 150 feet. ROW is the most constrained in the urban core between CR 82/ Third Avenue and CSAH 42, where ROW is between 66 and 80 feet, limiting improvement alternatives that would not have property impacts.

EXISTING TRAFFIC AND CONGESTIONS

Throughout the TH 29 corridor, traffic varies from 9,000 ADT on the north end to 17,700 on the south end. The southern segment of the TH 29 corridor carries the highest volumes, given its proximity to Alexandria's downtown and other businesses/employment locations. The corridor generally carries more traffic in the southbound direction, especially during the AM peak hour. The unbalanced lane configuration (one southbound lane and two northbound lanes) results in unbalanced congestion – the southbound lane currently operating at LOS E and is expected to reach maximum capacity, while the dual northbound lanes are expected to have adequate capacity through 2045.

EXISTING TRUCK TRAFFIC

The TH 29 corridor is a designated truck route with trucks being four to five percent of total traffic. Typical urban corridors carry two percent truck traffic. High truck traffic can create after perceived safety issues for pedestrians and bicyclists.

EXISTING LEVELS OF SERVICE

All intersections operate at LOS C or better during AM and PM peak. All approaches of the intersections operate at LOS D or better during the peak periods. The intersection of CR 82/ Third Avenue East and TH 29 is an important intersection of the corridor because of the multimodal traffic activities at this intersection.

FUTURE TRAFFIC PROJECTIONS

Traffic projections were developed through an analysis of historic traffic patterns and demographic projections in the area to evaluate the future traffic operations along the corridor. By 2045, traffic is expected to increase to 22,300 between CR 82/Third Avenue East and CSAH 42; and 13,000-14,000 between CSAH 42 and CR 73.

The traffic impact from a potential new I-94 interchange at CR 106 or CSAH 17 was also evaluated. A review of previous studies and origin-destination data does not indicate a significant impact to study area traffic patterns if a new interchange is built.

FUTURE TRAFFIC AND CONGESTION

By 2045, projected traffic volumes will exceed capacity along the southbound segment of TH 29 from Robert Street to CR 82/ Third Avenue East, and along the TH 29 segment between Robert Street and CR 73. Future traffic on the northbound segment of TH 29 between CR 82/ Third Avenue East and Robert Street will continue to remain under capacity through 2045.

Only the CR 82/ Third Avenue East intersection is expected to reach a deficient level of service (LOS "E") during the PM peak by 2045. The remaining study intersections will operate at LOS "D" or better. The future traffic volumes on the corridor will limit the number of acceptable gaps for minor approach vehicles turning onto TH 29, with peak hour minor approach LOS F expected at the two-way stop-controlled intersections in the corridor.

SAFETY

The corridor experienced 70 crashes between 2013 and 2017. Out of 70 crashes, 22 crashes occurred at the key intersections.

- None of the intersections had crash rates above the critical crash rate, although the CR 73 intersection did experience crash rates slightly higher than the statewide crash rate for similar facilities.
- The segment from CR 82/ Third Avenue East to CSAH 42 experienced a crash rate above the statewide average, but not above the critical crash rate. The most frequent crash types are rear ends and right angle, likely attributed to the dense access spacing.
- From CSAH 42 to 1,500 feet north of Robert Street, the corridor had nine crashes, including four injury crashes. This segment has a crash rate above the critical crash rate. This is the speed transition segment where the speed limit abruptly transitions from 55 miles per hour to 30 miles per hour.
- From 1,500 feet north of Robert Street to CR 73, the crash rate is above the statewide average, but not above the critical crash rate.

TRAFFIC CONTROL

The CR 83/Third Avenue East and CSAH 46 intersections are signalized and currently meet traffic signal warrants. The CR 73 intersection meets the intersection near a grade crossing signal warrant but is currently a stop-controlled intersection. Potential traffic control revisions will be further studied in subsequent alternatives analysis.

LIGHTING

The key intersections currently have roadway lighting installed. The CR 82/ Third Avenue East and TH 29 and CSAH 46/TH 29 intersections meet lighting warrants since they are signalized intersections, while the CSAH 42/TH 29 and CR 73/TH 29 do not meet lighting warrants.

PEDESTRIAN AND BICYCLE GENERATORS

There are 69 pedestrian and bicycle generators along the corridor, with most between CR 82/ Third Avenue East and Northside Drive. The most common generators are commercial centers, restaurants, and gas stations.

PEDESTRIAN FACILITIES

Pedestrian facilities are currently present between CR 82/Third Avenue East and Darling Avenue (sidewalk), between Carlos Avenue and CSAH 42 (shared-use path), and between Manor Hills Street and Crestwood Drive (shared-use path). No facilities are currently present from Darling Avenue to Carlos Avenue, and from CSAH 42 to Manor Hills Street.

There were also multiple Americans with Disabilities Act compliance issues noted including pedestrian push button orientation, detectable warning panels, and broken or obstructed sidewalks.

BICYCLE FACILITIES

There is a shared-use path along the west side of TH 29 from Carlos Avenue to CSAH 42, and another shared-use path from Manor Hills Street to beyond CR 73 (predominantly on the west/north side of the corridor, but transitions to the east/south side via a grade separated crossing 1,000 feet northeast of Manor Hill Street).

The existing sidewalks are not wide enough to serve as bike facilities. The rest of the corridor is designated as a City or County Bike Route (on-street, no striping). The corridor's speed limit variation between 30 miles per hour and 55 miles per hour coupled with traffic volumes over 15,000 AADT can make it uncomfortable for many on street cyclists.

PEDESTRIAN AND BICYCLE LEVEL OF SERVICE

The Pedestrian Level of Service (PLOS) and Bicycle Level of Service (BLOS) varies throughout the corridor.

- From CR 82/ Third Avenue East to Darling Avenue: PLOS "C" and BLOS "E".
- From Darling Avenue to Carlos Avenue: PLOS and BLOS "F".

- From Carlos Avenue to CSAH 42: PLOS “D” and BLOS “E” for the east side and PLOS and BLOS “A” for the west side. This is due to no designated pedestrian/bicycle facility on the east side of the road.
- From CSAH 42 to Manor Hills Street: PLOS “E” and BLOS “D”.
- From Manor Hills Street to CR 73, PLOS and BLOS “A”.

ENVIRONMENTAL CONDITIONS

- Surface water resources along the corridor should be avoided if possible, with impacts minimized to the extent practicable; impacts may require mitigation and permitting.
- There is a medium to high likelihood of encountering historic sites along the corridor; surveys should be conducted during project development to identify sites present and inform further coordination.
- Projects with FHWA involvement would be required to avoid parks, recreation, and refuge areas protected by Section 4(f) of the DOT Act, if possible; unavoidable impacts would require approval.
- The developed nature of the corridor increases the potential for encountering contaminated properties; surveys should be conducted to identify areas of concern and inform further coordination.
- Protected wildlife and plant species may be present along the corridor.
- Sensitive noise receptors occur along the corridor; a noise analysis may be required for projects with federal involvement.

TRUNK HIGHWAY 29 CORRIDOR STUDY

CHAPTER 3 – ALTERNATIVES ANALYSIS

KLJ

ENGINEERING, REIMAGINED

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

INTRODUCTION

The Trunk Highway (TH) 29 study area (Figure 3.1) is a 2.9-mile segment of the corridor between County Road (CR) 82/ Third Avenue East and CR 73 in Alexandria, Minnesota. The corridor connects downtown Alexandria to the northern outskirts of Alexandria and serves as an important route for local traffic, commuters, pedestrians and bicyclists.

This chapter discusses potential roadway improvements that were considered to mitigate issues identified in the *Existing and Future Conditions Report* as well as issues brought up by the project Study Review Committee (SRC). Roadway improvements are intended to balance the needs of automobiles, pedestrians and bicyclists, project costs, and impacts.

STUDY AREA CHARACTERISTICS

The corridor segment between CR 82/Third Avenue East and CSAH 42/Nokomis Street is within the urban core of Alexandria and is fully developed, having several intersections with local roadways and commercial access points. Between CSAH 42 and CR 73, the corridor is the urbanizing transition area between the core of Alexandria and rural areas outside of the city (see Figure 3.1).

Specific issues that have been identified in the study area include anticipated traffic growth, high access density and limited right-of-way in the urban core segment, and limited pedestrian and bicycle connectivity throughout most of the study area.

DEVELOPMENT OF ALTERNATIVES

Given the varying roadway, travel demand, and development characteristics present within the study area, alternatives were developed for specific intersections and segments to best serve roadway needs in those specific locations.

Intersection improvements were considered for the following intersections:

- TH 29 and Third Avenue
- TH 29 and CSAH 42 (Nokomis Street)
- TH 29 and McKay Avenue
- TH 29 and CR 73

Segment-type improvements like cross-section revisions or access management implementation were identified for the following segments of TH 29:

- Third Avenue to Nokomis Street
- Nokomis Street to McKay Avenue
- McKay Avenue to County Road 73

Figure 3.1: Study Area

IMPROVEMENT PRIORITIES

To determine improvement priorities along the TH 29 corridor (i.e. prioritize improved vehicular efficiency and improved multimodal facilities over project cost, etc.), the Study Review Committee was requested to rate the importance of the following elements:

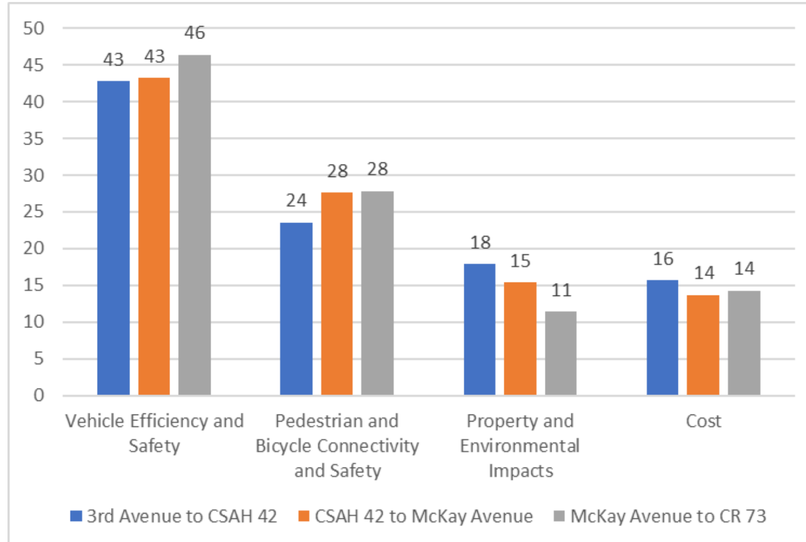
- » Vehicular efficiency and safety
- » Pedestrian and bicycle connectivity and safety
- » Property and environmental impacts
- » Project cost

Study Review Committee members were given 100 points to assign across the four elements above, and were requested to perform this exercise for the following corridor segments:

- » Segment 1 - Third Avenue to Nokomis Street
- » Segment 2 - Nokomis Street to McKay Avenue
- » Segment 3 - McKay Avenue to County Road 73

Based on committee feedback, across all three segments vehicle efficiency and safety was the top priority. Pedestrian and bicycle connectivity and safety was the second priority, followed by cost and impacts, which had approximately equal priority. This feedback shows a consistent vision for improvements on TH 29 even though the characteristics of the corridor vary from an urban setting to an urbanizing/rural setting.

Figure 3.2: Improvement Priority



EVALUATION AND RANKING OF ALTERNATIVES

Intersection and segment-type improvement alternatives were evaluated in terms of each of the elements that were prioritized by the Study Review Committee (vehicular efficiency and safety, project cost, etc.)

For each of the evaluation elements, a score between zero (○○○○○○○○○○) and ten (●●●●●●●●●●) was assigned. A score of zero indicates the alternative performs poorly in a given category and a score of ten indicates a significant improvement (or no consequences if conditions are already good).

Note that scores were assigned based on technical data and adjusted where appropriate using engineering judgement. Scores were assigned to alternatives relative to the other options at that same location due to the varying conditions present throughout the study area. Also note that alternative scores are not intended to serve as recommendations, rather they are meant to be a metric to help the Sturdy Review Committee and stakeholders better understand how different alternatives address the existing issues at each location.

Scoring Methods

VEHICULAR EFFICIENCY AND SAFETY

The vehicular efficiency and safety score was assigned based on the amount of expected traffic congestion associated with each alternative under 2045 conditions and the expected crash potential associated with each alternative.

Note that if a do-nothing condition operates with little delay and there is no safety issue, a high score can be achieved.

PEDESTRIAN AND BICYCLE MOBILITY AND SAFETY

The pedestrian and bicycle mobility and safety score were assigned based on the presence of efficient and safe multimodal facilities such as sidewalks, shared use paths, or bike lanes. Consideration was also given to safety enhancements associated with access management and the presence of controlled crossings for nonmotorized users.

PROPERTY AND ENVIRONMENTAL IMPACTS

The impacts score is based on the degree of private property impacts (i.e. buildings, driveways, or other infrastructure), right-of-way acquisition needs, and environmental impacts.

ESTIMATED COST

The cost score is based on planning level cost estimates for improvements, with all alternatives developed to minimize cost and impacts to the extent possible. More detailed cost estimates will be completed for alternatives that are selected for the implementation plan.

WEIGHTED AVERAGE SCORE

A weighted average score considering all categories described above was calculated using the Study Review Committee input as the weighting criteria.

Table 3.1: Example of Weighted Score for Alternatives

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●○○○○	●●●●●●●●○○
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●○○○	
Property and Environmental Impacts	18	●●●●●●●●●●	
Cost	16	●●●●●●●●●○	

In the example below, the weighted score was calculated as follows:

$$Weighted\ Score = (Vehicle\ Efficiency\ and\ Safety\ Score\ \times Category\ Weight) + (Pedestrian\ and\ Bicycle\ Score\ \times Category\ Weight) + (Impacts\ Score\ \times Category\ Weight) + (Cost\ Score\ \times Category\ Weight)$$

$$Weighted\ Score = (6\ \times 0.43) + (7\ \times 0.24) + (10\ \times 0.18) + (9\ \times 0.16)\ = 7.5\ \rightarrow \mathbf{8.0}$$

Category Weights at Boundary Intersections

At intersections that are at the boundary of two segments like the intersection of TH 29 and Nokomis Street, the weights from the two segments were averaged.

URBAN CORE SEGMENT – THIRD AVENUE TO NOKOMIS STREET

Within the urban core segment, the following alternatives were developed and evaluated:

INTERSECTION ALTERNATIVES:

TH 29 and Third Avenue

- Do nothing (signal control)
- Minor intersection improvements (maintain signal control)
- Major intersection improvements (maintain signal control)
- Two by one roundabout
- Two by two roundabout

TH 29 and Nokomis Street

- Do nothing (minor approach stop control)
- Continuous green T-Intersection
- Four-legged signalized intersection
- Continuous roundabout
- Four-legged standard roundabout

CROSS-SECTION ALTERNATIVES:

- Do nothing (two northbound lanes, one southbound lane, two-way left turn lane)
- Five-lane section (with two-way left turn lane)
- Four-lane section with raised median and sidewalk/shared use path
- Reversible flow lanes
- Three-lane section (with two-way left turn lane) with buffered two-way bike facility
- *Not considered: Four-lane undivided section (no turn lanes). This has been implemented in the past and was deemed to provide unacceptable operations.*

ACCESS-MANAGEMENT ALTERNATIVES:

- Do nothing (Existing)
- Backage road
- Raised median

PEDESTRIAN/BICYCLE ALTERNATIVES:

- Do nothing
- On-Street and off-street connections

Urban Core Intersection Alternatives

TH 29 AND THIRD AVENUE

Under the existing signal control, the following issues were identified:

- **Congestion:** The intersection is expected to operate at LOS "D" in the 2045 peak hour, but queue spillback issues are expected on the southbound and westbound approaches that will block the upstream business accesses. While the existing crash rate is well below the statewide average crash rate (69 percent lower), future congestion and queuing may increase rear-end crash potential.
- **Access Management:** Multiple business accesses located near the intersection increase conflict potential.
- **Channelized Right Turn and Pedestrians:** While there are crosswalks on all approaches, the free channelized southbound right turn can create conflicts between turning vehicles and pedestrians/bicyclists crossing the southbound approach.

Alternative: Do Nothing

This alternative assumes no improvements are made. The intersection will continue to operate at LOS "D". While there will be no major construction costs, the traffic signal will incur some maintenance costs for intermittent signal re-timing.

Table 3.2: Weighted Score for TH29/Third Avenue Intersection Alternative: Do Nothing

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●○○○○	●●●●●●●○○○
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●○○○○	
Property and Environmental Impacts	18	●●●●●●●●●●	
Cost	16	●●●●●●●●●●	

Figure 3.3: TH 29 and Third Avenue Intersection (Existing)

Alternative: Minor Intersection Improvements

This alternative would signalize the southbound right turn movement (currently a channelized free movement) and add a No Right Turn on Red dynamic message plaque that would only be displayed during a pedestrian actuation. This option would also add a short westbound right turn lane (around 50 feet).

Figure 3.4: No Right Turn on Red Dynamic Message Plaque

These improvements would have minimal impacts to traffic flow at the intersection but would mitigate existing conflicts between southbound right-turning vehicles and pedestrians crossing the southbound intersection approach. A small operational improvement can be expected for westbound right turning vehicles given the addition of a short turn lane (currently a shared through/right turn lane).

It is estimated that these improvements would cost between $50,000 and $100,000, depending on the layout of new signal heads on the southbound approach.

Table 3.3: Weighted Score for TH 29/Third Avenue Intersection Alternative: Minor Intersection Improvements

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●○○○	●●●●●●●●○○
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●○○○	
Property and Environmental Impacts	18	●●●●●●●●●○	
Cost	16	●●●●●●●●●○	

Alternative: Major Intersection Improvements

This alternative would add a second southbound right turn lane, and construct medians on the southbound, eastbound, and westbound approaches. A short dedicated westbound right turn lane can also be added (around 50 feet). A longer westbound right turn lane would impact the existing retaining wall and railroad grade separation on this approach.

Based on Vissim traffic simulation results, these improvements are not expected to significantly impact intersection delays, with 2045 peak hour LOS "D" still expected. Some queuing is still expected on the southbound and westbound approaches; however, the added turn lanes will mitigate this. The mitigation will however be less significant on the westbound approach given the short turn lane length.

While traffic flow is not expected to be significantly impacted, the added medians will reduce crash potential by reducing the number conflict points from business accesses near the intersection.

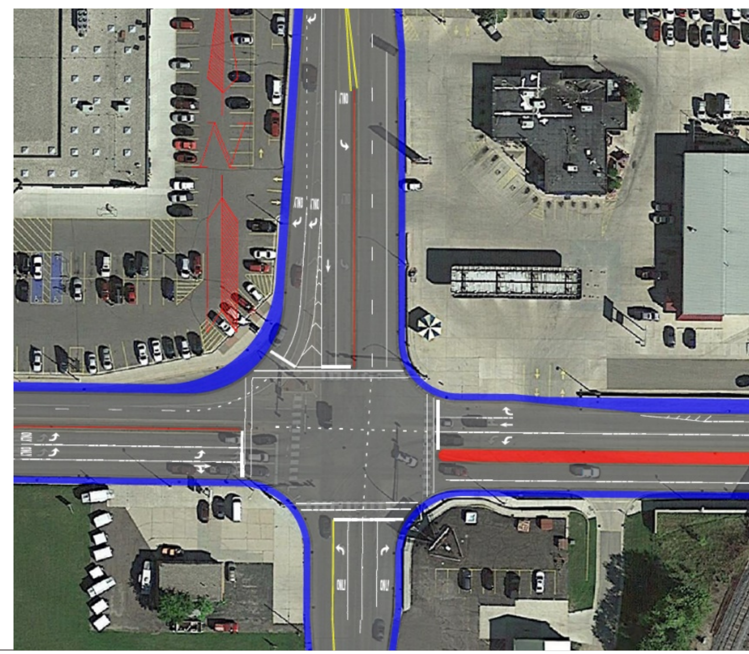
Pedestrian crossing safety is enhanced with these intersection revisions by eliminating the existing channelized southbound right turn movement, instead operating this under signal control with no right turn on red operations during pedestrian actuations. The added medians on three intersection approaches also provide a safety benefit by reducing the number of potential conflicts between vehicles and pedestrians.

It is estimated that these improvements would cost $200,000 - $250,000, however other impacts are expected to be minimal.

Table 3.4: Weighted Score for TH29/Third Avenue Intersection Alternative: Major Intersection Improvements

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●○○	●●●●●●●●○○
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	
Property and Environmental Impacts	18	●●●●●●●●●○	
Cost	16	●●●●●●●○○○	

Figure 3.5: TH 29/Third Avenue Intersection Alternative Concept: Minor Intersection Improvements



Alternative: Two-By-One Roundabout

This alternative would construct a two-by-one roundabout with two entering lanes on the eastbound and westbound approaches, and one entering lane with right turn bypass lanes on the northbound and southbound approaches.

Simulation results indicate a two-by-one roundabout is expected to operate at LOS "E" in the 2045 PM peak, compared to LOS "D" under the no-build signal control. Queue lengths in the 2045 peak hour are expected to approach 500 feet on the westbound approach and 400 feet on the northbound approach.

MnDOT's 2017 *A Study on the Traffic Safety at Roundabouts in Minnesota* evaluated 34 intersections that were converted to two-by-one roundabouts and found that crash frequency increased by 44 percent after the construction of a two-by-one roundabout, however serious injury crashes were reduced by 78 percent (only one injury crash was reported at the intersection in the most recent five-year data period).

There is conflicting data in research literature related to pedestrian safety issues at roundabouts, however reduced vehicle speeds associated with roundabout control allow more time for drivers and pedestrians to interact with each other, and the presence of raised splitter islands also simplifies the task of pedestrian crossings by allowing pedestrians to consider one direction of conflicting traffic at a time.

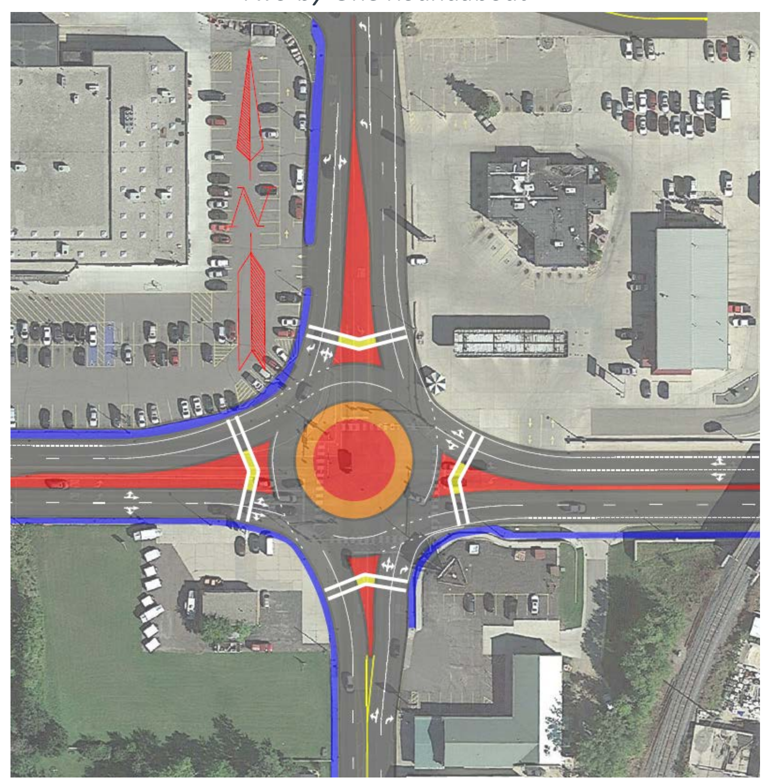
The splitter islands of roundabout serve as an access management feature, reducing the number of conflict points from business accesses. Additionally, some potentially difficult left turn movements near the intersection under existing conditions can instead turn right and perform a U-turns at the roundabout.

It is estimated that a two-by-one roundabout will cost $650,000 - $700,000, with some minor impacts to the southwest and northeast corners of the intersection.

Table 3.5: Weighted Score for TH29/Third Avenue Intersection Alternative: Two-by-One Roundabout

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●○○○○○○	●●●●●○○○○○
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●○○○	
Property and Environmental Impacts	18	●●●●●●●●○○	
Cost	16	●●●○○○○○○○	

Figure 3.6: TH 29/Third Avenue Intersection Alternative Concept: Two-by-One Roundabout



Alternative: Two-by-Two Roundabout

This alternative would construct a multilane roundabout with two entering lanes on all approaches.

Simulation results indicate a two-by-two roundabout is expected to significantly improve traffic flow, with peak hour LOS "B" expected through 2045.

The splitter islands of roundabout will reduce the number of conflict points from full access driveways near the intersection and substitute some potentially difficult left turns with the use of U-turns at the roundabout. However, due to the presence of additional entry lanes and the accompanying need to provide wider circulatory and exit roadways, double lane roundabouts introduce additional conflicts not present in traditional single-lane roundabouts.

MnDOT's 2017 roundabout study found that crash frequencies across six recently constructed two-by-two roundabouts increased by 146 percent after roundabout construction, but no serious injuries were reported after roundabout implementation.

The conflicts unique to multilane roundabouts are generally low-speed sideswipe conflicts that typically have low severity. Therefore, although the number of conflict points increases at multilane roundabouts when compared to a single lane roundabout, the overall severity of conflicts is generally less than alternative intersection control.

Like the two-by-one roundabout, research has provided conflicting data related to pedestrian safety at roundabouts, but reduced vehicle speeds at roundabouts provide a lower speed traffic environment for pedestrians that a traffic signal.

It is estimated that a two-by-one roundabout will cost $1.4 million - $1.6 million, with some minor impacts to the corners of the intersection.

Alternative Summary

A summary of all considered intersection alternatives at Third Avenue and Nokomis Street can be seen in Table 3.7

Table 3.6: Weighted Score for TH29/Third Avenue Intersection Alternative: Two-by-Two Roundabout

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●●●	●●●●●●●○○○
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●○○○	
Property and Environmental Impacts	18	●●●●●●●●○○	
Cost	16	○○○○○○○○○○	

Figure 3.7: TH 29/Third Avenue Intersection Alternative Concept: Two-by-Two Roundabout

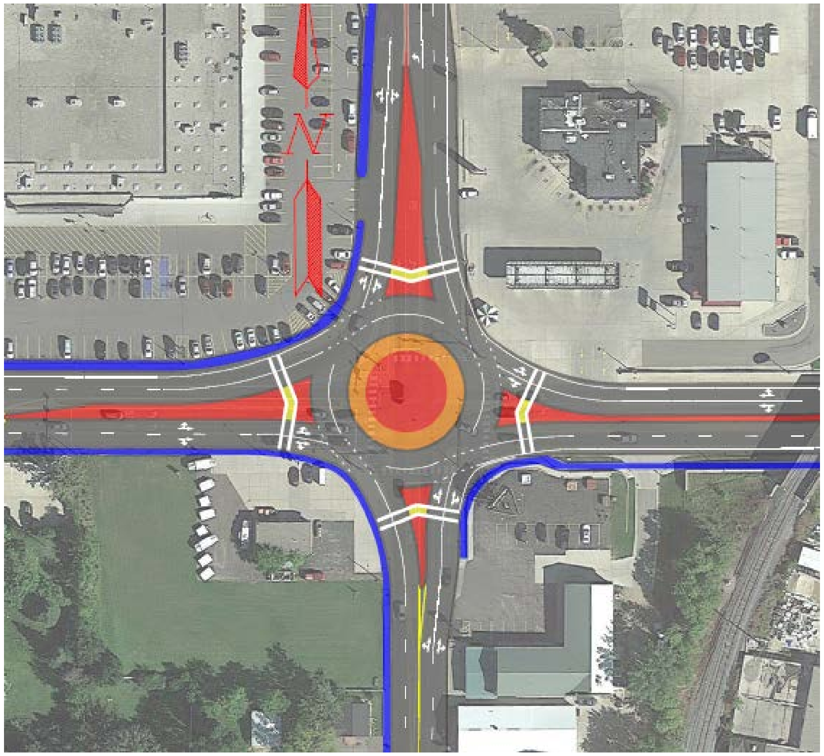


Table 3.7: TH29/Third Avenue Intersection Alternative Summary

Alternative	Concept Drawing	Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Do Nothing (Traffic Signal)		Vehicle Efficiency and Safety	43	●●●●●●○○○○	2045 peak hour intersection LOS "D". No existing crash issues, but future queuing issues on SB and WB approaches may increase rear-end crash potential.	●●●●●●●○○○ (7.4)
		Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●○○○○	Crosswalks and signal heads on all approaches, but channelized SB right turn creates potential conflicts between nonmotorized users and vehicles.	
		Property and Environmental Impacts	18	●●●●●●●●●●	No impacts.	
		Cost	16	●●●●●●●●●●	Intermittent signal maintenance costs.	
Minor Intersection Geometry Improvements		Vehicle Efficiency and Safety	43	●●●●●●●○○○	Minimal impacts to traffic flow, but westbound right turn lane has a minor traffic flow improvement.	●●●●●●●●○○ (7.8)
		Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●○○○	Removal of free southbound right turn movements improves nonmotorized crossing safety.	
		Property and Environmental Impacts	18	●●●●●●●●●○	Fits within existing intersection footprint.	
		Cost	16	●●●●●●●●●○	Estimated project cost: $50 - 100k	
Major Intersection Geometry Improvements		Vehicle Efficiency and Safety	43	●●●●●●●●○○	No change in 2045 peak hour intersection LOS. Peak hour queuing still present, but minor improvements expected. Medians reduce the number of conflict points from nearby business accesses.	●●●●●●●●○○ (8.1)
		Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Removal of free southbound right turn movements improves nonmotorized crossing safety. Access management via medians reduces the amount of conflicts between vehicles and pedestrians.	
		Property and Environmental Impacts	18	●●●●●●●●●○	Fits within existing intersection footprint.	
		Cost	16	●●●●●●●○○○	Estimated project cost: $200-250k	
2x1 Roundabout		Vehicle Efficiency and Safety	43	●●●●○○○○○○	2045 peak hour intersection LOS "E" with significant queuing. Potential increase in crash frequency, but reduction in serious injury crashes. Splitter islands likely to reduce the nuber of conflict points on nearby accesses	●●●●●○○○○○ (5.3)
		Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●○○○	Removes pedestrian signal phases, but reduces entering vehicle speeds. Splitter islands allow pedestrians to cross one direction of traffic at a time. Access management via medians reduces the amount of conflicts between vehicles and nonmotorized users.	
		Property and Environmental Impacts	18	●●●●●●●●○○	Minor impacts to intersection corners likely.	
		Cost	16	●●●○○○○○○○	Estimated project cost: $650-700k	
2x2 Roundabout		Vehicle Efficiency and Safety	43	●●●●●●●●●●	2045 peak hour intersection LOS "B". Potential increase in crash frequency, but reduction in serious injury crashes.Splitter islands likely to reduce the nuber of conflict points on nearby accesses	●●●●●●●○○○ (7.4)
		Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●○○○	Removes pedestrian signal phases, but reduces entering vehicle speeds. Splitter islands allow pedestrians to cross one direction of traffic at a time. Access management via medians reduces the amount of conflicts between vehicles and nonmotorized users.	
		Property and Environmental Impacts	18	●●●●●●●●○○	Minor impacts to intersection corners likely.	
		Cost	16	○○○○○○○○○○	Estimated project cost: $1.4-1.6 million	

TH 29 AND NOKOMIS STREET

Under the existing two-way stop control, the following issues were identified:

- **Congestion:** By 2045, increased volumes at the intersection are expected to result in peak hour LOS "E" on the eastbound approach, with queue spillback issues on all approaches. There is currently a significant number of northbound left turns from TH 29 to Nokomis Street, and this is expected is expected to increase in the future. While the existing crash rate is below the statewide average crash rate (33 percent lower), future congestion may increase the potential for both rear-end and left-turn crashes. The Study Review Committee indicated that drivers are avoiding the intersection and instead routing through adjacent properties to access the corridor because of significant intersection delays.
- **Safety:** There is a conflict at the merge point of the uncontrolled channelized eastbound right turn lane and southbound through traffic. Related to this conflict, the speed limit for southbound vehicles abruptly transitions to 30 miles per hour from 55 miles per hour just north of Nokomis Street. This abrupt change in speed may increase rear-end collisions because of sudden deceleration of traffic near the intersection.
- **Signal Warrants:** Signal warrants are not currently met, but are expected to be met in approximately 2035.

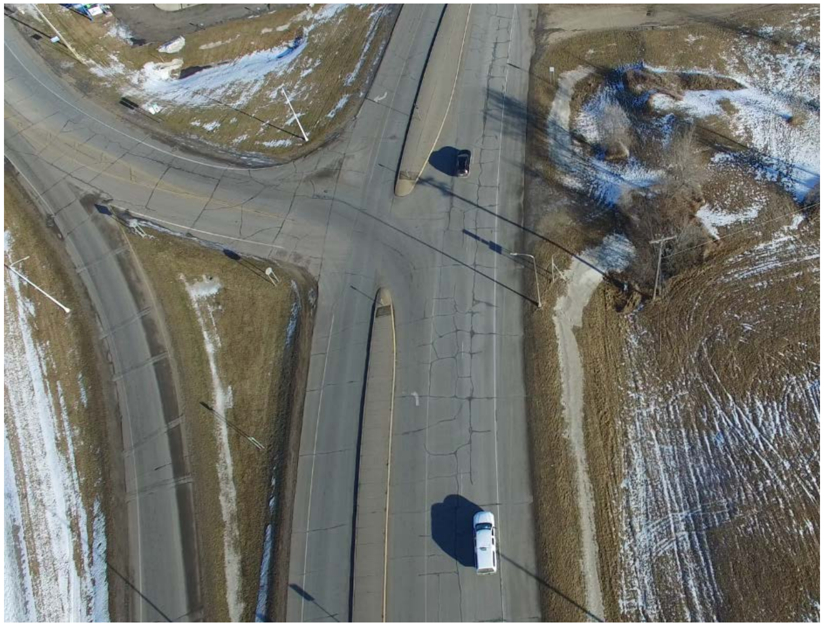
Alternative: Do Nothing

This alternative assumes no improvements to the intersection, meaning no issues will be mitigated. The intersection will continue to operate at LOS "D" by 2045 with significant unacceptable delay on northbound and eastbound approach.

Table 3.8: Weighted Score for TH29/Nokomis Street Intersection Alternative: Do Nothing

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●○○○○○○○	●●●●●○○○○○
Bicycle and Pedestrian Connectivity and Safety	26	●○○○○○○○○○	
Property and Environmental Impacts	17	●●●●●●●●●●	
Cost	15	●●●●●●●●●●	

Figure 3.8: TH 29/Nokomis Street Intersection (Existing Conditions)



Alternative: Continuous Green T-Intersection

A continuous green T-intersection alternative would construct a traffic signal, however the northbound through movement would be permitted to operate with a continuous green signal indication throughout the day. For the eastbound approach, the southbound approach, and the northbound left-turning movements, the signal operates like a typical signal. The continuous green for the northbound through movements is accommodated by providing a median-separated receiving lane for minor approach left-turning vehicles, allowing these vehicles to merge with through traffic downstream of the intersection.

This alternative will retain the free channelized eastbound right turn lane and requires a dedicated receiving lane on the south approach for the intersection to operate at an acceptable level of service. Depending on the future cross-section of TH 29, the receiving lane could become a second southbound through lane, otherwise a downstream merge will be required.

Figure 3.9: Example of a typical Green T-Intersection (CSAH 4 & Airport Road in Duluth, MN)

A continuous green-T configuration is expected to significantly improve traffic operations, with simulation results indicating intersection LOS "B" through 2045. Queueing issues are resolved on the northbound and eastbound approaches, but some longer peak hour queues are still expected on the southbound approach.

Research from Colorado that was published by the Federal Highway Administration (FHWA) found that crash frequency was reduced by 60 percent after conversion to a green-T configuration, with injury crashes reduced by 70 percent.

To improve pedestrian safety, a traffic signal should be designed to enable a pedestrian crossing phase across TH 29, which would also place a red indication for northbound vehicles (the typically continuous movement) after a pedestrian actuation. Note that a northbound red phase during pedestrian movements could interfere with driver expectation since this would often be a continuous green phase, therefore advance warning beacons may be required to mitigate this. There are still some potential pedestrian conflicts on the uncontrolled minor approach right turn movement (required for acceptable traffic flow), however this can be mitigated with a pedestrian actuated beacon for the channelized right turn.

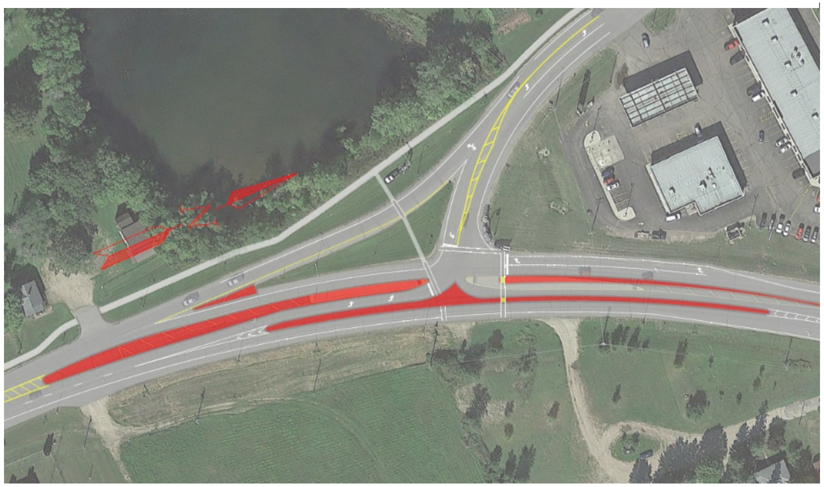
It is estimated these improvements would cost $350,000 - $400,000 but can fit within the existing intersection footprint.

Table 3.9: Weighted Score for TH29/Nokomis Street Intersection Alternative: Green T-Intersection

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●●○	●●●●●●●●●○
Bicycle and Pedestrian Connectivity and Safety	26	●●●●●●●●●○	
Property and Environmental Impacts	17	●●●●●●●●●●	
Cost	15	●●●●●●○○○○	

Alternative: Signalized Intersection with Fourth Intersection

Figure 3.11: TH 29/Nokomis Street Intersection Alternative Concept: Green T-Intersection



Approach

This alternative would add an east intersection approach and add a traffic signal (Figure 3.11). The fourth intersection approach can help alleviate potential access issues associated with access management treatments which are described in greater detail in a subsequent section of this chapter.

This alternative will retain the free channelized eastbound right turn lane and requires a dedicated receiving lane on south approach for the intersection to provide acceptable operations. Like the green-T option, this requires a dedicated receiving lane on the south approach for the intersection to operate at an acceptable level of service.

These improvements are expected to improve operations and provide 2045 peak hour intersection LOS "B", but some longer queues are still expected on northbound and southbound approaches.

Research has found that traffic signals reduce crashes by around 34 percent compared to two-way stop control, but the addition of a fourth intersection leg does increase the total number of conflict points from nine to 32.

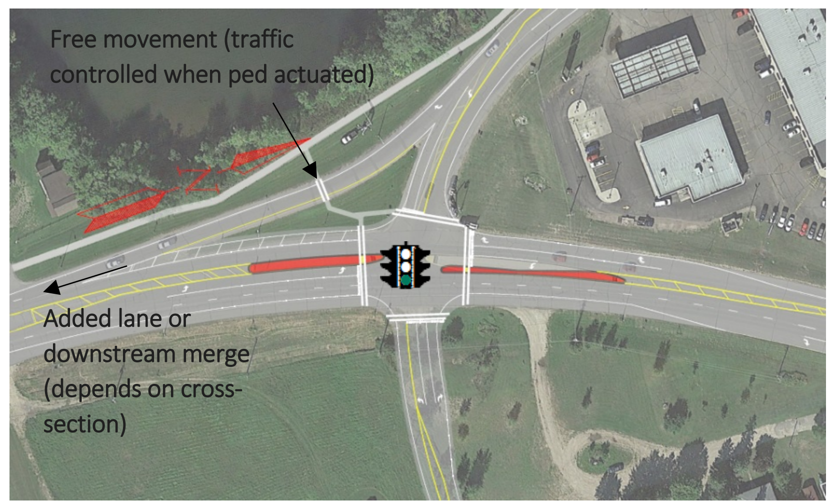
A standard traffic signal enables pedestrian crossing phases across all intersection approaches, improving pedestrian crossing safety.

It is estimated these improvements would cost $575,000 - $625,000. Right-of-way will need to be obtained for the new intersection approach, however no building impacts are anticipated.

Table 3.10: Weighted Score for TH29/Nokomis Street Intersection Alternative: Signalized Intersection with Fourth Intersection Approach

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●○○	●●●●●●●●○○
Bicycle and Pedestrian Connectivity and Safety	26	●●●●●●●●●●	
Property and Environmental Impacts	17	●●●●●●●●○○	
Cost	15	●●●○○○○○○○	

Figure 3.10: TH 29/Nokomis Street Intersection Alternative Concept: Signalized Intersection with Fourth Intersection Approach



Alternative: Continuous Roundabout

This alternative would construct a three-legged roundabout with a northbound lane that bypasses the circulating lane. This alternative will also retain the free channelized eastbound right turn lane, having similar receiving lane needs as the green-T and signal alternatives.

Simulation results indicate a continuous roundabout will operate at peak hour LOS “A” through 2045. While this alternative will mitigate the queuing on eastbound approach, queuing is still expected on northbound and southbound approaches.

Deflection associated with roundabout control will mitigate issues related to high vehicle speed differentials between southbound vehicles since all vehicles will be forced to slow down as they approach and navigate the roundabout.

MnDOT’s 2017 roundabout study evaluated 104 intersections that were converted to a single lane roundabout and found that crash frequency reduced by 27 percent, and serious injuries crashes reduced by 83 percent. The separation of the northbound through movement from the circulating lane will likely further decrease crash potential.

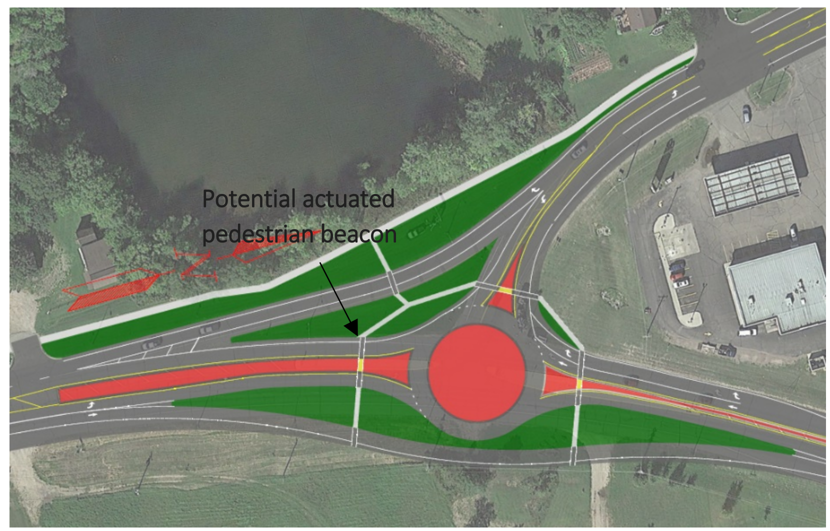
Like roundabouts discussed previously, research related to pedestrian and vehicle conflicts at roundabouts varies, but reduced vehicle speeds on most approaches through the intersection can benefit nonmotorized users. The northbound bypass lane does however permit higher entering speeds for these vehicles, creating more conflict potential between crossing pedestrians and northbound traffic.

It is estimated that a single lane hybrid roundabout at this intersection will cost $1.25 to $1.35 million. Some right-of-way will need to be obtained, but no buildings will be impacted.

Table 3.11: Weighted Score for TH29/Nokomis Street Intersection Alternative: Continuous Roundabout

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●●●	●●●●●●●○○○
Bicycle and Pedestrian Connectivity and Safety	26	●●●○○○○○○○	
Property and Environmental Impacts	17	●●●●●●●●○○	
Cost	15	●○○○○○○○○○	

Figure 3.12: TH 29/Nokomis Street Intersection Alternative Concept: Continuous Roundabout



Alternative: Standard Roundabout with Added East Intersection Approach

This alternative would add a new access on east approach and construct a roundabout. Given the existing cross-section configuration, two lanes are available for northbound through movements, with a single lane available for all other through movements. This alternative will also retain the free channelized eastbound right turn lane, with the same receiving lane needs as alternatives described above.

Simulation results indicate a four-legged roundabout is expected to operate at 2045 peak hour intersection LOS "A" and will mitigate the eastbound and northbound queueing issues. Longer queues are however still expected on southbound approach. Note that cross-section revisions north and south of the intersection could impact the final roundabout configuration.

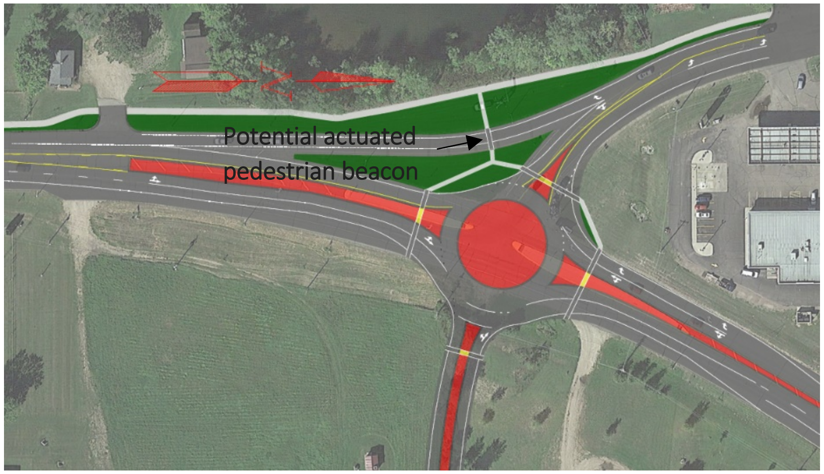
Like the roundabouts discussed for the Third Avenue intersection, a roundabout will reduce entering vehicle speeds and will provide pedestrian refuge on splitter islands. Compared to the continuous roundabout, northbound vehicles will have a greater deflection angle, requiring these vehicles to enter at a lower speed, improving pedestrian safety.

It is estimated that this alternative will cost $1.1 to $1.2 million. The added intersection approach will require right-of-way acquisition, but no buildings will be impacted.

Table 3.12: Weighted Score for TH29/Nokomis Street Intersection Alternative: Full Access Roundabout

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●●●	●●●●●●●●○○
Bicycle and Pedestrian Connectivity and Safety	26	●●●●●●●●○○	
Property and Environmental Impacts	17	●●●●●●●●○○	
Cost	15	○○○○○○○○○○	

Figure 3.13: TH 29/Nokomis Street Intersection Alternative Concept: Full Access Roundabout



Alternative Summary

A summary of all considered intersection alternatives at Third Avenue and Nokomis Street can be seen in Table 3.13.

Table 3.13: TH29/Nokomis Street Alternative Summary

Alternative	Concept Drawing	Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Do Nothing (Minor Approach Stop Control)		Vehicle Efficiency and Safety	43	●●●○○○○○○○	2045 peak hour NB LOS "E" and EB LOS "D". No existing crash issues, but future delays can increase rear-end and angle crash potential.Abrupt speed change near the intersection likely to increase rear end crashes	●●●●●○○○○○ (4.7)
		Bicycle and Pedestrian Connectivity and Safety	26	●○○○○○○○○○	Uncontrolled crossing - Channelized EB right turn creates conflicts between nonmotorized users and vehicles.	
		Property and Environmental Impacts	17	●●●●●●●●●●	No impacts.	
		Cost	15	●●●●●●●●●●	No project costs.	
Continuous Green-T		Vehicle Efficiency and Safety	43	●●●●●●●●●○	2045 peak hour intersection LOS "B", crash potential reduction. Signal however not expected to be warranted until 2035.	●●●●●●●●●○ (8.7)
		Bicycle and Pedestrian Connectivity and Safety	26	●●●●●●●●●○	Adds pedestrian signal control and refuge islands. Remaining conflicts associated with free flow minor approach right turn movement can be mitigated with pedestrian beacon.	
		Property and Environmental Impacts	17	●●●●●●●●●●	Fits within existing roadway footprint.	
		Cost	15	●●●●●●○○○○	Estimated project cost: $350-400k	
Signal + Added East Intersection Approach		Vehicle Efficiency and Safety	43	●●●●●●●●○○	2045 peak hour intersection LOS "B". Signal reduces angle crash potential, but addition of fourth approach increases number of conflict points.	●●●●●●●●○○ (7.8)
		Bicycle and Pedestrian Connectivity and Safety	26	●●●●●●●●●●	Signal allows crosswalks and pedestrian signal heads on all approaches.	
		Property and Environmental Impacts	17	●●●●●●●●○○	Added east approach requires right-of-way acquisition, but no building impacts.	
		Cost	15	●●●○○○○○○○	Estimated project cost: $575-625k	
Continuous Roundabout		Vehicle Efficiency and Safety	43	●●●●●●●●●●	2045 peak hour LOS "A" and reduced crash potential.	●●●●●●●○○○ (6.6)
		Bicycle and Pedestrian Connectivity and Safety	26	●●●○○○○○○○	Northbound through movement and eastbound right turning movement present pedestrian crossing challenges without supplemental beacons.	
		Property and Environmental Impacts	17	●●●●●●●●○○	Minor right-of-way acquisition needed, but no building impacts.	
		Cost	15	●○○○○○○○○○	Estimated project cost: $1 million.	
Standard Roundabout + Added East Intersection Approach		Vehicle Efficiency and Safety	43	●●●●●●●●●●	2045 peak hour LOS "A" and reduced crash potential.	●●●●●●●●○○ (7.7)
		Bicycle and Pedestrian Connectivity and Safety	26	●●●●●●●●○○	Reduced vehicle entering speeds, however eastbound right turning movement still presents pedestrian challenges without supplemental beacons.	
		Property and Environmental Impacts	17	●●●●●●●●○○	Added east approach requires right-of-way acquisition, but no building impacts.	
		Cost	15	○○○○○○○○○○	Estimated project cost: $1.2 million.	

Urban Core Access Management Alternatives

Given the limited right-of-way available on the urban segment of the corridor, access management treatments can be lower impact solutions to improve traffic flow and reduce crash potential along the corridor. These concepts are intended to reduce the number of accesses on TH 29 since research indicates that each access on a corridor increases crash potential by four percent and reduces travel speeds by 0.25 miles per hour.

The concepts described below can be applied to various cross-section alternatives.

Backage Road

This alternative utilizes parallel roadways (Kenwood Drive and Oak Street) for property access to minimize the number of accesses to TH 29 itself. This would maintain existing public roadway accesses, but remove many private accesses, and consolidate some of the remaining accesses.

A potential backage road access concept is shown in Figure 3.14.

Between First Avenue and Carlos Avenue, there are 28 accesses currently which equates to access density of 74 accesses per mile. This alternative removes 19 accesses and reduces the access density to 24 accesses per mile. This reduces the total number of conflict points from 344 to 182 and the predicted frequency of crashes related to accesses by 54% in this segment.

Access Control With Raised Median

If a median is implemented as part of overall cross-section improvements, left turns to and from TH 29 can be restricted at several accesses. To accommodate existing left turn movements, intermittent median openings can be provided. For example, full access could be provided at Lakeview Avenue and rest of the other accesses being right-in/right-out only. Vehicle routing impacts from median construction could be mitigated if roundabouts were constructed at Third Avenue, Nokomis Street, or elsewhere since these roundabouts could function as U-turn locations.

A raised median configuration has safety benefits since full accesses have 32 conflict points and right-in/right-out accesses have four conflict points. Based on the proposed access configuration, the total number of conflict points would be reduced from 344 to 154.

Information in the Transportation Research Board's *Access Management Manual* indicates the addition of a median to a road that previously had a two-way left turn lane can reduce the crash rate by 37% and the injury rate by 48%.

Figure 3.15 shows the median configuration alternative.

Lakeview Avenue Intersection Alternatives

In association with access management implementation, intermittent full accesses should be provided to maintain reasonable access to TH 29. The Study Review Committee has noted public concerns regarding the difficulty of minor approach left turns onto TH 29 due to poor gap availability.

Since the Lakeview Avenue intersection is approximately half-way between major intersections at Third Avenue and Nokomis Street and provides connectivity to Kenwood Drive (a potential backage road), Lakeview Avenue is a reasonable location for a full access intersection for vehicles, pedestrians and bicyclists. To provide full access at this location, a traffic signal or a roundabout could be considered.

It is important to note that detailed traffic data was not collected between Third Avenue and Nokmois Street as part of this study, therefore it is difficult to estimate the degree of traffic pattern changes associated with access revisions and traffic control revisions or whether the Lakeview Drive intersection meets specific traffic control warrants. Additionally, corridor cross-section decisions as well as intersection control decisions at adjacent intersection can also impact the what the optimal traffic control device is.

Figure 3.14: Third Avenue to Nokomis Street: Access Management Alternative (Backage Road)

Figure 3.15: Third Avenue to Nokomis Street: Access Management Alternative (Raised Median)

Traffic Signal at Lakeview Avenue

Lakeview Avenue is located over a quarter-mile from Third Avenue, therefore this would meet MnDOT minimum signal spacing standards. If other access points are restricted or removed, additional traffic at this location could be better accommodated with signal control, and a signal would also better accommodate non-motorized crossing activity due to pedestrian signal phases. The intersection does not currently meet signal warrants, however access restrictions and associated traffic rerouting could potentially result in warrants being met in the future.

Roundabout at Lakeview Avenue

This alternative would construct a roundabout at the intersection. Based on traffic volumes, it is likely a two by one roundabout would be required. A roundabout would improve minor approach traffic operations and serve as a traffic calming device to potentially make an easier crossing environment for nonmotorized roadway users. This alternative can also reduce crash potential, especially for severe crashes. A major benefit of a roundabout at this location is facilitating U-turn movements, which is especially beneficial if minor approach left-turns are restricted along the corridor.

While there are benefits to roundabout control at this intersection, a two by one roundabout will be a challenge to fit within existing right-of-way.

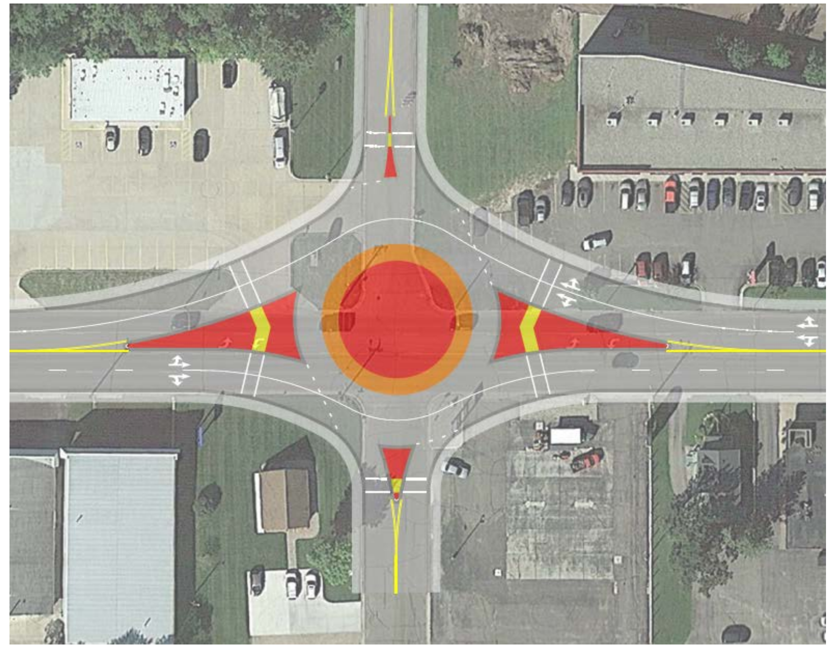
Third Avenue to CR 42/Nokomis Street: Cross-Section Alternatives

Under the existing unbalanced 4-lane segment, the following issues were identified:

Capacity Issues and Right-of-Way Limitations: The unbalanced lane assignment is not conducive to directional traffic fluctuations throughout the day. Around 65 percent of traffic is travelling southbound in the morning using a single lane, while there are two northbound lanes that are underutilized. This is expected to result in corridor LOS "F" in the near future.

The narrow right-of-way in this segment makes roadway widening a challenge.

Figure 3.16: Potential Roundabout at Lakeview Avenue



Access Density: The existing access density is 69 access points per mile which is more than five times than the MnDOT-preferred 12 access per mile. The congestion impacts, vehicle conflicts and crashes increase with greater frequencies of intersections and accesses.

Pedestrian/Bicycle Facility Gaps: There are several generators for pedestrian and bicyclists in this segment. The existing multimodal network has little consistency, with many gaps in some areas of the sidewalk network, and a complete absence of facilities in other areas.

Maintain Existing Roadway Section with Access Management

This alternative assumes no improvements to the cross section of the segment, meaning no issues will be mitigated. It is however possible to implement access management to reduce crash potential and improve traffic flow. The existing roadway section, possible access revisions, and technical scores for this configuration are shown in Figure 3.18.

Five-Lane Section with Access Management

This alternative would add a second southbound lane, improving corridor operations to LOS "C" through 2045. This section can fit within existing right-of-way, however will not fit within the existing curb lines. The expanded roadway section would place curb lines closer to existing off-street parking spaces, especially on the west side of the corridor.

This option is not expected to have a significant impact on crash potential and will not add nonmotorized facilities.

It is estimated that conversion to a five-lane cross section will cost $400,000. The concept layout, possible access revisions, and technical scores for this alternative are shown in Figure 3.19.

Four/Five-Lane Section with Raised Median

This alternative would add a second southbound lane and convert the existing two-way left turn lane to a raised median, with left turn lanes at appropriate locations. A six foot wide sidewalk and a 10 foot shared use path would also be added to better accommodate multimodal users.

This cross-section is expected to provide LOS "C" through 2045, however the 74-foot typical roadway width is expected to have significant impacts to both residential yards on the east side of the corridor and commercial parking spaces on the west side of the corridor. Additional width would be required to provide left turn lanes at major intersections (for example, Lakeview Drive) however the number of required left turn lanes could be reduced through access management and associated left turn restrictions.

It is estimated that this alternative will cost approximately $600,000.

The concept layout, possible access revisions, and technical scores for this alternative are shown in Figure 3.20.

Three-Lane Section with Buffered 2-Way Bike Lane with Access Management

This alternative would reduce the roadway section to a three-lane section with a two-way left turn lane in the center lane, reallocating the remaining space to provide a bidirectional bicycle facility. Sidewalks would also be added to each side of the corridor.

The reduced vehicle capacity is expected to result in peak hour LOS "F" in 2045. Increased congestion can also increase rear-end crash potential and can increase angle-crash potential due to more challenging gap selection for minor approach vehicles.

This alternative benefits cyclist, however to maximize the effectiveness of this improvement an expanded area-wide network must be added, otherwise this would be an isolated facility.

It is estimated that this alternative will cost approximately $150,000.

The concept layout, possible access revisions, and technical scores for this alternative are shown in Figure 3.21.

Four-Lane Section with Reversible flow Lanes

This alternative would add both a sidewalk and a shared use path to improve nonmotorized mobility and safety. To accommodate these new multimodal facilities, the existing roadway width would be maintained, however it would alternate the number of lanes in each travel direction depending on the time-of-day and associated directional travel demand.

A sample lane assignment by time-of-day is:

- **AM Peak**: Two southbound lanes, one two-way left turn lane, one northbound lane
- **PM Peak**: Two northbound lanes, one two-way left turn lane, one southbound lane
- **Off-Peak Option 1**: One through lane in each direction, one-two way left turn lane, one parking lane
- **Off-Peak Option 2**: Two through lanes in each direction

The lane assignments would be made clear by overhead dynamic plaques as below:

Figure 3.17: Example of Reversible flow lane segment (Section of Tyvola Road in Charlotte, NC)

Traffic Flow Benefits:

An analysis of peak hour directional traffic volumes can illustrate the capacity-utilization benefit of a reversible flow configuration. The existing unbalanced lane configuration with two northbound lanes is conducive to PM peak hour traffic where northbound traffic is predominant (55 to 60 percent of traffic), but this configuration is detrimental in the AM peak hour where 65 percent of traffic is travelling southbound. With the existing one southbound lane, corridor LOS "F" is expected under future traffic volumes, however a second southbound lane would improve this to LOS "C".

Clear Identification of Lane Assignment by Time-of-Day:
While a reversible flow section has clear benefits in better accommodating unbalanced directional flow, there is the added requirement of having several overhead signs to clearly indicate which lanes are available for each travel direction throughout the day. This can be a challenge in areas with limited right-of-way for extra utilities, and also adds many overhead illuminated signs. It would be necessary to ensure that lane assignment signs are visible at every entry point onto TH 29. If further consideration is given to a reversible flow configuration, an extensive public outreach and education campaign will be critical in ensuring roadway users understand this unique configuration.

Safety Impacts:
Clear identification of lane assignments will be critical in minimizing the potential for head-on collisions. Implementation of reversible flow sections on non-freeway roadways has been limited across the United States, therefore formal safety analysis for such configurations is limited. Agencies responsible for the design and management of existing reversible flow sections have however generally regarded them as safe and efficient.

Compatibility with Terminal Intersection Geometries:
A reversible flow configuration will require careful planning of intersection configurations at the terminal intersections to ensure all time-of-day lane assignments are compatible.

Estimated Cost:
It is estimated that this segment alternative will cost approximately $400,000. Note that this planning-level cost estimate assumes that all overhead sign configurations can be supported by cantilever sign supports. Gantry-type structures will increase the project cost.

The concept layout, possible access revisions, and technical scores for this alternative are shown in Figure 3.22.

Alternative Summary

A summary of all considered intersection alternatives at Third Avenue and Nokomis Street can be seen in Table 3.14.

Figure 3.18: Third Avenue to Nokomis Street Cross Section Alternative – Existing Section

Existing Cross Section

Plan View:

Potential Access Management Concept:

Typical Cross Section:

Alternative Scoring:

Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Vehicle Efficiency and Safety	43	○○○○○○○○○○	2045 peak hour southbound LOS "F" due to demand exceeding capacity. Crash rate is currently above statewide average, with increased crash rates likely due to future congestion increases.	●●●○○○○○○○ (3.4)
Bicycle and Pedestrian Connectivity and Safety	24	○○○○○○○○○○	No bicycle or pedestrian facilities.	
Property and Environmental Impacts	18	●●●●●●●●●●	No impacts.	
Cost	16	●●●●●●●●●●	No project cost.	

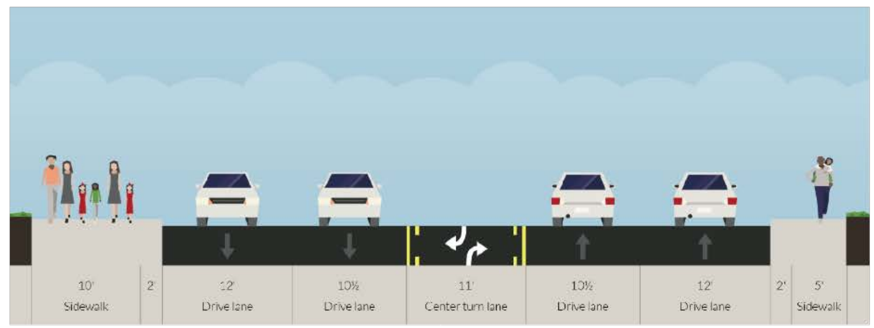
Figure 3.19: Third Avenue to Nokomis Street Cross Section Alternative – Five Lane section with Access Management

3rd Avenue to Nokomis Street - 5 Lane Section

Proposed Roadway Concept:

Potential Access Management Concept:

Typical Cross Section:



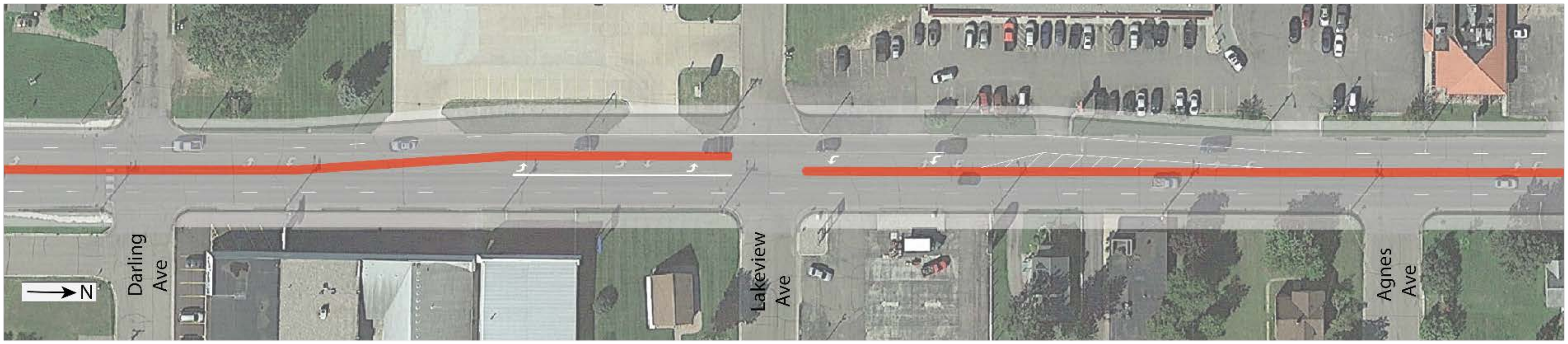
Alternative Scoring:

Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●○○	Increased capacity improves traffic flow and improves gap selection for side street vehicles. Consolidation of redundant accesses will reduce the number of conflict points and improve traffic operations and safety.	●●●●●●○○○○ (5.8)
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Adds sidewalks and bicycle facilities (north side shared use path). Access management reduces number of conflicts between cars and pedestrians/bikes.	
Property and Environmental Impacts	18	○○○○○○○○○○	75' typical roadway width would impact business parking on the west side of the corridor and residential yards on the east side of the corridor.	
Cost	16	●●●○○○○○○○	Estimated project cost: $715k	

Figure 3.20: Third Avenue to Nokomis Street Cross Section Alternative – Four/Five-Lane section with Raised Median

3rd Avenue to Nokomis Street - 4 Lane Section With Raised Median

Proposed Roadway Concept:



Potential Access Management Concept:

Typical Cross Section:

Alternative Scoring:

Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●●○	Increased capacity improves traffic flow and improves gap selection for side street vehicles. Consolidation of redundant accesses will reduce the number of conflict points and improve traffic operations and safety.	●●●●●●○○○○ (6.3)
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Adds sidewalks and bicycle facilities (north side shared use path). Access management reduces number of conflicts between cars and pedestrians/bikes.	
Property and Environmental Impacts	18	○○○○○○○○○○	70' typical roadway width would impact business parking on the west side of the corridor and residential yards on the east side of the corridor.	
Cost	16	●●●○○○○○○○	Estimated project cost: $660k	

Figure 3.21: Third Avenue to Nokomis Street Cross Section Alternative – Three-Lane Section with Buffered 2-Way Bike Lane and Access

3 Lane Section With Bidirectional Bicycle Facility

Plan View:

Potential Access Management Concept:

Typical Cross Section:

Alternative Scoring:

Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Vehicle Efficiency and Safety	43	○○○○○○○○○○	2045 peak hour LOS "F".	●●●●●○○○○○ (5.5)
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●●●	Adds sidewalks and bicycle facilities.	
Property and Environmental Impacts	18	●●●●●●●●●●	Fits within existing ROW (66' - 80') and curb lines.	
Cost	16	●●●●●●●●○○	Estimated project cost: $150k.	

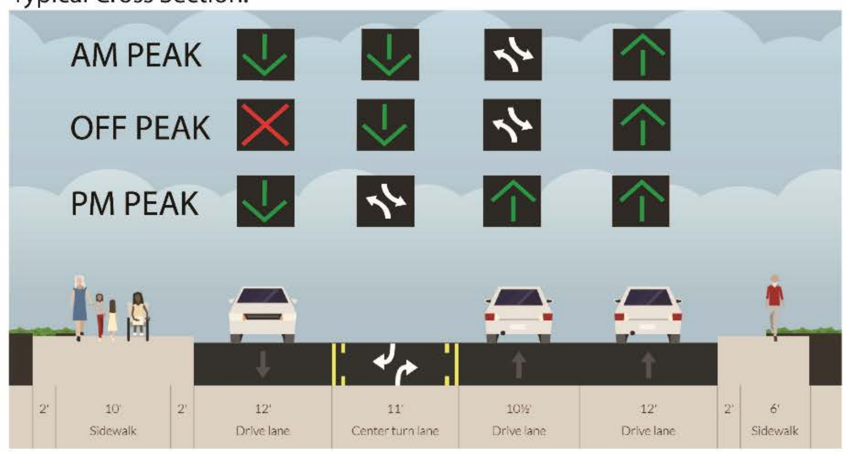
Figure 3.22: Third Avenue to Nokomis Street Cross Section Alternative –Reversible Flow Lanes

Reversible Flow Lanes

Plan View:

Potential Access Management Concept:

Typical Cross Section:



Alternative Scoring:

Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●●○	Improves peak hour corridor operations to LOS "C" through 2045. No significant safety improvements over existing conditions.	●●●●●●●●○○ (8.3)
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●●○	Adds sidewalks and bicycle facilities.	
Property and Environmental Impacts	18	●●●●●●●○○○	No impacts to curb lines, but added sidewalks have some minor property impacts. Overhead structures may have minor property impacts.	
Cost	16	●●●●●●○○○○	Estimated project cost: $400k	

Table 3.14: Third Avenue to Nokomis Street Cross-Section Alternative Summary

Do Nothing		Vehicle Efficiency and Safety	43	○○○○○○○○○○	Heavy congestion by 2045, especially for southbound traffic. Difficult for side street vehicles to turn onto TH 29. Crash rate is currently above statewide average, with increased crash rates likely due to future congestion increases.	●●●○○○○○○○ (3.4)
		Bicycle and Pedestrian Connectivity and Safety	24	○○○○○○○○○○	No bicycle or pedestrian facilities.	
		Property and Environmental Impacts	18	●●●●●●●●●●	No impacts.	
		Cost	16	●●●●●●●●●●	No project cost.	
Five-Lane Section with Access Management		Vehicle Efficiency and Safety	43	●●●●●●●●○○	Increased capacity improves traffic flow and improves gap selection for side street vehicles. Consolidation of redundant accesses will reduce the number of conflict points and improve traffic operations and safety.	●●●●●●○○○○ (5.8)
		Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Adds sidewalks and bicycle facilities (north side shared use path). Access management reduces number of conflicts between cars and pedestrians/bikes.	
		Property and Environmental Impacts	18	○○○○○○○○○○	75' typical roadway width would impact business parking on the west side of the corridor and residential yards on the east side of the corridor.	
		Cost	16	●●●○○○○○○○	Estimated project cost: $715k	
Four/Five-Lane Section With Median		Vehicle Efficiency and Safety	43	●●●●●●●●●○	Increased capacity improves traffic flow and improves gap selection for side street vehicles. Consolidation of redundant accesses will reduce the number of conflict points and improve traffic operations and safety.	●●●●●●○○○○ (6.3)
		Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Adds sidewalks and bicycle facilities (north side shared use path). Access management reduces number of conflicts between cars and pedestrians/bikes.	
		Property and Environmental Impacts	18	○○○○○○○○○○	70' typical roadway width would impact business parking on the west side of the corridor and residential yards on the east side of the corridor.	
		Cost	16	●●●○○○○○○○	Estimated project cost: $660k	
Three-Lane Section with Buffered Two-Way Bike Facility with Access Management		Vehicle Efficiency and Safety	43	○○○○○○○○○○	2045 peak hour LOS "F".	●●●●●○○○○○ (5.5)
		Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●●●	Adds sidewalks and bicycle facilities.	
		Property and Environmental Impacts	18	●●●●●●●●●●	Fits within existing ROW (66' - 80') and curb lines.	
		Cost	16	●●●●●●●●○○	Estimated project cost: $150k.	
Reversible Flow Lanes		Vehicle Efficiency and Safety	43	●●●●●●●●●○	Improves peak hour corridor operations to LOS "B" through 2045. No significant safety improvements over existing conditions.	●●●●●●●●○○ (8.3)
		Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●●○	Adds sidewalks, but no bicycle facilities.	
		Property and Environmental Impacts	18	●●●●●●●○○○	No impacts to curb lines, but added sidewalks have some minor property impacts. Overhead structures may have minor property impacts.	
		Cost	16	●●●●●●○○○○	Estimated project cost: $400k	

Urban Core: Expanded Nonmotorized Network

If pedestrian or bicycle facilities are not deemed to be a feasible cross-section element due to right-of-way concerns, other options can be considered due to the presence of pedestrian and bicycle generators in the area. There is an existing shared use path along Lake Agnes, as well as an existing shared use path on the west side of the corridor. A short on-street bike facility can be added on Kenwood Drive/Henry Avenue, then a one block segment of shared-use path can be added on the west side of TH 29 to connect to the existing segment north of Carlos Avenue. This concept can be seen in Figure 3.23.

Figure 3.23: Urban Core Segment - Expanded Bike Network

URBANIZING SEGMENT –NOKOMIS STREET TO COUNTY ROAD 73

Within the urbanizing segment, the following alternatives were developed and evaluated:

INTERSECTION ALTERNATIVES:

TH 29 and McKay Avenue

- Do nothing (signal control)
- Minor intersection improvements

TH 29 and CR 73

- Do nothing (minor approach stop control)
- Minor intersection improvements
- Continuous T-intersection (unsignalized)
- Continuous green T-intersection

CROSS SECTION ALTERNATIVES:

Nokomis Street to McKay Avenue

- Do nothing (Two lane rural section)
- Frontage road and shared use trail facility
- Four-lane section with frontage road and shared use trail facility

Nokomis Street to McKay Avenue

- Do nothing (Two lane rural section)
- Access Management and Shared Use Trail facility
- Four-lane section with access management and shared use trail facility

Urbanizing Area Intersection Alternatives

TH 29 AND MCKAY AVENUE

Under the existing signal control, the intersection is currently operating at peak hour LOS "B" with no queuing or safety issues. The intersection currently does not have any pedestrian and bicycle crossing accommodations.

Alternative: Do Nothing

This alternative assumes no improvements to the intersection. While no capacity needs are anticipated through 2045, no multimodal improvements would be made.

Table 3.16: Weighted Score for TH29/McKay Avenue Intersection Alternative: Do Nothing

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	46	●●●●●●●●●○	●●●●●●●○○○
Bicycle and Pedestrian Connectivity and Safety	28	○○○○○○○○○○	
Property and Environmental Impacts	11	●●●●●●●●●●	
Cost	14	●●●●●●●●●○	

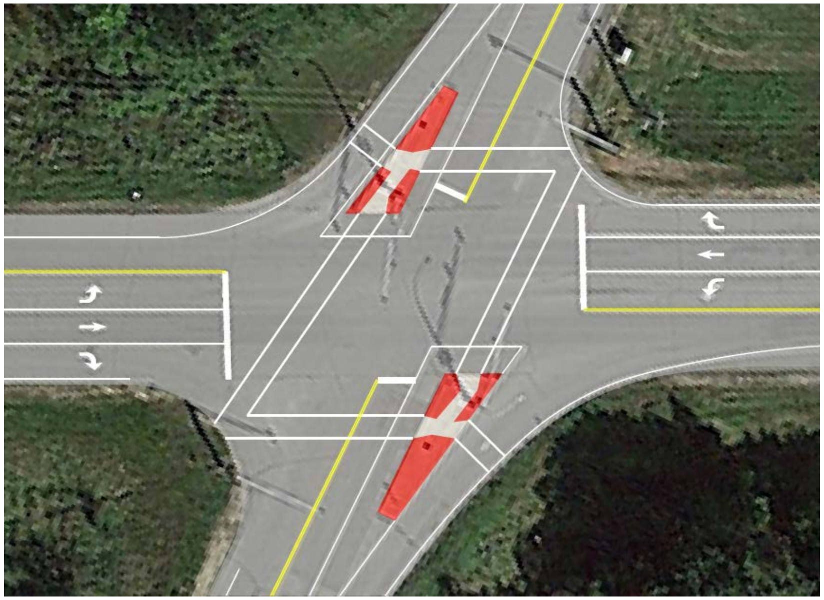
Alternative: Minor Intersection Improvements

This alternative involves installing pedestrian crosswalks, pedestrian signals and intersection lighting improvements to accommodate pedestrians/bicyclists. If roundabout alternatives are selected at the upstream intersection of TH 29/Nokomis Street then a roundabout may need to be considered at the intersection to maintain continuity.

Table 3.15: Weighted Score for TH29/McKay Avenue Intersection Alternative: Minor Intersection Improvements

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	46	●●●●●●●●○○	●●●●●●●●●○
Bicycle and Pedestrian Connectivity and Safety	28	●●●●●●●●●●	
Property and Environmental Impacts	11	●●●●●●●●●●	
Cost	14	●●●●●●●●○○	

Figure 3.24: TH 29/CR 73 Intersection Alternative Concept: Minor Intersection Improvements



TH 29 AND CR 73

Under the existing two-way stop control, the following issues were identified:

- **Railroad Crossing:** There is an at-grade railroad crossing (Canadian Pacific) on CR 73 that is within 100 feet of the intersection at TH 29. On an average day, there are six through trains with typical speeds between 10 and 40 miles per hour. The existing crossing safety features are pavement markings, crossbucks, and two-quadrant gates. Although the crash trends did not indicate any railroad-related crashes, the queue lengths on the CR 73 approach are expected to extend past the existing railroad crossing. The intersection currently meets MUTCD signal warrants per Warrant 9 (intersection near a grade crossing).
- **Traffic Safety:** The intersection experiences crash rates greater than the statewide average crash rate for similar type of intersection. Crash rates however do not exceed the critical crash rate. Sideswipe and rear end crashes are the most represented crashes at the intersection. The southbound approach of TH 29 has a right-hand bypass lane to separate through and left turn traffic, which is likely a contributing factor to the sideswipe crashes. Additionally, the presence of another TH 29 bypass lane at Le Homme Dieu Heights Drive (just north of the CR 73 intersection) creates a potentially confusing roadway alignment, especially during inclement weather when visibility is reduced.
- **Minor Approach Delays:** Peak hour minor approach LOS "F" is expected by 2045, which can also create potential safety issues due to the at-grade railroad crossing.
- **Non-Motorized Crossing Safety Issues**: There is a shared use path on the east side of the TH 29 frontage road (Geneva Road), however this path ends at CR 73. This can lead to pedestrians or cyclists crossing TH 29 at this location to access the shared use path on the northwest side of TH 29, which can be a difficult maneuver given the lack of major approach traffic control and high vehicle speeds.

Alternative: Do Nothing

This alternative assumes no improvements to the intersection, meaning no issues will be mitigated. The peak hour minor approach will continue to operate at LOS "F" and crash frequencies are expected to rise if no improvements are made.

Table 3.17: Weighted Score for TH 29/CR 73 Intersection Alternative: Do Nothing

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	46	●○○○○○○○○○	●●●○○○○○○○
Bicycle and Pedestrian Connectivity and Safety	28	○○○○○○○○○○	
Property and Environmental Impacts	11	●●●●●●●●●●	
Cost	14	●●●●●●●●●●	

Figure 3.26: TH 29/CR 73 Intersection (Existing Conditions)

Alternative: Minor Intersection Improvements

This alternative would convert the southbound approach to have a dedicated left turn lane rather than the existing southbound bypass lane. A short westbound right turn lane would also be added. Intersection reconfiguration can also support a median refuge for nonmotorized users crossing TH 29.

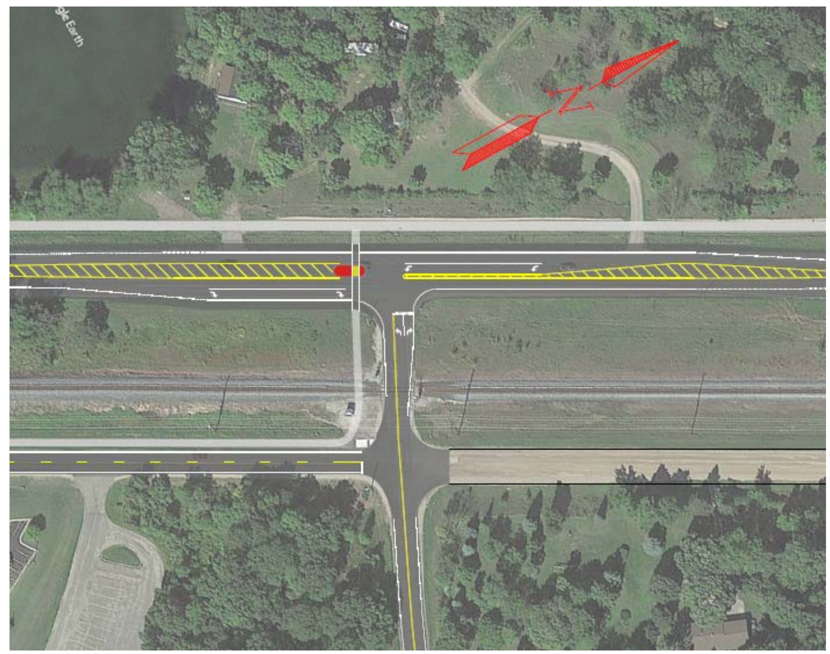
These improvements will result in peak hour LOS “C” through 2045. Also, the westbound right turn lane can have a minor benefit to queuing issues since right and left turning vehicles can line up side-by-side. However, queuing issues will continue to exist on CR 73 approach.

It is estimated these improvements would cost $125,000 - $135,000, however other impacts are expected to be minimal.

Table 3.18: Weighted Score for TH29/CR 73 Intersection Alternative: Minor Intersection Improvements

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	46	●●●○○○○○○○	●●●●●○○○○○
Bicycle and Pedestrian Connectivity and Safety	28	●●●●●○○○○○	
Property and Environmental Impacts	11	●●●●●●●●○○	
Cost	14	●●●●●●●●○○	

Figure 3.25: TH 29/CR 73 Intersection Alternative Concept: Minor Intersection Improvements



Alternative: Continuous T Intersection (Unsignalized)

A continuous T-intersection would provide a receiving lane for westbound left turns that is median-separated from southbound through movements, allowing them to merge and enter the through traffic stream downstream of the intersection. Note that this configuration does not include a traffic signal. The benefit of this configuration is that minor approach left turns only are required to select gaps in northbound traffic to make their turning movement.

This alternative is expected to operate with minor approach LOS "B" through 2045, however there is still some potential for conflicts with the at-grade railroad crossing due to no way to give priority to minor approach vehicles during a train event.

Research has found significant safety benefits for signalized green T configurations, with total crashes reduced by 60 percent and injury crashes reduced by 70 percent. There is however no safety data available for unsignalized green T intersections.

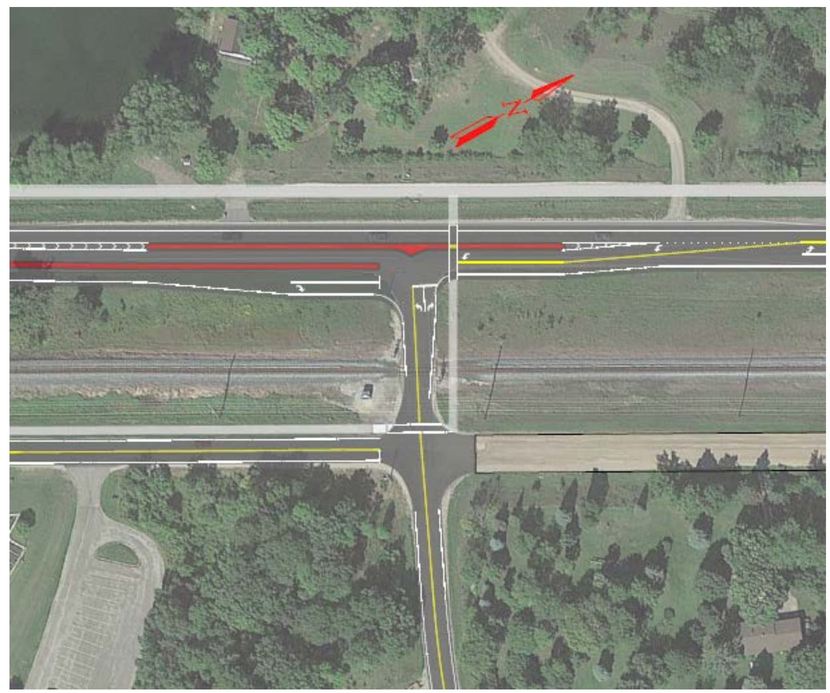
The medians constructed as part of a continuous T configuration can serve as a refuge for crossing non-motorized users, reducing crossing distances, simplifying the gap selection process and improving visibility of pedestrians/cyclists. Research by the Minnesota Local Road Research Board has found that around 30 percent of drivers will yield to pedestrians at median refuges.

It is estimated that these improvements would cost $400,000, however other impacts are expected to be minimal.

Table 3.19: Weighted Score for TH 29/CR 73 Intersection Alternative: Continuous T-Intersection (Unsignalized)

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	46	●●●●●●●○○○	●●●●●●○○○○
Bicycle and Pedestrian Connectivity and Safety	28	●●●●●○○○○○	
Property and Environmental Impacts	11	●●●●●●●●○○	
Cost	14	●●●●●●○○○○	

Figure 3.27: TH 29/CR 73 Intersection Alternative Concept: Continuous T-Intersection (Unsignalized)



Alternative: Continuous Green T-Intersection

This alternative would be geometrically the same as the unsignalized continuous T alternative, simply adding a traffic signal. This would provide a continuous green to the southbound through movement, with all other movements operating as they would at a typical traffic signal.

The addition of a signal to the continuous T configuration is expected to result in peak hour LOS "A" through 2045, also enabling railroad preemption, mitigating the rail safety issues associated with other alternatives.

The medians constructed as part of a continuous T configuration would provide a refuge for crossing non-motorized users, simplifying the gap selection process and improving safety.

Non-motorized crossings can be improved with the signal control for most movements, however the free southbound through movement will still create potential conflicts. Pedestrian actuation could present a signal indication to southbound through traffic, however this may increase high-speed rear-end crash potential since the southbound through movement will not expect a red signal indication under most conditions.

It is estimated that these improvements would cost $600,000.

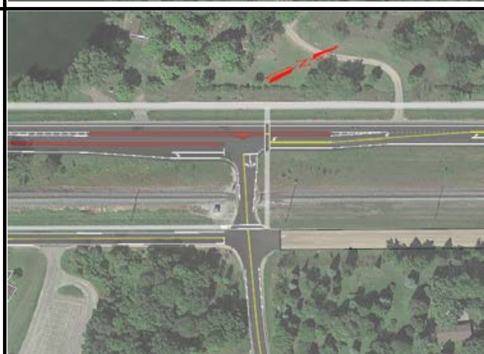
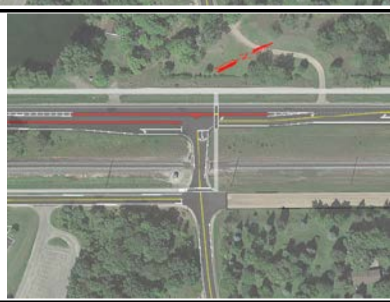
Alternative Summary

A summary of all considered intersection alternatives at Third Avenue and Nokomis Street can be seen in Table 3.21.

Table 3.20: Weighted Score for TH 29/CR 73 Intersection Alternative: Continuous Green T-Intersection (Signalized)

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	46	●●●●●●●●●●	●●●●●●●●●○
Bicycle and Pedestrian Connectivity and Safety	28	●●●●●●●●●●	
Property and Environmental Impacts	11	●●●●●●●●○○	
Cost	14	●●●●○○○○○○	

Table 3.21: TH29/CR 73 Intersection Alternative Summary

Alternative	Concept Drawing	Category	Category Weight	Category Score	Notes	Weighted Score
Do Nothing (Minor Approach Stop Control)		Vehicle Efficiency and Safety	46	●○○○○○○○○○	Long side street delays by 2045. Existing crash rate is greater than statewide average, but lower than ciritcal crash rate. Queues can sometimes back up past railroad tracks	●●●○○○○○○○ (3)
		Bicycle and Pedestrian Connectivity and Safety	28	○○○○○○○○○○	Shared use trail leads to this intersection, but no crossing amenties across TH 29. Non-motorized users have experienced issues crossing this intersection, high vehicle speeds.	
		Property and Environmental Impacts	11	●●●●●●●●●●	No impacts	
		Cost	14	●●●●●●●●●●	No impacts	
Minor Geometric Revisions		Vehicle Efficiency and Safety	46	●●●○○○○○○○	No improvement of minor approach delays. Short minor approach right turn lane allows left and right turning vehicles to line up side-by-side, slightly mitigating queuing issues. Removal of bypass lane will reduce rear end and sideswipe crashes.	●●●●●○○○○○ (4.8)
		Bicycle and Pedestrian Connectivity and Safety	28	●●●●●○○○○○	Medians provide refuge island for crossing non-motorized users.	
		Property and Environmental Impacts	11	●●●●●●●●○○	Larger roadway footprint, but no property or right-of-way impacts.	
		Cost	14	●●●●●●●●○○	Estimated project cost: $100-150k	
Continuous T Intersection (Unsignalized)		Vehicle Efficiency and Safety	46	●●●●●●●○○○	Significant delay improvement for side street vehicles, however potential conflicts with railroad crossing remain due to minor approach stop control.	●●●●●●○○○○ (6.4)
		Bicycle and Pedestrian Connectivity and Safety	28	●●●●●○○○○○	Medians provide refuge island for crossing non-motorized users.	
		Property and Environmental Impacts	11	●●●●●●●●○○	Larger roadway footprint, but no property or right-of-way impacts.	
		Cost	14	●●●●●●○○○○	Estimated project cost: $400k	
Continuous Green T Intersection (Signalized)		Vehicle Efficiency and Safety	46	●●●●●●●●●●	2045 peak hour intersection LOS "A", signal accomodates railroad pre-emption.	●●●●●●●●●○ (8.9)
		Bicycle and Pedestrian Connectivity and Safety	28	●●●●●●●●●●	Medians provide refuge island for crossing non-motorized users, signal can stop automobile traffic.	
		Property and Environmental Impacts	11	●●●●●●●●○○	Larger roadway footprint, but no property or right-of-way impacts.	
		Cost	14	●●●●○○○○○○	Estimated project cost: $600k	

Urbanizing Area Access Management Alternatives

NOKOMIS STREET TO MCKAY AVENUE

South Frontage Road

This alternative (Figure 3.29) would extend the existing frontage road on the south side of the corridor (Sunnyside Drive) to Northside Drive. Other modifications include the addition of an east approach at the Nokomis Street intersection, closing the driveway just north of Nokomis Street, and aligning the approaches at Robert Street.

The south side frontage road can accommodate future development without the addition of new access points to the corridor. The added Nokomis Street approach can facilitate a new driveway after the removal of the driveway just north of the intersection, and the Robert Street realignment would mitigate the potential for head-on collisions associated with the negative approach offset for left turns (Figure 3.28).

Based on the access management concept shown in Figure 3.29, the number of conflict points would be reduced from 109 to 93.

Access Management Alternative: Frontage Road and Backage Road

This option is a variant of the frontage road concept described above that adds a backage road network (see Figure 3.30). This option also can implement three-quarters accesses at the realigned Robert Street intersection and at Northside Drive, with minor approach left-turning movements accommodated at Nokomis Street or a full access between Robert Street and Northside Drive.

Access revisions reduce crash potential by reducing the number of conflict points from 109 to 84. This option also can improve traffic flow by reducing the number of locations where minor approach left-turning traffic enters the through traffic stream on TH 29.

A potential issue with this option is the presence of wetlands near the proposed backage road network.

Figure 3.28: Existing Left-turn offset at Robert Street

MCKAY AVENUE TO CR 73

Access Management Alternative: Consolidation of Accesses

This access management concept (see Figure 3.31) removes the access at Oak Knoll Drive and the redundant access at New Testament Church (access still available on Le Homme Dieu Drive). Other improvements include realigning the Birch Avenue intersection to South Le Homme Dieu Drive.

These improvements do not improve the overall number of conflicts on this segment, but creates more uniform access spacing, reducing crash potential.

Figure 3.29: Nokomis Street to McKay Avenue: Access Management Alternative - Frontage Road

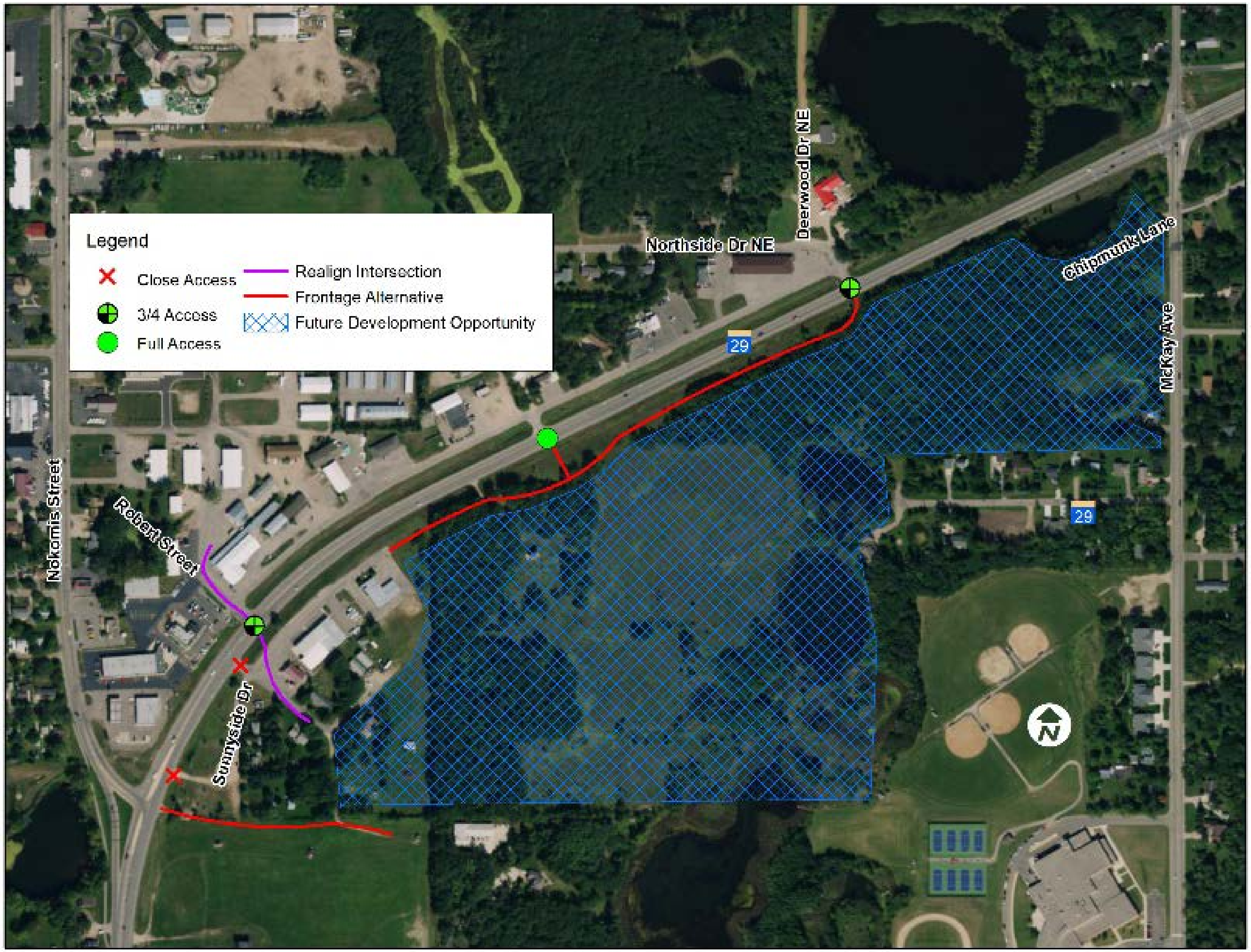


Figure 3.30: Nokomis Street to McKay Avenue: Access Management Alternative - Frontage Road and Backage Road

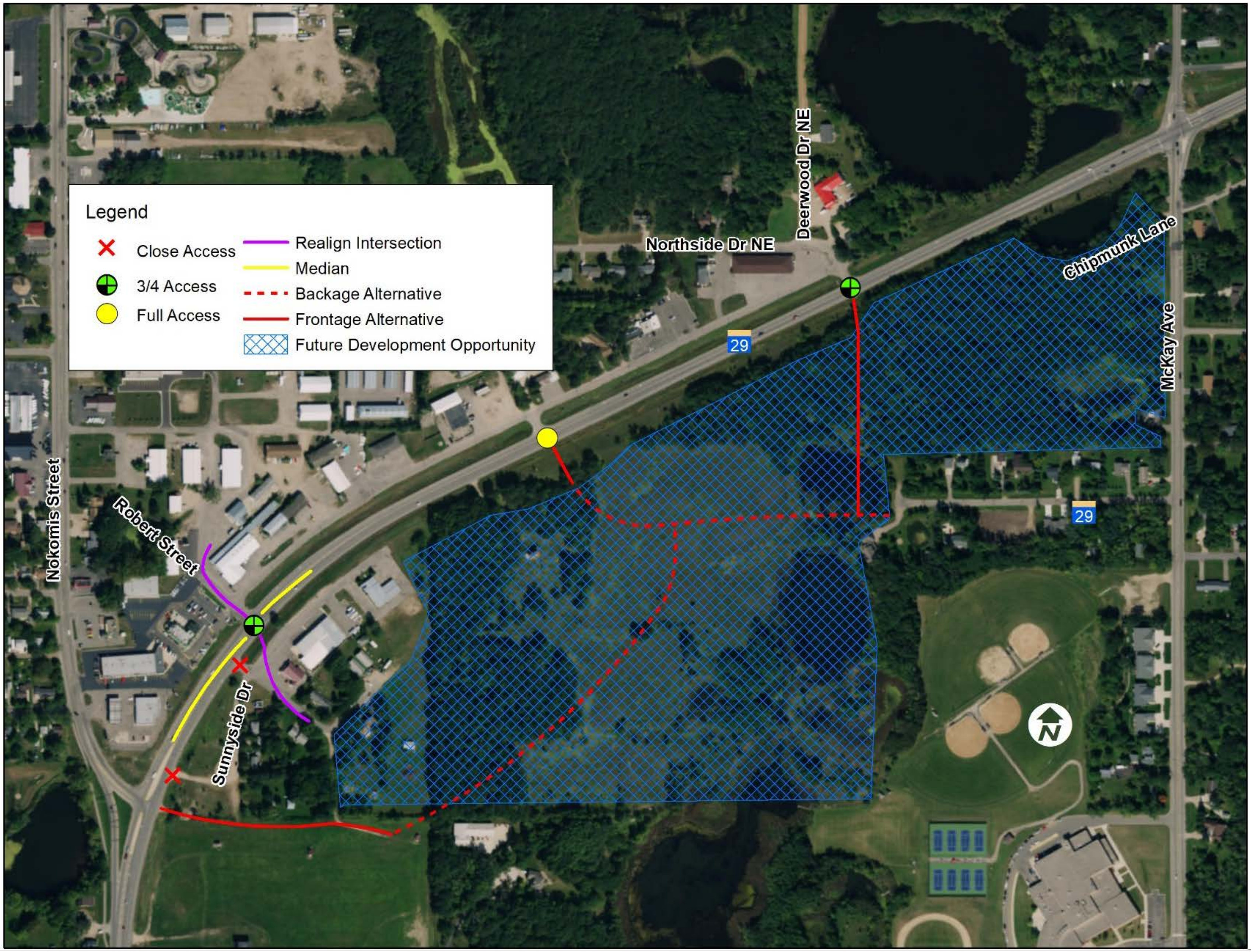
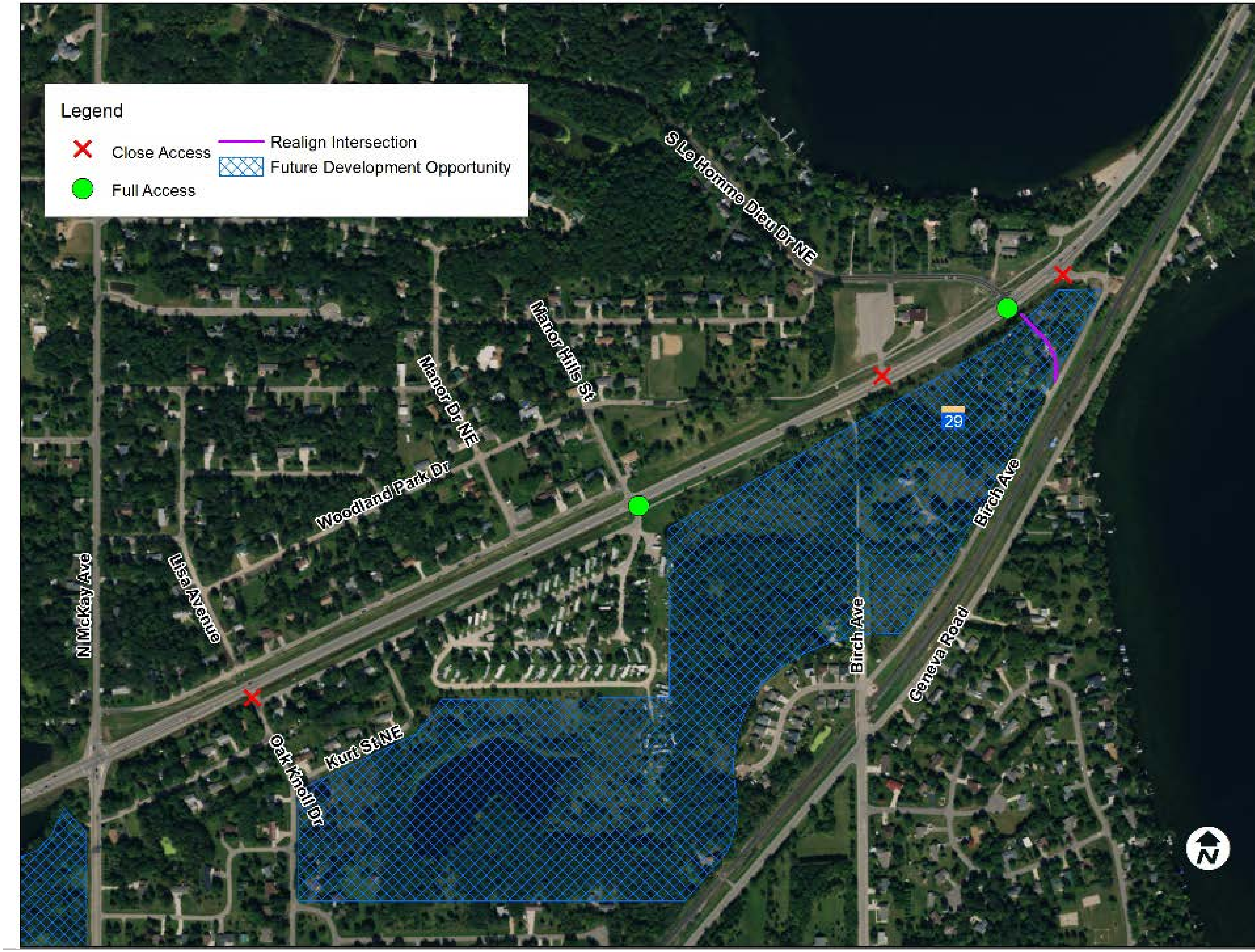


Figure 3.31: McKay Avenue to CR 73: Access Management Alternative - Consolidation of Accesses



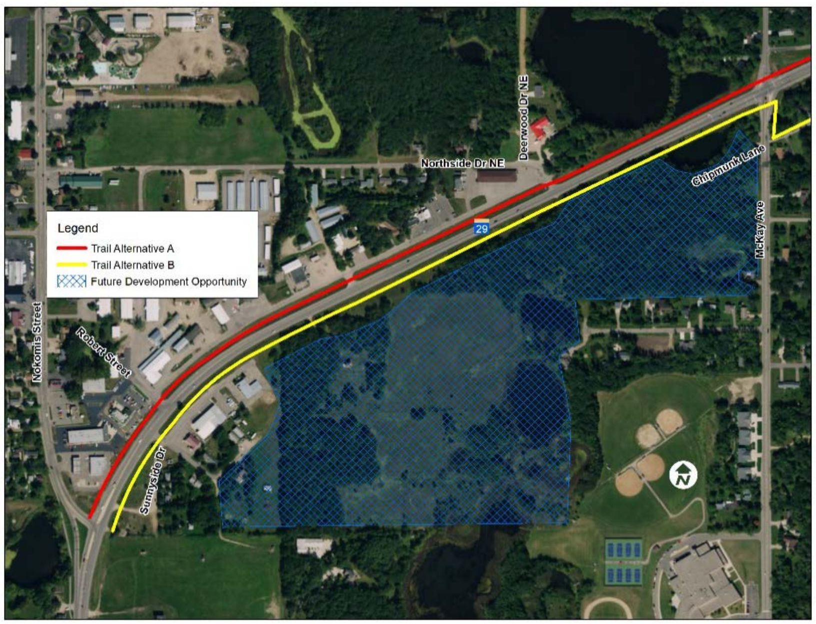
Urbanizing Area: Expanded Nonmotorized Network

The existing non-motorized network is inconsistent in the urbanizing area, with a shared use path present between Manor Hills Street and CR 73, but no facilities between Nokomis Street and McKay Avenue.

Nokomis Street to McKay Avenue

A shared use path can be added to the southeast, northwest or both sides of the corridor to bridge the pedestrian/bicycle network on the corridor (Figure 3.32). These can connect to existing facilities east of Manor Hills Street, providing a more complete multimodal network in the study area. Trail Alternative A considers trails on the northwest side of TH 29. The northwest side has more generators compared to the southeast side of TH 29. Alternative A would also mitigate the safety concerns of pedestrians and bicyclists crossing TH 29. Having the trails on both sides would enhance the pedestrian and bicycle connectivity in the corridor.

Figure 3.33: Nokomis Street to McKay Avenue: Expanded Nonmotorized Network



McKay Avenue to County Road 73

Land use is primarily residential along this segment. Currently there are no significant generators to generate non-recreational trips. A shared use path to the southeast, northwest, or both sides of the corridor to connect to the existing facilities east of Manor Hills Street (see Figure 3.33). These alternatives would provide lower stress bicycling environment in this segment.

Figure 3.32: McKay Avenue to CR 73: Expanded Nonmotorized Network

Urbanizing Area Cross Section Alternatives

NOKOMIS STREET TO MCKAY AVENUE

Between Nokomis Street and McKay Avenue, the following issues were identified:

» **Capacity Issues:** Increased future traffic volumes on TH 29 will limit the number of acceptable gaps for minor approach vehicles turning onto TH 29, with peak hour minor approach LOS “F” expected at two-way stop-controlled intersections. It should however be noted that traffic flow on TH 29 is expected to remain adequate through 2045, operating at LOS "B" or better between intersections.

- **Crash Rates:** The observed crash rate between Nokomis Street and Robert Street exceeds the critical crash rate for similar facilities. Note that crash analysis did not reveal any discernable trends regarding crash type or contributing factors to crashes.
- **Multimodal Facilities:** There are no multimodal facilities along this segment of the corridor.
- **Access Density:** Existing access density exceeds MnDOT guidelines (quarter-mile access spacing preferred), especially near the intersection of Nokomis Street

Cross Section Alternative: Do Nothing

This alternative assumes no improvements, maintaining the existing cross-section configuration (unbalanced three-lane section near Nokomis Street, transitioning to a two-lane section toward McKay Avenue). Minor approach capacity issues will not be mitigated, with 2045 peak hour LOS "F" expected.

Table 3.22: Weighted Score for Nokomis Street to McKay Avenue Cross Section Alternative: Do Nothing

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●○○○○○○○○	●●●●○○○○○○
Bicycle and Pedestrian Connectivity and Safety	24	○○○○○○○○○○	
Property and Environmental Impacts	18	●●●●●●●●●●	
Cost	16	●●●●●●●●●●	

No crash improvements are expected, and increased traffic volumes will likely increase crash potential, especially with no access revisions.

Cross Section Alternative: Access Management and Shared Use Facility

This alternative maintains the existing cross-section on TH 29, however implements the frontage road and nonmotorized trail concepts discussed above. This will provide more uniform access spacing and reduce the number of conflicts on the corridor, reducing crash potential and improving traffic flow. A trail will improve multimodal accessibility and can be part of an expanded area-wide multimodal system that incorporates improvements in other portions of the study area discussed in this report.

It is estimated that this alternative will cost approximately $775,000. The concept layout, possible access revisions, and technical scores for this alternative are shown in Figure 3.34.

Table 3.23: Weighted Score for Nokomis Street to McKay Avenue Cross Section Alternative: Access Management and Shared Use Trails

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●○○○○○○	●●●●●●●○○○
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	
Property and Environmental Impacts	18	●●●●●●●○○○	
Cost	16	●●○○○○○○○○	

Cross Section Alternative: Roadway Widening, Access Management and Shared Use Facility

This alternative would expand TH 29 to a four-lane, median-divided section, and would also add the frontage road and multimodal elements discussed above. Beyond the improvements associated with access management and multimodal facilities discussed above, the widened roadway is expected to improve gap selection for vehicles turning onto TH 29, improving minor roadway level of service to peak hour LOS "D" through 2045.

It is estimated that this alternative will cost approximately $3.2m.

The concept layout, possible access revisions, and technical scores for this alternative are shown in Figure 3.34.

Alternative Summary

A summary of all considered cross-section alternatives for the segment between Nokomis Street and McKay Avenue can be seen in Table 3.24.

Figure 3.34: Nokomis Street to McKay Avenue Cross Section Alternative – Four-Lane section with Access Management and Shared Use Facility

Nokomis Street to McKay Avenue - 4-Lane Section + Access Management + Trail

Proposed Roadway Concept:

Typical Cross Section:

Alternative Scoring:

Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●●●	Lane add coupled with access management improvements will improve traffic operations and safety.	●●●●●●●●○○ (7.1)
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Low stress pedestrian and bicycle facility	
Property and Environmental Impacts	18	●●●●●○○○○○	Fits within existing ROW, but will require roadway widening with the potential for some minor impacts.	
Cost	16	○○○○○○○○○○	Estimated project cost: $3.2M	

Table 3.24: Nokomis Street to McKay Avenue Cross-Section Alternative Summary

Alternative	Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Do Nothing	Vehicle Efficiency and Safety	43	●●○○○○○○○○	Poor traffic flow by 2045, with vehicles closely following each other during peak commuting times. Difficult for side street vehicles to turn onto TH 29. Crash rate is currently above ciritcal rate, with increased crash rates likely due to future congestion increase.	●●●●○○○○○○ (4.3)
	Bicycle and Pedestrian Connectivity and Safety	24	○○○○○○○○○○	No bicycle or pedestrian facilities.	
	Property and Environmental Impacts	18	●●●●●●●●●●	No Impacts.	
	Cost	16	●●●●●●●●●●	No project cost.	
Frontage Roads and Trails	Vehicle Efficiency and Safety	43	●●●●○○○○○○	Access Management improvements to improve traffic operations and safety.	●●●●●●●○○○ (5.2)
	Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Low stress pedestrian and bicycle facility	
	Property and Environmental Impacts	18	●●●●●●●○○○	No impacts to curb lines, but added trails may have some minor property impacts.	
	Cost	16	●●○○○○○○○○	Estimated project cost: $775K	
Four-Lane Section, Frontage Roads and Trails	Vehicle Efficiency and Safety	43	●●●●●●●●●●	Lane add coupled with access management improvements will improve traffic operations and safety.	●●●●●●●●○○ (7.1)
	Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Low stress pedestrian and bicycle facility	
	Property and Environmental Impacts	18	●●●●●○○○○○	Fits within existing ROW, but will require roadway widening with the potential for some minor impacts.	
	Cost	16	○○○○○○○○○○	Estimated project cost: $3.2M	

MCKAY AVENUE TO CR 73

- **Capacity Issues:** Increased future traffic volumes on TH 29 will limit the number of acceptable gaps for minor approach vehicles turning onto TH 29, with peak hour minor approach LOS "F" expected at two-way stop-controlled intersections. It should however be noted that traffic flow on TH 29 is expected to remain adequate through 2045, operating at LOS "B" or better between intersections.
- **Multimodal Facilities:** There are no multimodal facilities between McKay Avenue and Manor Hills Street, however a shared use path is present northeast of Manor Hills Street.
- **Access Density:** Existing access density exceeds MnDOT guidelines (quarter-mile access spacing preferred) near McKay Avenue and near Birch Avenue

Cross Section Alternative: Do Nothing

This alternative assumes no improvements to the existing two-lane section. Minor approach delays will result in LOS "F" during the 2045 PM peak hour, and nonmotorized facility gaps will remain.

Table 3.25: Weighted Score for McKay Avenue to CR 73 Cross Section Alternative- Do Nothing

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●○○○○○○○○	●●●●○○○○○○
Bicycle and Pedestrian Connectivity and Safety	24	○○○○○○○○○○	
Property and Environmental Impacts	18	●●●●●●●●●●	
Cost	16	●●●●●●●●●●	

Cross Section Alternative: Access Management and Shared Use Facility

This alternative maintains the existing two-lane segment, but implements access management and an expanded nonmotorized trail system as discussed in the previous section. This alternative will provide more uniform access spacing, which will reduce crash potential and improve traffic flow. A trail will improve multimodal accessibility and can be part of an expanded area-wide multimodal system that incorporates improvements in other portions of the study area discussed in this report.

It is estimated that this alternative will cost approximately between $125,000 -$250,000, depending on if trails are constructed on one or both sides of TH 29.

Table 3.26: Weighted Score for McKay Avenue to CR 73 Cross Section Alternative- Access Management and Shared Use Trails

Scoring Category	Category Weight	Category Score	Weighted Score
Vehicle Efficiency and Safety	43	●●●●○○○○○○	●●●●●●○○○○
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	
Property and Environmental Impacts	18	●●●●●●●○○○	
Cost	16	●●●●●●●○○○	

Cross Section Alternative: Roadway Widening, Access Management and Shared Use Facility

This alternative would expand TH 29 to a four-lane, median-divided section, and would also add the frontage road and multimodal elements discussed above. Beyond the improvements associated with access management and multimodal facilities discussed above, the widened roadway is expected to improve gap selection for vehicles turning onto TH 29, improving minor roadway level of service to peak hour LOS "D" through 2045.

To avoid the introduction of a capacity bottleneck, expansion to a four-lane section should only be considered on this segment if it also is considered between Nokomis Street and McKay Avenue

It is estimated that this alternative will cost approximately $4 million.

The concept layout, possible access management alternative, typical section and Scoresfor the alternative is displayed in Figure 3.35.

Alternative Summary

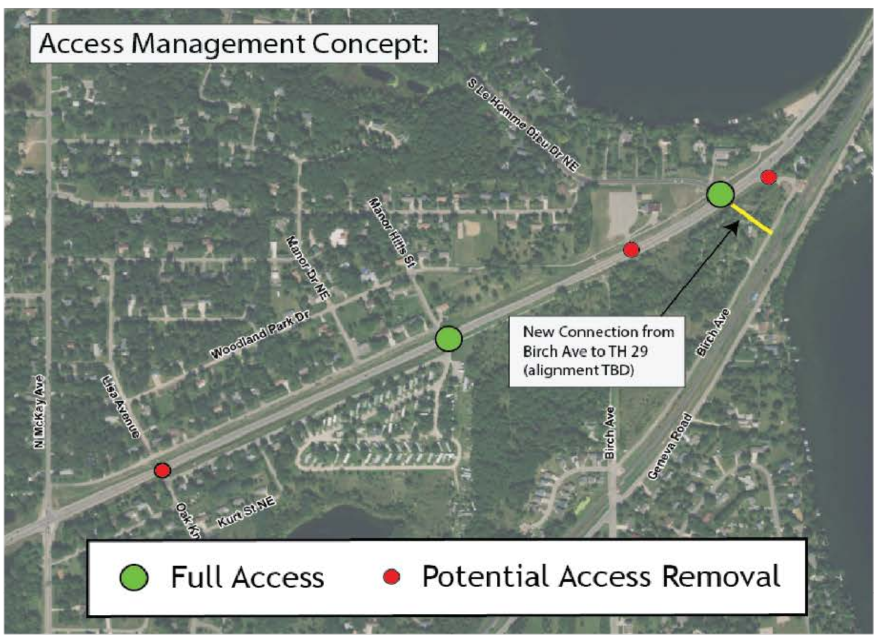
A summary of all considered cross-section alternatives for the segment between McKay Avenue and CR 73 can be seen in in Table 3.27.

Figure 3.35: McKay Avenue to CR 73 Cross Section Alternative – Four-Lane section with Access Management and Shared Use Facility

McKay Avenue to CR 73 - 4-Lane Section + Access Management + Trail

Plan View:

Access Management /Multimodal Facilities Concept:



Typical Cross Section:

Alternative Scoring:

Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Vehicle Efficiency and Safety	43	●●●●●●●●○○	Lane add coupled with access management improvements will improve traffic operations and safety.	●●●●●●○○○○ (6.3)
Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Low stress pedestrian and bicycle facility	
Property and Environmental Impacts	18	●●●●●○○○○○	Fits within existing ROW, but will require roadway widening with the potential for some minor impacts.	
Cost	16	○○○○○○○○○○	Estimated project cost: $4M	

Table 3.27: McKay Avenue to CR 73 Cross-Section Alternative Summary

Alternative	Scoring Category	Category Weight	Category Score	Notes	Weighted Score
Do Nothing	Vehicle Efficiency and Safety	43	●●○○○○○○○○	Poor traffic flow by 2045, with vehicles closely following each other during peak commuting times. Difficult for side street vehicles to turn onto TH 29. Crash rate is currently above ciritcal rate, with increased crash rates likely due to future congestion increase.	●●●●○○○○○○ (4.3)
	Bicycle and Pedestrian Connectivity and Safety	24	○○○○○○○○○○	No bicycle or pedestrian facilities.	
	Property and Environmental Impacts	18	●●●●●●●●●●	No impacts.	
	Cost	16	●●●●●●●●●●	No project cost.	
Access Management and Trails	Vehicle Efficiency and Safety	43	●●●●○○○○○○	Access Management improvements to improve traffic operations and safety.	●●●●●●○○○○ (6)
	Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Low stress pedestrian and bicycle facility	
	Property and Environmental Impacts	18	●●●●●●●○○○	No impacts to curb lines, but added trails may have some minor property impacts.	
	Cost	16	●●●●●●●○○○	Estimated project cost: $125-250K	
Four-Lane Section, Access Management and Trails	Vehicle Efficiency and Safety	43	●●●●●●●●○○	Lane add coupled with access management improvements will improve traffic operations and safety.	●●●●●●○○○○ (6.3)
	Bicycle and Pedestrian Connectivity and Safety	24	●●●●●●●●○○	Low stress pedestrian and bicycle facility	
	Property and Environmental Impacts	18	●●●●●○○○○○	Fits within existing ROW, but will require roadway widening with the potential for some minor impacts.	
	Cost	16	○○○○○○○○○○	Estimated project cost: $4M	

NEXT STEPS

This document is intended to present analysis results for several alternatives that were developed to address transportation issues in the TH 29 study area. Information and technical scores presented in this document should not be interpreted as recommendations, rather this information is intended to help the Study Review Committee and other stakeholders understand the improvements and impacts associated with various intersection, cross-section, access management, and multimodal alternatives in both the urban core and urbanized parts of the study area.

Given the number of alternatives that have been considered thus far, it is important to note that much of this analysis was performed at a planning level, meaning preferred concepts will need additional refinement though preliminary and final design. Environmental review and permitting is also required, with the extent of this based on the scope of preferred improvements and the funding sources used.

After the Study Review Committee and other stakeholders have reviewed the information in this document, KLJ will continue to work with the committee and public to select the preferred alternatives throughout the study area. The collaborative selection of preferred alternatives will be based on funding availability, the timeframe of improvement needs, right-of-way requirements, among other priorities.

TRUNK HIGHWAY 29 CORRIDOR STUDY

CHAPTER 4 – IMPLEMENTATION PLAN

KLJ

ENGINEERING, REIMAGINED

Table of Contents

LIST OF FIGURES

LIST OF TABLES

Introduction

The implementation plan chapter of this Corridor Study summarizes the results of the alternatives evaluation, scoring, and ranking to help guide the selection of improvements to be carried through to implementation.

Alternatives were scored and ranked using the following scoring categories:

- Technical Score
- Steering Committee Support Score
- Public Support Store
- Overall Score

Technical Score

The technical score describes each alternative's expected performance related to vehicular efficiency and safety, pedestrian and bicycle connectivity and safety, property and environmental impacts, and estimated project cost.

Once technical scores for each criteria were established (vehicular efficiency and safety, pedestrian and bicycle connectivity and safety, etc.), a weighted average technical score was calculated based on the importance the Study Review Committee members have assigned to each evaluation criteria. Higher average technical scores indicate the alternative better meets technical and stakeholder needs. The maximum technical score an alternative can receive is 10, but due to the value profile adjustments, no alternative scored higher than 8.9 and no alternative scored lower than 3.4.

Detailed information related to the technical scoring can be found in the *Alternatives Development and Assessment* chapter of this Corridor Study.

Study Review Committee Support Score

The Study Review Committee (SRC) support score describes the amount of support the SRC gave to the alternatives under consideration. The KLJ team presented results from the alternatives analysis to the SRC on October 29th, 2018.

SUMMARY OF SRC INPUT

The SRC were requested to review and rank alternatives for each location in order of most preferred to least preferred. This was also an opportunity for SRC members to suggest refinements to alternatives. The group met again on November 28th to debrief on the results from this exercise.

High rankings resulted in higher scores and low rankings resulted in lower scores. The maximum SRC support score varies by the number of alternatives under consideration. For a location with four alternatives, the maximum score would be 4, for three alternatives the maximum score would be 3, etc. The scores from the SRC input were then normalized to have a maximum score of 10 to maintain overall scoring consistency. Note that while SRC discarded some alternatives, the discarded alternatives still count toward the total number of considered alternatives for the SRC score.

The following alternatives presented by KLJ were considered and discarded at the SRC meeting on November 28:

Intersection Alternatives: 3rd Avenue and Nokomis Street

Alternatives for Further Consideration:

- Do nothing.
- Major intersection improvements.
- Two-by-two Roundabout.

Discarded Alternatives:

- Minor Intersection Improvements because of minimal benefits.
- Two-by-one Roundabout because of poor operations.

Segment Alternatives: 3rd Avenue to Nokomis Street

Alternatives for Further Consideration:

- Do nothing.
- Five-lane section with shared use path.
- Four-lane section with raised median and shared use path.

Discarded Alternatives:

- Reversible flow lanes because of safety concerns.

» Three-lane section with buffered two-way bike facility because of poor operations.

Intersection Alternatives: TH 29 and Nokomis Street

Alternatives for Further Consideration:

» Do nothing.
» Continuous Green-T Intersection.
» Single lane roundabout with northbound bypass lane.

Discarded Alternatives:

» Four-legged signalized intersection because of the uncertainty related to a southeast access in the future.
» Continuous roundabout because of the uncertainty related to a southeast access in the future.

Segment Alternatives: Nokomis Street to McKay Avenue

Alternatives for Further Consideration:

» Do nothing.
» Access management and shared use trail.
» Widen road with access management and trail.

Segment Alternatives: McKay Avenue to CR 73

Alternatives for Further Consideration:

» Do nothing.
» Access management and shared use trail.
» Widen road with access management and trail.

Intersection Alternatives: TH 29 and County Road 73

Alternatives for Further Consideration:

» Do nothing.
» Continuous T-intersection (unsignalized).

Discarded Alternatives:

» Minor Intersection Improvements because of limited benefits.
» Continuous Green-T Intersection because of mainline rear-end crash potential.

This final list of improvement alternatives was presented to the public at a public input meeting on February 6, 2019.

Public Support Score

This score describes the amount of community support for considered alternatives. Public feedback on alternatives was obtained at the public input meeting on February 6, 2019

A variety of methods were used to inform the community about their opportunity to provide input on the improvement alternatives for the TH 29 corridor. Outreach methods included:

» A press release was published in Echo Press.
» Fliers were distributed to local businesses along the corridor and neighborhood associations.
» Postcards were sent to properties within 500-feet of the corridor.
» Social media posts on Facebook and Twitter accounts.
» Multiple articles on local radio, newspaper, and television news outlets.

Figure 4. 1: Community Voting

SUMMARY OF COMMUNITY INPUT

The February public meeting was attended by more than 50 members of the community. At the meetings, attendees were given multiple opportunities to provide comments.

- A written comment form that included a mailing address and e-mail address was provided at the meeting. Comment forms were also made available online for the community to print and mail with their comments. People could elect to leave the forms with the team that evening, send them in later or e-mail their comments to the project manager. The team received five comment forms on the day of the public input meeting. All comments between February 6, 2019 and February 22, 2019 were reviewed and used for ranking the alternatives. Other topics were compiled and presented to the SRC for review and potential incorporations.
- Graphics of existing configurations and alternative concepts were presented to the public on large display boards. The Attendees were requested to place stickers for their most preferred alternative. The votes collected at the meeting were compiled to develop the community preferred alternatives.

Figure 4. 2: Public Input Meeting

Community Comments

Seven written comments were received by mail or in person and 18 e-mail comments were received. The following concerns and support were the most common:

- Six comments were received with requests to reduce the 60-mph speed limit from Nokomis Street to McKay Avenue.
- Four comments were received to close the access at Elden's on TH 29 or convert the access to right-in/out only.
- Two comments were received indicating strong support towards roundabout options in the corridor.
- Two comments were received indicating the need for better multi-modal mobility in the corridor.
- A comment was received to extend the study limits to the north and add a turn lane into Crestwood Drive approximately half a mile north of CR 73. MnDOT made note of the request to incorporate into future planning and projects for this stretch of Th 29.
- The developer of the land south of TH 29 and east of Manor Hills Street requested a revised access plan due to the challenge with a cross-access agreement at Manor Hills Street. Although no changes were made in this report in response to this comment, MnDOT noted that this will be evaluated further once the project has funding and can advance into project development.

A summary of all community input is presented in the following section with more details available in Appendix A.

Overall Score

An overall score was calculated to factor technical benefits, SRC support, and community support. The overall score is the average of the three scores, all weighted equally. The purpose of this analysis is to concisely summarize the different evaluation techniques to allow decision makers to make informed decisions. In other words, the summary scores are not recommendations. Rather, they are merely a tool to summarize a lot of information from varying sources.

Summary of Alternatives

Intersection Alternatives: 3rd Avenue and Nokomis Street

The two-by-two roundabout received the highest overall score, being the highest ranked option by SRC and the community, and the second highest ranked option in terms of technical score. This alternative significantly improves traffic flow and reduces delays by over 50 percent. The splitter islands also reduce the number of conflict points on nearby accesses and serve as a pedestrian refuge islands.

Table 4.1: Summary of Intersection Alternatives- 3rd Avenue & Nokomis Street

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
Two-by-two Roundabout	7.4	8.8	5.2	7.1
Major Intersection Improvements	8.1	8.6	1.6	6.1
Do Nothing	7.4	2.0	3.2	4.2

- Highest Ranked Alternative: Two-by-two Roundabout.
- Estimated planning level cost: $1.4 to 1.6 million

Segment Alternatives: 3rd Avenue to Nokomis Street

The five-lane section with a shared-use path received the highest overall score, being the highest ranked option by the community, and the second highest ranked option by the SRC and technical score. These alternative increases capacity and improves gap selection for side street movements. There was strong community support for improved non-motorized mobility along this segment. This alternative includes the addition of sidewalks and bicycle facilities (north side shared use path). Access management associated with this alternative will also reduce the number of conflicts between motorized and non-motorized traffic. It is important to note that spot access management solutions (access removal, consolidation, etc.) are typically more challenging to implement than access management via raised medians due to the required right-of-way negotiation.

The four-lane section with raised median option was deemed to be the best alternative, contrary to public feedback for the following reasons:

- It was deemed that the access management plan, which is imperative to meet the high standard of safety suggested, would require a raised median. The number of on-site reconfigurations was deemed a major challenge to the project and potentially render the final solution with far less benefits then the raised median option.
- Given the number of crossings currently occurring midblock the raised median option provides a safe pedestrian refuge island option that the TWLTL option did not.
- The raised median increases the utilization at key crossing points making the utilization and success of a roundabout at Lake Street more likely under this alternative. Specifically, the medians would convert most driveways and streets to right-in/right-out. This would funnel more traffic to the roundabout increasing its utilization. Additionally, the presence of roundabouts at Lake Street and Nokomis means drivers with limited left-turn movements could take a right-turn and make a U-turn at the closest roundabout.

Traffic control opportunities at Lakeview Avenue intersection may be added as part of the project for this segment.

Table 4.2: Summary of Segment Alternatives- 3rd Avenue to Nokomis Street

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
5-Lane Section with Access Management	5.8	8.6	7	7.1
4-Lane Section with Raised Median	6.3	8.4	2.4	5.7
Do Nothing	3.4	2.2	0.6	2.1

- Highest Ranked Alternative: Five-lane section with shared use path and access management.
- Estimated planning level cost: $715 K. This amount includes a contingency for right-of-way acquisition but does not include costs associated with potential intersection control improvements at Lakeview Avenue.

Intersection Alternatives: TH 29 and Nokomis Street

The continuous roundabout received the highest overall score, being the highest ranked option by SRC and the community, and the second highest ranked option per the technical score. This alternative significantly improves traffic flow and will reduce injury crash potential. This alternative also serves as a natural traffic calming device in an area where speed differential is a predominant crash trend.

Table 4.3: Summary of Intersection Alternatives- TH 29 & Nokomis Street

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
Continuous Roundabout	6.6	9.8	8.4	8.3
Continuous Green-T Intersection	8.7	6.6	1.3	5.5
Do Nothing	4.7	1.0	0.3	2.0

- Highest Ranked Alternative: Continuous Roundabout.
- Estimated planning level cost: $1 Million.

Segment Alternatives: Nokomis Street to McKay Avenue

The four-lane section with shared use trail and access management received the highest overall score, being the highest ranked option in all three categories. The widening of road coupled with access management improvements will improve traffic operations and safety and supports a low-stress pedestrian and bicycle facility. The alternative also fits well with the alternatives preferred for the rest of the network. The alternative is expected to be the most expensive of the three options in this segment. It is important to note that deficient operations are not expected until sometime in the future. Phasing of improvements (i.e. short-term, long-term) will be considered in the next chapter of the report.

Table 4.4: Summary of Segment Alternatives- Nokomis Street To McKay Avenue

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
Four-lane section with shared use trail and access management	7.1	9.0	8.8	8.3
Frontage Road and Shared Use Trail	5.2	7.2	0.8	4.4
Do Nothing	4.3	2.0	0.4	2.2

- Highest Ranked Alternative: Four-lane section with shared use path and access management.
- Estimated planning level cost: $3.2 Million.

Segment Alternatives: McKay Avenue to CR 73

The four-lane section with shared use trail and access management received the highest overall score, being the highest ranked option in all three categories. The widening of road coupled with access management improvements will improve traffic operations and safety. It also creates low stress pedestrian and bicycle facility. The alternative also fits well with the alternatives preferred for the rest of the network. The alternative is expected to be the most expensive of the three options in this segment. Project phasing will be considered in the next chapter of the report.

Table 4.5: Summary of Segment Alternatives- McKay Avenue To CR 73

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
Four-lane section with shared use trail and access management	6.3	9	9.4	8.2
Frontage Road and Shared Use Trail	6	6.7	0.3	4.3
Do Nothing	4.3	2.3	0.3	2.3

- Highest Ranked Alternative: Four-lane section with shared use path and access management.
- Estimated planning level cost: $4 Million.

Intersection Alternatives: TH 29 and County Road 73

The continuous T-intersection received the highest overall score, being the highest ranked option in all three categories. The alternative is expected to reduce the side street vehicular delay, minimizing potential conflicts with the adjacent railroad crossing. However, potential conflicts with railroad crossing remain due to minor approach stop control. The alternative is also expected to reduce crash potential by eliminating angle crashes. The alternative has no property or right-of-way impacts.

Table 4.6: Summary of Intersection Alternatives- TH 29 & CR 73

Alternative	Technical Score	SRC Score	Community Support Score	Overall Score
Contunuous T-Intersection (Unsignalized)	6.4	10.0	9.6	8.7
Do nothing	0	0	0.4	0.1

- Highest Ranked Alternative: Continuous T-intersection.
- Estimated planning level cost: $400 K.

Prioritization of Improvements

The intersection and segment improvement options identified in this study were prioritized based on the timing of needs. Improvements were divided into three priority categories: Short-term improvements, Mid-term improvements and Long-term improvements.

Short-Term Improvements

Short-term improvements are intended to mitigate existing deficiencies in the study area. Note that the prioritization of these improvements does not consider funding availability. The following improvements should be made in the short term, or as soon as feasible:

- Intersection of 3rd Avenue and Nokomis Street – Construct Multilane Roundabout
    - Improvements should be prioritized at the intersection of 3rd Avenue and Nokomis Street due to existing delays (especially the westbound approach) that will further deteriorate by 2045. The overall intersection will operate at unacceptable delay by 2045. Intersection improvements will also improve intersection safety, especially for nonmotorized users. This improvement will likely be most appropriate if added to the segment project between 3rd Avenue and Nokomis Street.
- Segment Between 3rd Avenue and Nokomis Street – Construct Four Lane Median Divided Section
    - Segment improvements to TH 29 between 3rd Avenue and Nokomis Street are a high priority because the segment experiences high volumes of both through traffic and business traffic, with operations at LOS "F" expected in the near future. Existing multimodal facility gaps also present a challenge to nonmotorized users, especially those with disabilities.
- Intersection of TH 29 and Nokomis Street – Construct Continuous Roundabout
    - Northbound left turning vehicles from TH 29 to Nokomis Street currently experience unacceptable delays during the PM peak hour. There is also a merging conflict between southbound through vehicles and the merging eastbound right turning vehicles, which creates queues extending to Robert Street. Speed differential between vehicles on TH 29 in this area continues to be an issue as well. Delaying any improvements will result in further deteriorated intersection operations and overall southbound operations on TH 29.
- Intersection of TH 29 and CR 73 – Construct Unsignalized Continuous-T Intersection
    - The intersection is located near an at-grade rail crossing with its westbound approach about 95-feet between the railroad tracks and roadway edge. The intersection is currently stop controlled on CR 73 and experiences long delays and queues because of high vehicular volumes on TH 29. The long queues extend past the railroad tracks during peak traffic conditions, creating a safety concern.
- Shared-use Path on Segment Between Nokomis Street and CR 73

- The addition of a shared use path between Nokomis Street and CR 73 is well-supported by the Study Review Committee and the public, therefore this can be a short-term improvement after an improved network south of this segment is constructed.

» Access and Turn-Lane Improvements Between Nokomis Street and CR 73

- These improvements are presented with the Nokomis Street to CR 73 improvements and include frontage roads, access revisions and turn-lane improvements. These segments of the corridor experience higher then expected crash rates that can be mitigated with a consistent access and turn lane design.

The total estimated cost of all short-term improvements is $5.9 million.

The Short-term improvements can be seen in Figure 4. 3 and Figure 4. 4.

Mid-Term Improvements

Mid-term improvements are short-term projects that provide immediate benefits but because they aren't resolving major deficiencies under existing conditions, could be delayed if funding limitations arise.

The intersection of Third Avenue and Nokomis Street which was included in the short-term improvement projects can also be considered for mid-term improvement given that it is not imperative under existing operations. However, combining this projects with the larger short-term project package has the potential to lead to economy of scales and reduce overall cost of the improvements.

Long-Term Improvements

Long-term improvements are not required for existing or imminent issues, however should be planned and later programmed to mitigate issues that are expected in the future. Traffic and safety conditions should be monitored to determine when these improvements become more urgent.

» Widen TH 29 between Nokomis Street and CR 73

- The widening of TH 29 segment from Nokomis Street to CR 73 can be selected as long-term priority since the segment is currently operating at an acceptable condition. The issues identified in these segments do not require immediate attention and the widening of the segment can be delayed until traffic forecasts indicate the need for increase in roadway capacity.
- The estimated cost of these improvements is $7.2 million.

Next Steps

This report is intended to present the overall score results for the alternatives that were developed to address the transportation issues in TH 29 study corridor.

Once a preferred alternative is identified, funding will need to be identified and secured. At that point the project can advance into environmental documentation and project development.

Figure 4. 3: Short-Term Improvement Plan (1 of 2)

Figure 4. 4: Short-Term Improvement Plan (2 of 2)

Table 4.7: Planning Level Cost Estimates - Short-Term Plan

ESTIMATE OF QUANTITIES						
Short Term Improvements						
TH 29 Corridor Study						
SPEC	CODE	ITEM DESCRIPTION		QUANTITY	UNIT COST	TOTAL COST
2104	504/00120	REMOVE BITUMINOUS PAVEMENT	SY	5,198.021	$ 3.30	$ 17,153.47
2104	503/00205	SAWING BITUMINOUS PAVEMENT (FULL DEPTH)	LF	1,036.500	$ 1.37	$ 1,420.01
2211	507/00170	AGGREGATE BASE (CV) CLASS 5	CY	16,821.514	$ 30.00	$ 504,645.43
2357	506/00010	BITUMINOUS MATERIAL FOR TACK COAT	GAL	2,523.227	$ 1.06	$ 2,674.62
2360	501/23300	TYPE SP Wearing Course Mixture	TON	19,625.100	$ 55.00	$ 1,079,380.50
2521	518/00030	3" CONCRETE WALK	SF	46,782.189	$ 6.00	$ 280,693.13
2521	518/00040	4" CONCRETE WALK	SF	142,898.058	$ 7.00	$ 1,000,286.40
2531	503/18120	CONCRETE CURB & GUTTER	LF	16,882.647	$ 25.00	$ 422,066.17
		Subtotal	-	-	-	**$ 3,308,319.73**
		20% Earthwork	LS	1.000	$ 661,663.95	$ 661,663.95
		15% Drainage	LS	1.000	$ 496,247.96	$ 496,247.96
		5% Traffic Control	LS	1.000	$ 165,415.99	$ 165,415.99
		3% Signing and Striping	LS	1.000	$ 99,249.59	$ 99,249.59
		2% Turf	LS	1.000	$ 66,166.39	$ 66,166.39
		3% Lighting	LS	1.000	$ 99,249.59	$ 99,249.59
					Total =	$ 4,896,313
					+ 10% Contingency =	$ 5,385,945
					+ 10% Mobilization =	$ 5,924,539

NOTE: Cost estimates do not include right-of-way costs or city utility costs.

Figure 4. 5: Long-Term Improvement Plan