

12th Avenue South Corridor Study River Drive to Main Avenue SE

APRIL 2019

METROCOG
FM REGIONAL TRANSPORTATION PLANNING ORGANIZATION



Apex
Engineering Group

Draft

12th Avenue South Corridor Study

River Drive to Main Avenue SE

Moorhead, Minnesota

Draft Document

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Fargo-Moorhead Metropolitan Council of Governments

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1.0 INTRODUCTION

1.1 Study Background

The Fargo-Moorhead Metropolitan Council of Governments (Metro COG) and the City of Moorhead (City) commissioned a study of the 12th Avenue South corridor between River Drive and Main Avenue SE in Moorhead. The 2014 Metropolitan Long Range Transportation Plan (LRTP) classifies 12th Avenue South in Moorhead as a major collector west of 8th Street, and as a minor arterial east of 8th Street. The 2014 LRTP also identifies this corridor for a mid-term (2021-2030) Preservation and Rehabilitation project. The City of Moorhead currently has a project programmed for 2020 to construct improvements on 12th Avenue South.

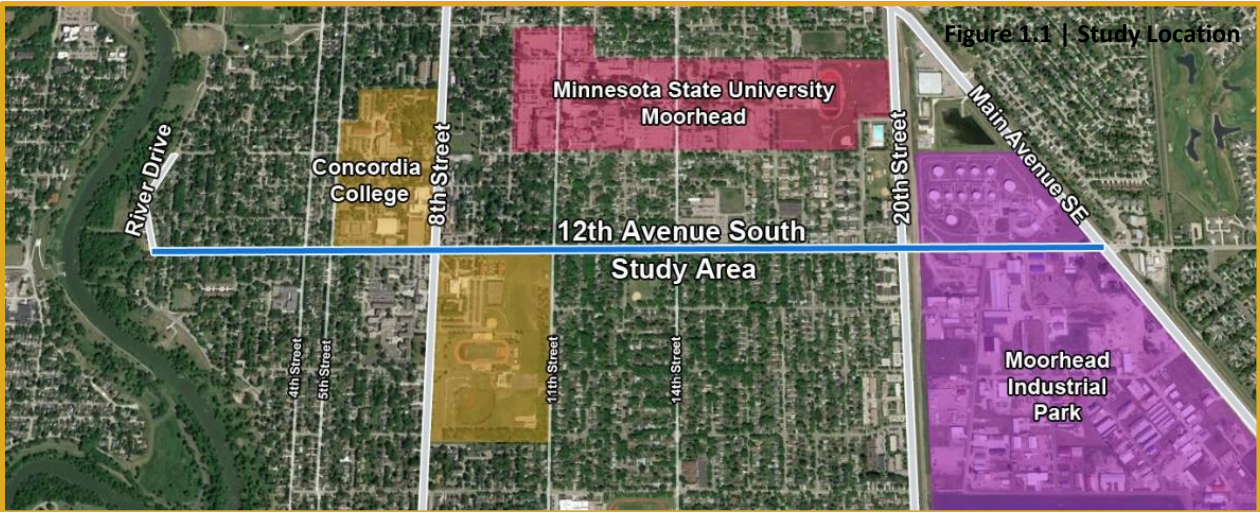
The purpose of this study is to:

- Consider a context-sensitive approach that consider the needs of all transportation system users
- Evaluate the current and future needs along the corridor
- Encourage input from the general public and 12th Avenue South community through several outreach methods
- Identify short-term and long-range improvements that should be considered for future implementation
- Provide a framework for future project implementation and informed decision-making by City leaders

1.2 Study Location

12th Avenue South is a 2-lane undivided roadway that runs east-west with a speed limit of 30 mph throughout the corridor (see Figure 1.1). The corridor has areas of on-street parking and on-street bike lanes. Different land uses exist along the corridor including residential, institutional, industrial and mixed-use. BNSF has five railroad tracks that cross the corridor just east of 20th Street. Key intersections along the corridor include:

- 4th Street
- 5th Street
- 8th Street (US 75)
- 11th Street
- 14th Street
- 20th Street
- Main Avenue SE



1.0 INTRODUCTION

12th Avenue South – West of 11th Street



12th Avenue South – East of 11th Street



Railroad Crossing at 20th Street



**12th Avenue South
Industrial Area East of 20th Street**



1.3 Intersecting Study: US 10/75 Corridor Study

Metro COG, the City of Moorhead, and the Minnesota Department of Transportation (MnDOT) are conducting a corridor study on US 10/75 which intersects the 12th Avenue South study corridor at the 8th Street (US 75) intersection. The US 10/75 study started approximately three months after the start of the 12th Avenue South study, and as of this writing (May 2019) is still ongoing. The teams for both studies have coordinated their efforts at the 8th Street (US 75) intersection, particularly regarding the future traffic projection and analysis methodologies. The 12th Avenue South study is using Year 2040 for future traffic volume development, while the US 10/75 study is using Year 2045. However, the intent is for the proposed improvements at the 8th Street intersection to be supported by both studies. Preliminary analysis on the US 10/75 study does support the recommended alternative improvements at 8th Street from this study.

8th Street Intersection



2.0 SUMMARY OF PUBLIC INVOLVEMENT

2.1 Study Review Committee Meetings

A Study Review Committee (SRC) was formed at the beginning of the Study process to provide general guidance on the direction of the study, to assist in identifying issues and reviewing alternatives, to evaluate information prior to public viewing, and to relay information back to other members of their respective agency.

A total of four in-person meetings and one conference call were held with the SRC during the study. In addition, a streetscaping and art meeting was held in December 2018 which was not an official SRC Meeting, but did have several members of the SRC in attendance.

- ➔ **SRC Meeting #1: May 16, 2018** | Kickoff meeting including study team introductions and initial discussions on issues, needs, traffic analysis process, and the public engagement plan.
- ➔ **SRC Conference Call: August 20, 2018** | The SRC reviewed and discussed comments on Draft Tech Memo #1 (Existing Conditions), confirmed the future traffic projection methodology, discussed the online survey, and reviewed the plan for the upcoming Public Meeting #1.
- ➔ **SRC Meeting #2: October 18, 2018** | The SRC debriefed on Public Meeting #1 and reviewed public comments received both at the meeting and through the online survey. Issue identification and needs were verified from the public input, and a discussion was held on alternative development.
- ➔ **Streetscape and Art Meeting: December 17, 2018** | This meeting was held to review concepts and ideas for streetscaping and street art near Concordia College.
- ➔ **SRC Meeting #3: March 8, 2019** | The SRC reviewed and discussed comments on Draft Tech Memo #3 (Alternative Development and Evaluation), summarized the coordination that was ongoing with the intersecting study on the US 10/75 corridor, and reviewed the plan for the upcoming Public Meeting #2.
- ➔ **SRC Meeting #4: April 30, 2019 (tentative)** | The SRC reviewed and discussed comments on the Draft Corridor Study Report and finalized arrangements for presentations to boards and councils to obtain approval for the final study report.

Meeting minutes, sign-in sheets, and handouts from the SRC Meetings are included in **Appendix A**. The SRC included participation from the following agencies and individuals:

Metro COG

Adam Altenburg

City of Moorhead

Kristie Leshovsky
Jonathan Atkins
Tom Trowbridge
Steve Moore

MATBUS

Lori Van Beek

Concordia College

Roger Olson

Apex Engineering Group

Matt Kinsella
Brent Muscha

Stonebrooke Engineering

Kate Miner

Flint Group

Chris Hagen

Hanson Design Associates

Jim Hanson

2.2 Public Participation Plan

The study team developed a Public Participation Plan (PPP) document to guide the public engagement strategies for the 12th Avenue South study. A copy of the full PPP document can be found in **Appendix B**.

The PPP identified the key stakeholders and outlined the various engagement tactics that would be used during the study.

2.3 Public Input Meetings

Two public input meetings were held during the study – one midway through the study and one near the end of the study. Each meeting utilized an open house format with informational handouts and displayed exhibits, as well as a formal presentation. The public meetings were held on the campus of Concordia College, in the Birkeland Lounge at Offutt Concourse. Advertising and notification tactics included the following:

- Posts on Metro COG and the City’s websites
- Boost posts on Facebook and on Metro COG and City social media channels
- Posts to Nextdoor neighborhood social network app
- Mailed notices from the City to properties adjoining the corridor
- Print ad in the Clay County Extra newspaper
- Shareable emails and alerts were provided to partners such as Concordia College, Minnesota State University Moorhead (MSUM), MATBUS, MState, and Eventide
- Moorhead Community Access Media (MCAM) also aired an advertisement on community access television

↪ *Public Input Meeting #1 – September 20, 2018*

At the first meeting, the Existing Conditions and Future Conditions traffic analyses were presented. The goal was to hear from the public regarding what they viewed as the key issues and needs along the corridor. Approximately 25 members of the public attended the meeting. Meeting materials and a transcript of comments received during and after the meeting can be found in **Appendix C**.

↪ *Public Input Meeting #2 – March 19, 2019*

At the second meeting, the study issues and needs and proposed alternatives were presented. The results of the online survey were also summarized. The goal was to reflect back what the study team heard during the first round of comment and feedback, and to receive feedback on whether the proposed alternatives were in alignment with the public sentiment. Approximately 40 members of the public attended the meeting. Meeting materials and a transcript of comments received during and after the meeting can be found in **Appendix C**.



2.4 Online Surveys

Two online surveys were available to the public during the course of the study. The surveys were hosted on the SurveyMonkey platform and were accessible from weblinks on both the Metro COG and City of Moorhead websites.

↳ Online Survey #1

Online Survey #1 was available from July 3 – October 18, 2018, coinciding with the Issue Identification phase of the study. 172 survey responses were received. The survey consisted of 10 general questions about how the respondent used 12th Avenue South, what they saw as the key issues on the corridor, and what type of improvements they would be in favor of.

With that many responses being received, the comments received spanned across a large category of issues and needs. Overall, the most common topics commented on by respondents were:

- Pavement Condition
- Pedestrian/Bicycle Connectivity and Safety
- Railroad Crossing Improvement at 20th Street
- Transit Facilities (benches, shelters)
- Trees and Streetscaping

A complete summary of the survey questions and responses can be found in **Appendix D**.

↳ Online Survey #2

Online Survey #1 was available from March 20 – April 22, 2019, coinciding with the Alternative Development and Evaluation phase of the study. xx survey responses were received. The survey consisted of 16 questions asking the respondent to rate the various proposed improvement alternatives on a scale of one to five stars. A complete summary of the survey questions and responses can be found in **Appendix D**.





3.0 EXISTING CONDITIONS

3.1 Traffic Operations

This section is intended to summarize the description of data collection, methodologies for modeling the corridor, as well as operational, queuing, and safety analysis for the Existing Conditions. The following nine intersections were identified and evaluated along the corridor:

- 1. Elm Street
- 2. 4th Street South
- 3. 5th Street South
- 4. 8th Street South
- 5. 11th Street South
- 6. 14th Street South
- 7. 17th Street South
- 8. 20th Street South
- 9. Main Avenue SE

Supporting data for the traffic analysis can be found in **Appendix E**.

3.1.1 DATA COLLECTION

In an effort to obtain all the data along the 12th Avenue S corridor necessary for both analyzing existing and proposed conditions, 12-hour turning movement counts for the nine intersections were collected in April 2018. The 2017 Average Annual Daily Traffic (AADT) volumes are required for safety analysis and were collected from MnDOT GIS layers.

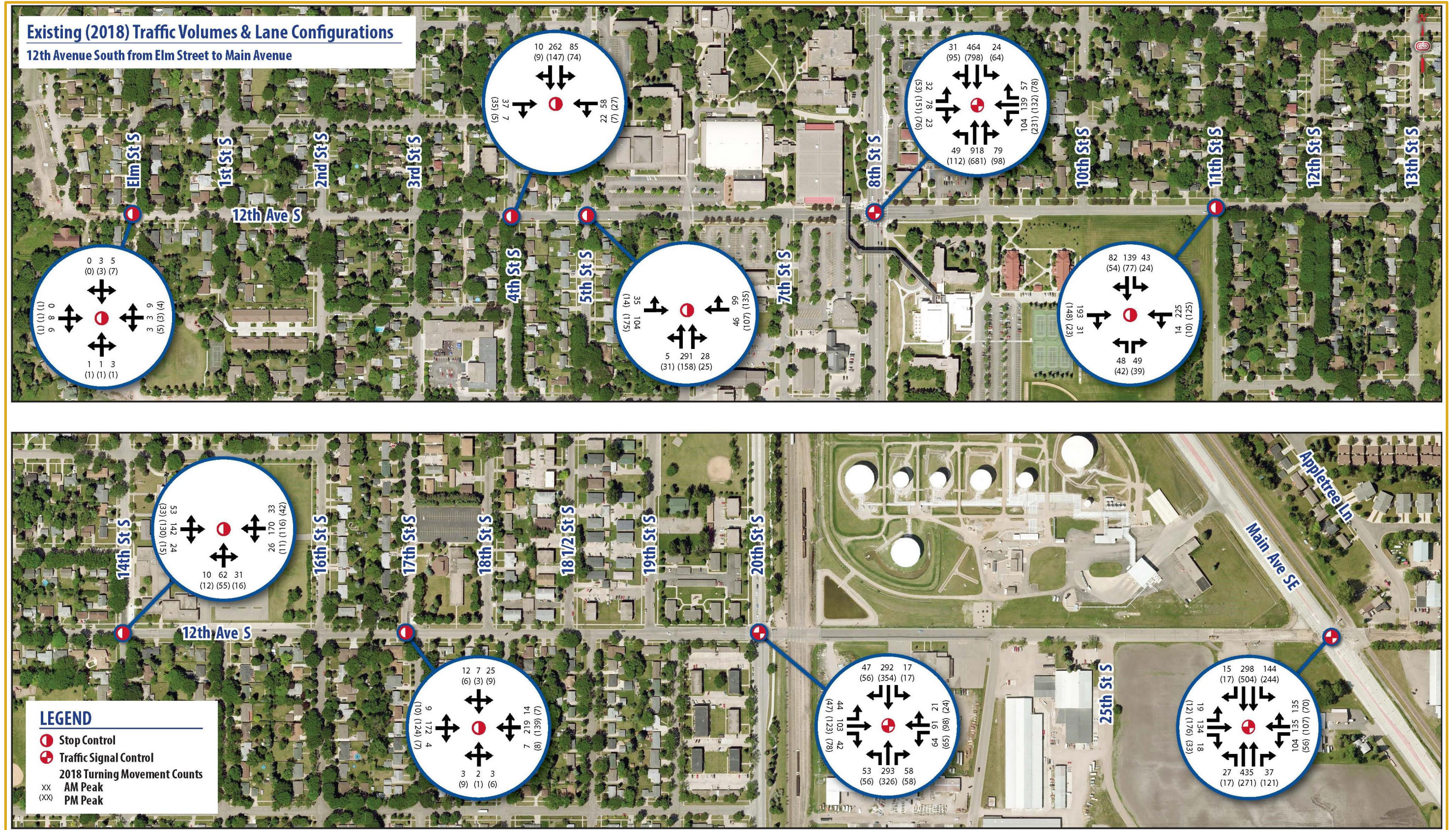
Figure 3.1 displays the existing AM and PM turning movement counts and lane configurations of each intersection along the study corridor.

Crash data was collected for the last full 5-year period for which data was fully available, 2011-2015 from the Minnesota Crash Mapping Analysis Tool (MCMAT) database.

8th Street Intersection



Figure 3.1 | Existing Traffic Volumes



3.1.2 MODEL SET UP

An existing conditions traffic model in Synchro was created, which included in-place geometry such as number of thru lanes and turn lanes, storage lengths for turn lanes, link distances, speed limits, and existing signal timing parameters. Separate files were created for the AM Existing Conditions and PM Existing Conditions, using the turning movement counts collected. Following creation of the models in Synchro, the files were output to SimTraffic for further analysis.

SimTraffic is a microsimulation software package that is the companion to Synchro. SimTraffic 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.

Results of the analysis are displayed as measures of effectiveness (MOE). MOEs establish quantitative information about the performance of an intersection. The primary MOEs that are used in the study are delay, level of service (LOS), and queue lengths.

3.1.3 EXISTING CONDITIONS

Existing conditions include operational and queuing analysis of 2018 conditions as represented by the turning movement counts collected in April 2018. Safety analysis includes data from the last full five-year period for which data was available, 2011-2015. The following section includes methodology and results for operational, queuing, and safety analysis.

3.1.4 OPERATIONAL AND QUEUING ANALYSIS

The traffic operations analysis is based on methodologies documented in the Highway Capacity manual (HCM). The HCM contains analysis techniques for evaluating the operations of transportation facilities under various conditions, such as roadway and intersection configuration, intersection traffic control, type of roadway, number and type of lanes, impact due to presence of pedestrians, and many other factors.

↳ *Delay and Level of Service*

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. LOS is determined based on methodology from the HCM, which defines LOS based on control delay. Control delay is the wait time experienced by vehicles slowing down for a signal, roundabout, or stop sign 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 or all-way stop intersection.

Intersection delay and corresponding LOS for signalized and unsignalized all-way stop intersections, as defined by HCM are presented in **Table 3.1**. The LOS delay thresholds for unsignalized intersections are lower than signalized intersections which accounts for the fact that drivers tend to accept longer delays at signals compared to stop or yield signs.

Based on standard practice in the traffic engineering industry, as well as guidance from the American Association of State Highway and Transportation Officials (AASHTO) and conformance with MnDOT, the threshold for acceptable level of intersection operations is commonly taken to be the border between LOS D and LOS E. LOS D is considered acceptable and LOS E is considered unacceptable during the peak hour.

Table 3.1
Intersection Control Delay and Level of Service Definitions

Level of Service (LOS)	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 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. Finally, 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.

Queuing values were taken from SimTraffic for average queue length and 95th percentile modeled queue length. The following criteria was used to identify “queuing issues” for particularly movements. A queuing issue was identified if any of the three conditions were met at a signalized intersection:

- Condition 1: 95th percentile queue length exceeds storage length and the movements operate at LOS E or LOS F
- Condition 2: Average queue length exceeds storage length
- Condition 3: 95th percentile queue length blocks upstream full access intersection

And at a stop-controlled intersection if the following was met:

- Condition 4: 95th percentile queue length exceeds 500 feet on a stop-controlled approach

3.1.5 CAPACITY ANALYSIS

The following subsections include planning level corridor-wide capacity analysis, intersection operations analysis, and queuing analysis.

↳ *Existing Corridor Traffic Demand*

Existing traffic demands were analyzed along 12th Avenue S corridor. **Table 3.2** displays planning level capacity analysis using 2015 Average Annual Daily Traffic (AADT) volumes obtained from the Fargo-Moorhead Long Range Transportation Plan. The table shows that looking from a planning level only, the corridor is currently well below the planning level thresholds.

Table 3.2
2015 AADT and Capacity Analysis

Segment	Existing Roadway Type	Section Capacity ¹	AADT			
			Existing 2015	Forecast 2040 ³	Additional Capacity 2015 ²	Additional Capacity 2040 ³
Elm Street to 4th Street S	Two-Lane Undivided	10,000	3,100	TBD	6,900	TBD
4th Street S to 5th Street S	Two-Lane Undivided	10,000	3,100	TBD	6,900	TBD
5th Street S to 8th Street S	Two-Lane Undivided	10,000	5,200	TBD	4,800	TBD
8th Street S to 11th Street S	Two-Lane Undivided	10,000	7,000	TBD	3,000	TBD
11th Street S to 14th Street S	Two-Lane Undivided	10,000	5,750	TBD	4,250	TBD
14th Street S to 17th Street S	Two-Lane Undivided	10,000	4,700	TBD	5,300	TBD
17th Street S to 20th Street S	Two-Lane Undivided	10,000	3,900	TBD	6,100	TBD
20th Street S to Main Ave SE	Three-Lane	18,000	4,900	TBD	13,100	TBD
Main Ave SE to Ridgeway St	Three-Lane	18,000	4,800	TBD	13,200	TBD

¹ Planning level capacities are highly dependent on assumptions used such as access spacing, peak hour percent, directional distribution, saturation flow rates, etc. Values should not be used for operational analysis or final design.

² Positive numbers indicate that additional capacity is available. Negative numbers indicate over capacity.

³ Forecast AADT and capacity analysis is To Be Determined, and will be included in subsequent reports

➡ Existing Intersection Traffic Operations Analysis Results and Conclusions

Table 3.3 displays a summary of AM and PM peak hour intersection delay by approach and by intersection, 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. Note that intersection LOS is not defined by the HCM for thru-stop control intersections. This is because the minor approaches with relatively low percentages of overall traffic could experience excessive delay, while the mainline could experience little or no delay. The result likely would be low overall intersection delay, which on its face would indicate acceptable operations, when individual stop-controlled movements could be failing.

All intersections currently operate at LOS C or better during AM and PM Peak. During the PM Peak at 8th Street S the EB movement is operating at a LOS D with a delay of 38 sec/vehicle.

Table 3.3
2018 AM and PM Level of Service and Intersection Delay¹

Intersection			AM Peak Hour				PM Peak Hour			
Control	Location	Approach	LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Thru-stop	Elm Street	NB	3	A	2	N/A ²	4	A	2	N/A ²
		WB	2	A			2	A		
		SB	4	A			4	A		
		EB	0	A			0	A		
All-way	4th Street S	NB	-	-	7	A	-	-	5	A
		WB	7	A			3	A		
		SB	7	A			6	A		
		EB	6	A			6	A		
All-way	5th Street S	NB	6	A	6	A	6	A	6	A
		WB	4	A			5	A		
		SB	-	-			-	-		
		EB	7	A			7	A		
Signalized	8th Street S	NB	16	B	15	B	25	C	26	C
		WB	16	B			24	C		
		SB	11	B			24	C		
		EB	21	C			38	D		
All-way	11th Street S	NB	4	A	8	A	4	A	6	A
		WB	9	A			8	A		
		SB	7	A			6	A		
		EB	8	A			5	A		
All-way	14th Street S	NB	5	A	7	A	6	A	6	A
		WB	7	A			6	A		
		SB	-	-			-	-		
		EB	6	A			7	A		
Thru-Stop	17th Street S	NB	4	A	2	N/A ²	4	A	2	N/A ²
		WB	2	A			2	A		
		SB	6	A			5	A		
		EB	2	A			2	A		
Signalized	20th Street S	NB	10	A	13	B	10	B	14	B
		WB	19	B			21	C		
		SB	12	B			13	B		
		EB	14	B			15	B		
Signalized	Main	NB	16	B	15	B	13	B	13	B
		WB	16	B			15	B		
		SB	11	B			10	B		
		EB	24	C			23	C		

¹ Delay for all movements taken from SimTraffic reports.

² LOS is undefined for two-way stop control intersections

➡ *Existing Queuing Analysis Results and Conclusions*

Synchro uses HCM based equations to determine queues. SimTraffic is a microscopic model that uses observations based on simulation to measure queues. For its robust features, we have used SimTraffic tool for reporting average queue and 95th percentile queue by turning movements for each of the nine key intersections.

Tables 3.4 and 3.5 display a summary of existing storage lengths, average queues lengths, and 95th percentile modeled queue lengths for the AM and PM Peak Hours, respectively. Based on queuing analysis methodology previously identified, no queuing issues were identified along the corridor.

**Table 3.4
2018 AM Queuing Summary**

Scenario		2018								
		Existing Condition								
Intersection	Appr	Storage (ft) ²			Average Queue (ft) ¹			95th % Queue (ft) ¹		
		LT	TH	RT	LT	TH	RT	LT	TH	RT
Elm Street S (Thru-Stop)	EB	-	225	-	-	0	-	-	0	-
	WB	-	310	-	-	0	-	-	0	-
	NB	-	690	-	-	6	-	-	26	-
	SB	-	330	-	-	10	-	-	34	-
4th Street S (All-Way Stop)	EB	-	340	-	-	37	-	-	51	-
	WB	-	250	-	-	31	-	-	49	-
	NB	-	-	-	-	-	-	-	-	-
	SB	340	-	340	50	-	29	75	-	49
5th Street S (All-Way Stop)	EB	-	250	-	-	37	-	-	57	-
	WB	-	350	-	-	40	-	-	64	-
	NB	690	-	690	45	-	31	71	-	52
	SB	-	-	-	-	-	-	-	-	-
8th Street S (Signalized)	EB	130	315	-	24	50	-	56	91	-
	WB	160	390	160	52	56	28	95	105	70
	NB	130	710	710	40	160	143	107	244	223
	SB	120	670	670	16	81	51	55	130	104
11th Street S (All-Way Stop)	EB	-	530	-	-	54	-	-	82	-
	WB	-	340	-	-	49	-	-	76	-
	NB	645	-	645	22	-	27	47	-	52
	SB	650	-	650	26	-	50	49	-	80
14th Street S (All-Way Stop)	EB	-	545	-	-	42	-	-	65	-
	WB	-	350	-	-	54	-	-	90	-
	NB	-	645	-	-	34	-	-	55	-
	SB	-	-	-	-	-	-	-	-	-
17th Street S (Thru-Stop)	EB	-	315	-	-	2	-	-	16	-
	WB	-	240	-	-	2	-	-	19	-
	NB	-	645	-	-	8	-	-	30	-
	SB	-	1045	-	-	25	-	-	50	-
20th Street S (Signalized)	EB	170	300	170	26	41	14	56	82	33
	WB	180	885	-	31	38	-	66	80	-
	NB	200	645	200	25	77	14	55	140	34
	SB	220	1450	175	13	89	19	38	154	48
Main Avenue SE (Signalized)	EB	130	800	130	11	60	6	34	115	28
	WB	220	220	220	50	49	24	97	99	54
	NB	180	1250	500	9	97	47	26	153	104
	SB	240	530	500	42	51	27	86	96	63

¹ Queue for the movements taken from SimTraffic reports (60 min run)

² Thru lane storage is taken as the distance to the prior intersection

**Table 3.5
2018 PM Queuing Summary**

Scenario		2018								
		Existing Condition								
Intersection	Appr	Storage (ft) ²			Average Queue (ft) ¹			95th % Queue (ft) ¹		
		LT	TH	RT	LT	TH	RT	LT	TH	RT
Elm Street S (Thru-Stop)	EB	-	225	-	-	0	-	-	0	-
	WB	-	310	-	-	0	-	-	0	-
	NB	-	690	-	-	3	-	-	18	-
	SB	-	330	-	-	10	-	-	34	-
4th Street S (All-Way Stop)	EB	-	340	-	-	26	-	-	52	-
	WB	-	250	-	-	21	-	-	44	-
	NB	-	-	-	-	-	-	-	-	-
	SB	340	-	340	40	-	19	62	-	47
5th Street S (All-Way Stop)	EB	-	250	-	-	42	-	-	70	-
	WB	-	350	-	-	51	-	-	75	-
	NB	690	-	690	39	-	23	58	-	50
	SB	-	-	-	-	-	-	-	-	-
8th Street S (Signalized)	EB	130	315	-	43	126	-	119	253	-
	WB	160	390	160	104	63	49	164	148	98
	NB	130	710	710	86	168	154	169	264	250
	SB	120	670	670	55	172	157	129	264	250
11th Street S (All-Way Stop)	EB	-	530	-	-	44	-	-	67	-
	WB	-	340	-	-	41	-	-	65	-
	NB	645	-	645	24	-	24	49	-	48
	SB	650	-	650	17	-	37	42	-	59
14th Street S (All-Way Stop)	EB	-	545	-	-	38	-	-	57	-
	WB	-	350	-	-	45	-	-	68	-
	NB	-	645	-	-	31	-	-	52	-
	SB	-	-	-	-	-	-	-	-	-
17th Street S (Thru-Stop)	EB	-	315	-	-	2	-	-	16	-
	WB	-	240	-	-	1	-	-	10	-
	NB	-	645	-	-	14	-	-	39	-
	SB	-	1045	-	-	15	-	-	42	-
20th Street S (Signalized)	EB	170	300	170	29	50	22	65	91	46
	WB	180	885	-	31	50	-	63	103	-
	NB	200	645	200	27	86	18	54	160	56
	SB	220	1450	175	12	115	23	41	197	67
Main Avenue SE (Signalized)	EB	130	800	130	8	71	11	28	128	43
	WB	220	220	220	33	40	13	70	84	30
	NB	180	1250	500	7	71	23	20	121	66
	SB	240	530	500	58	64	45	104	115	87

¹ Queue for the movements taken from SimTraffic reports (60 min run)

² Thru lane storage is taken as the distance to the prior intersection

3.1.6 SAFETY ANALYSIS

Crash and traffic volume data were collected and analyzed for intersections along the corridor. Existing average daily traffic volumes were taken from the online MnDOT Traffic Mapping Application. The nine intersections identified and evaluated along the 12th Avenue S corridor include:

- Three traffic signal controls at 8th Street S, 20th Street S and Main Avenue SE
- Four All-Way Stops at 4th Street S, 5th Street S, 11th Street S and 14th Street S
- All other intersections operate as a thru-stop condition with the north-south approaches under stop control

↳ *Crash Severity*

Crashes are generally divided into five severity levels. Each severity level is defined below:

- Fatal (F) – One or more deaths resulted due to injuries sustained from the crash, either at the scene or within 30 days of the crash.
- Incapacitating injury (A) – This is a severe injury that prevents continuation of normal activities such as a broken bone.
- Non-Incapacitating Injury (B) – This is an evident injury such as bruising, abrasions or minor lacerations, which do not incapacitate the individual.
- Possible Injury (C) – This is an injury that is claimed, reported, or indicated by behavior but without any obvious wound. This includes limping or a simple complaint of pain.
- Property Damage Only (PDO) – This is a crash that results in no injuries and only damage to property.

↳ *Crash Rate and Severity Rate*

Crash rate, expressed as crashes per million entering vehicles at intersections, accounts for exposure and is used as a method to facilitate comparisons to other similar intersections or sections. Severity crash rate applies a weighted average to crashes more severe in nature, i.e. fatal crashes have the highest weighted multiplier. There were no Fatal or 'A' crashes at intersections, therefore severity rate was not calculated.

↳ *Critical Crash Rate and Severity Rate*

Using critical rates to compare against observed crash rates is considered to be one of the most statistically valid methods for identifying hazardous locations. Critical rates account for the type of intersection (traffic control, approach speed, environment), amount of exposure measured in volume traveling through the intersection, and the random nature of crashes. This analysis uses a 99.5% confidence interval in calculating critical crash and severity rates.

↳ *Critical Crash Index*

Critical Index is simply the actual rate divided by the critical rate. A critical index in excess of 1.0 indicates that the actual rate is higher than the critical rate, and thus, from a statistical perspective, the location can be considered hazardous for the particular measure of effectiveness under consideration (crash rate and severity rate).

3.0 EXISTING CONDITIONS

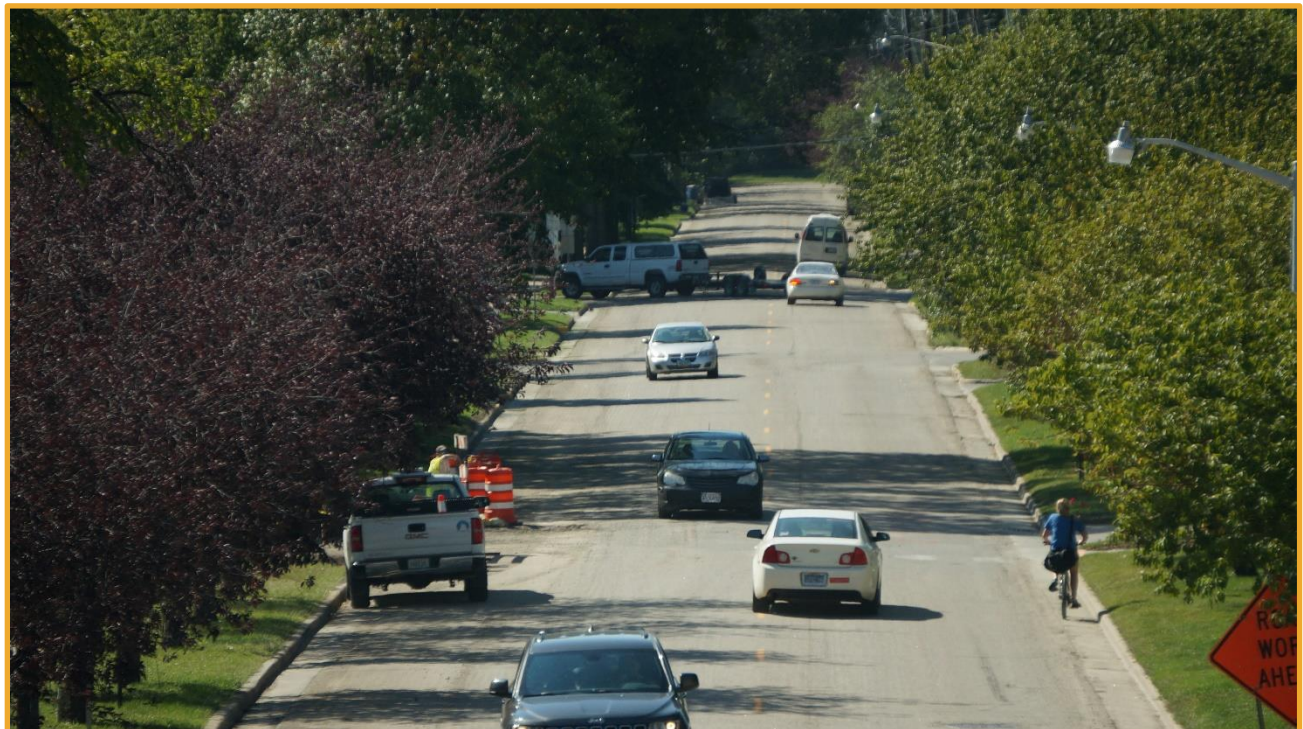
➔ Safety Analysis Results and Conclusions

Crashes from the five-year time period 2011-2015 were queried from the online MnDOT Crash Mapping Analysis Tool. The five-year state average crash rates for different roadway intersections and segments were obtained from MnDOT’s 2015 Intersection and Segment Toolkit and are listed in **Table 3.6**. These averages include intersections statewide in Minnesota. The table shows that there are three intersections with a crash rate slightly higher than the statewide average, but none of them above the critical crash rate. Indicating the intersections are operating with a normal and expected range.

Table 3.6
Intersection Crash Rates 2011-2015

12th Avenue S Intersection with	Total Number of Crashes	Crash Types					Daily Entering Volume	Observed Crash Rate (crashes/MEV)	Average Crash Rate (crashes/MEV)	Critical Crash Rate (crashes/MEV)	Critical Index ¹
		PD	C	B	A	K					
Elm Street	0	0	0	0	0	0	-	-	-		-
4th Street S	1	1	0	0	0	0	7,850	0.07	0.35	0.79	0.09
5th Street S	1	1	0	0	0	0	6,500	0.08	0.35	0.84	0.10
8th Street S	34	25	7	2	0	0	24,550	0.76	0.70	1.03	0.74
11th Street S	2	1	1	0	0	0	8,050	0.14	0.35	0.78	0.18
14th Street S	4	4	0	0	0	0	5,675	0.39	0.35	0.87	0.45
17th Street S	1	0	1	0	0	0	5,350	0.10	0.18	0.59	0.17
20th Street S	19	12	6	1	0	0	17,475	0.60	0.52	0.86	0.70
Main Ave SE	10	5	4	1	0	0	14,650	0.37	0.52	0.89	0.42

¹ A Critical Index greater than 1.0 indicates a hazardous location



3.2 Construction History

The available history of construction on the 12th Avenue South corridor is shown in **Table 3.7**.

Table 3.7 – Construction History

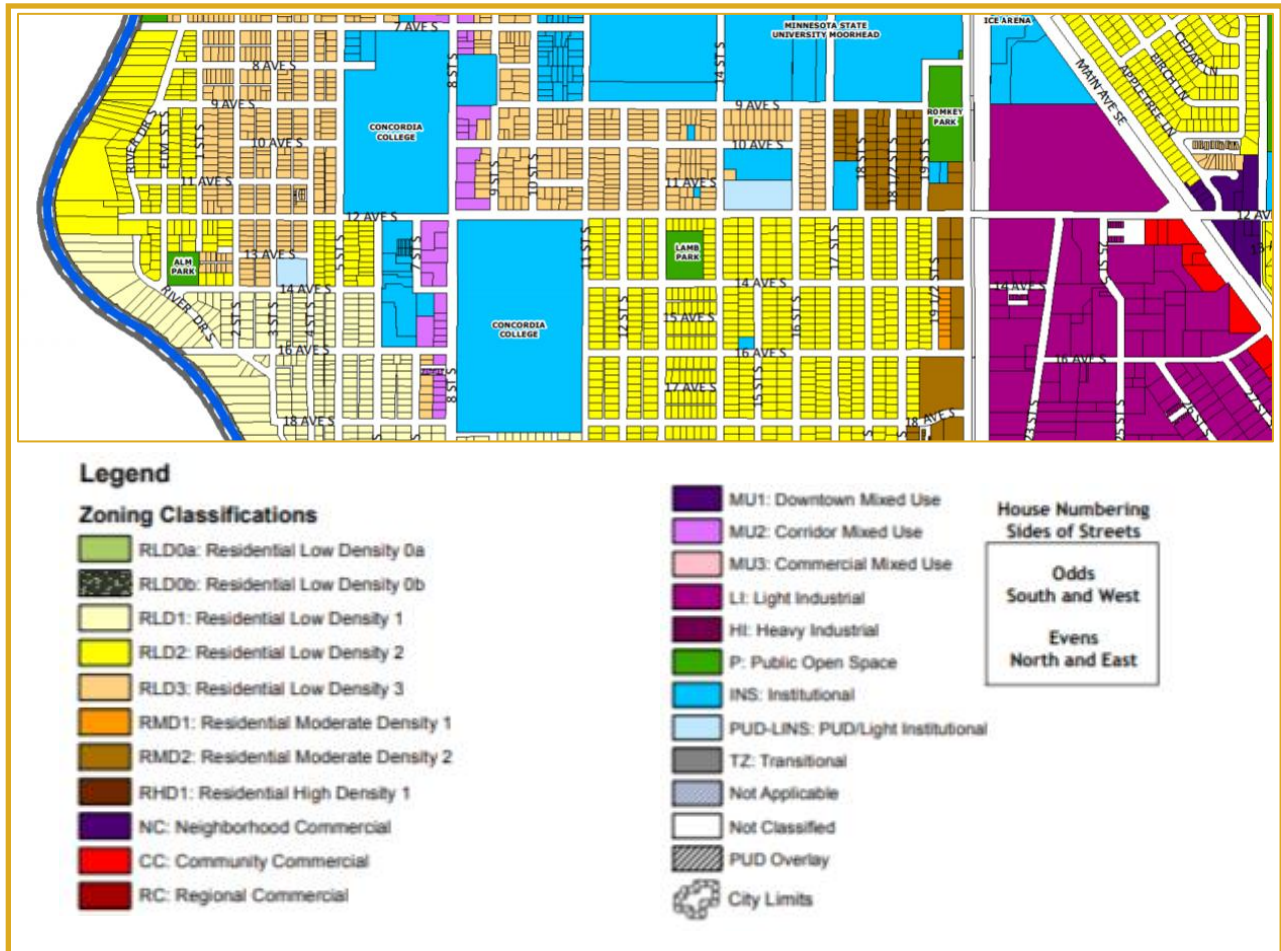
Year	Type of Work	Specific Location (if applicable)
River Drive to 9th Street		
Mid 1950s	Original Grading and Paving	
1988	Full depth asphalt reconstruction	8 th to 9 th St
1991	Full depth asphalt reconstruction, some curb replacement	4 th to 8 th St
2006	Rehab – 6" asphalt over 6" agg base	River Dr to 1 st St
2006	Mill and asphalt overlay	1 st St to 4 th St
9th Street to 20th Street		
Mid 1950s	Original Grading and Paving	
1994	Full depth asphalt reconstruction, some curb replacement (<50%)	
20th Street to Main Avenue SE		
1964	Original Grading and Paving – 2" asphalt over 8" soil cement base	
1979	Asphalt overlay (2")	
1988	Mill and asphalt overlay (4")	

3.3 Land Use

Between River Drive and 20th Street, land use is almost entirely low-density residential, with some moderate-density residential properties located just west of 20th Street. Institutional zoning is also present along the corridor (including Concordia College, Grace United Methodist Church, and the former Thomas Edison Elementary School), with some mixed-use also along the 8th Street north-south corridor.

East of 20th Street, zoning is light and heavy industrial. **Figure 3.2** shows the City’s zoning map along 12th Avenue South.

Figure 3.2 | Zoning Map



3.4 Geometry

The horizontal alignment is straight on 12th Avenue South, since it is a section line road. The vertical alignment is flat, with the exception of the area just east of 20th Street, where the road grade rises to meet the BNSF RR crossing grade.

3.5 Typical Section

The existing typical street sections found on the 12th Avenue South corridor are shown in **Table 3.8**. All segments have sidewalks/paths on both sides of the street, unless otherwise noted.

Table 3.8
Typical Section

Segment	Street Width	Notes
River Drive to 4 th Street	36'	<ul style="list-style-type: none"> 2-lane with parking No sidewalk on south side between River Drive and Elm Street (1 block) No sidewalk on north side between 2nd Street and 4th Street (2 blocks)
4 th Street to 7 th Street	32'	<ul style="list-style-type: none"> 2-lane with parking No sidewalk on north side between 4th Street and 6th Street (2 blocks)
7 th Street	46'	<ul style="list-style-type: none"> 2-lane with parking Bus pullout on north side of street
7 th Street to 8 th Street	42'	<ul style="list-style-type: none"> 3-lane (2 EB, 1 WB) No parking
8 th Street to 9 th Street	Varies 38' – 56'	<ul style="list-style-type: none"> 4-lane (3 WB, 1 EB) No parking
9 th Street to 15 th Street	36'	<ul style="list-style-type: none"> 2-lane with parking No sidewalk on south side between 9th Street and 11th Street (2 blocks)
15 th Street to 16 th Street	46'	<ul style="list-style-type: none"> 2-lane with parking Bus pullout on north side of street
16 th Street to 19 th Street	36'	<ul style="list-style-type: none"> 2-lane with parking
19 th Street to 20 th Street	48'	<ul style="list-style-type: none"> 4-lane (3 EB, 1 WB) No parking
20 th Street to 25 th Street	50'	<ul style="list-style-type: none"> 3-lane with bike lanes both sides No sidewalk either side No parking
25 th Street to Main Ave SE	56'	<ul style="list-style-type: none"> 4-lane (3 EB, 1 WB) No sidewalk either side No parking

Note: Widths are from face of curb to face of curb.

3.6 Pavement Condition

The following sections summarize the existing pavement condition within the 12th Avenue South study corridor. The information provided is based on visual observation and construction history data.

↳ *River Drive to 9th Street*

The existing pavement in this segment is asphalt and is generally in average condition, with some below-average areas present at the 4th Street, 7th Street, 8th Street (US 75), and 9th Street intersections. Some cracking and patching is present, and some potholes have formed near 8th Street and 9th Street. The River Drive to 4th Street segment was last rehabbed and overlaid in 2006, while the 4th Street to 9th Street segment dates to the late 1980s/early 1990s.

↳ *9th Street to 20th Street*

The existing pavement in this segment is asphalt and dates to the mid-1990s. It is generally in average to below-average condition, with cracking (some large cracks) and patching present.

↳ *20th Street to Main Avenue SE*

The existing pavement in this segment is asphalt and was last overlaid in the late 1980s. It is generally in average to below-average condition, with an area in particularly rough shape around the BNSF RR tracks just east of 20th Street.

3.7 Right of Way

The existing right of way width, as measured from the centerline of 12th Avenue South, varies throughout the corridor, as shown below in **Table 3.9**.

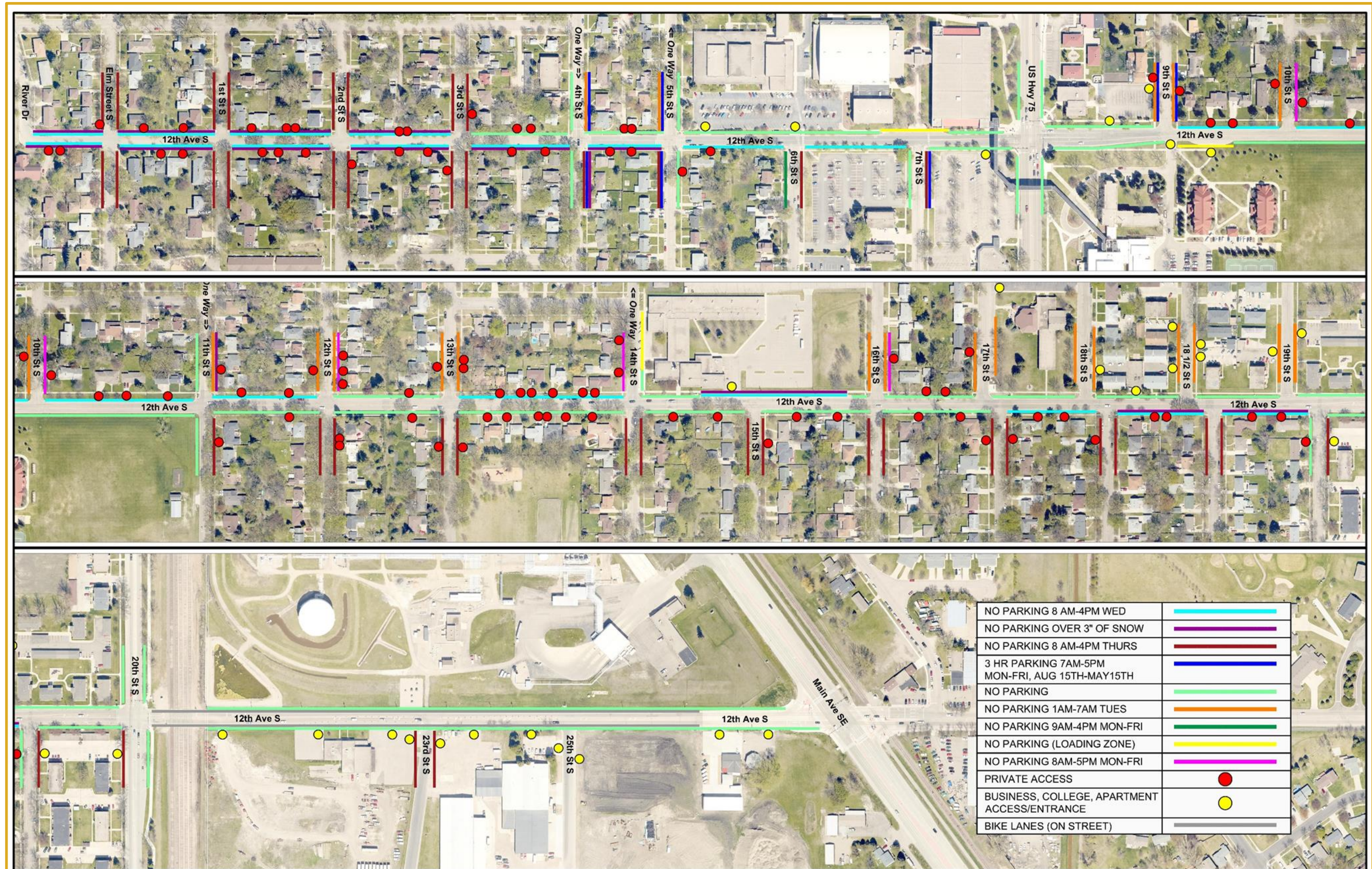
Table 3.9
Right of Way Width

Segment	North ROW Width (typical)	South ROW Width (typical)
River Drive to 8th Street	33'	33'
8th Street to 11th Street	40'	60'
11th Street to 17th Street	40'	40'
17th Street to 18th Street	40'	37.5'
18th Street to 20th Street	37.5'	37.5'
20th Street to Main Avenue SE	36'	36'

3.8 Access and Parking

There are several different parking conditions and restrictions in place along 12th Avenue South. **Figure 3.3** on the next page shows the areas where parking is allowed or not allowed, and the restrictions (if any) that are in place. The location and type of access points along the corridor are also shown on **Figure 3.3**.

Figure 3.3 | Access and Parking



3.9 Pedestrian and Bicycle Facilities

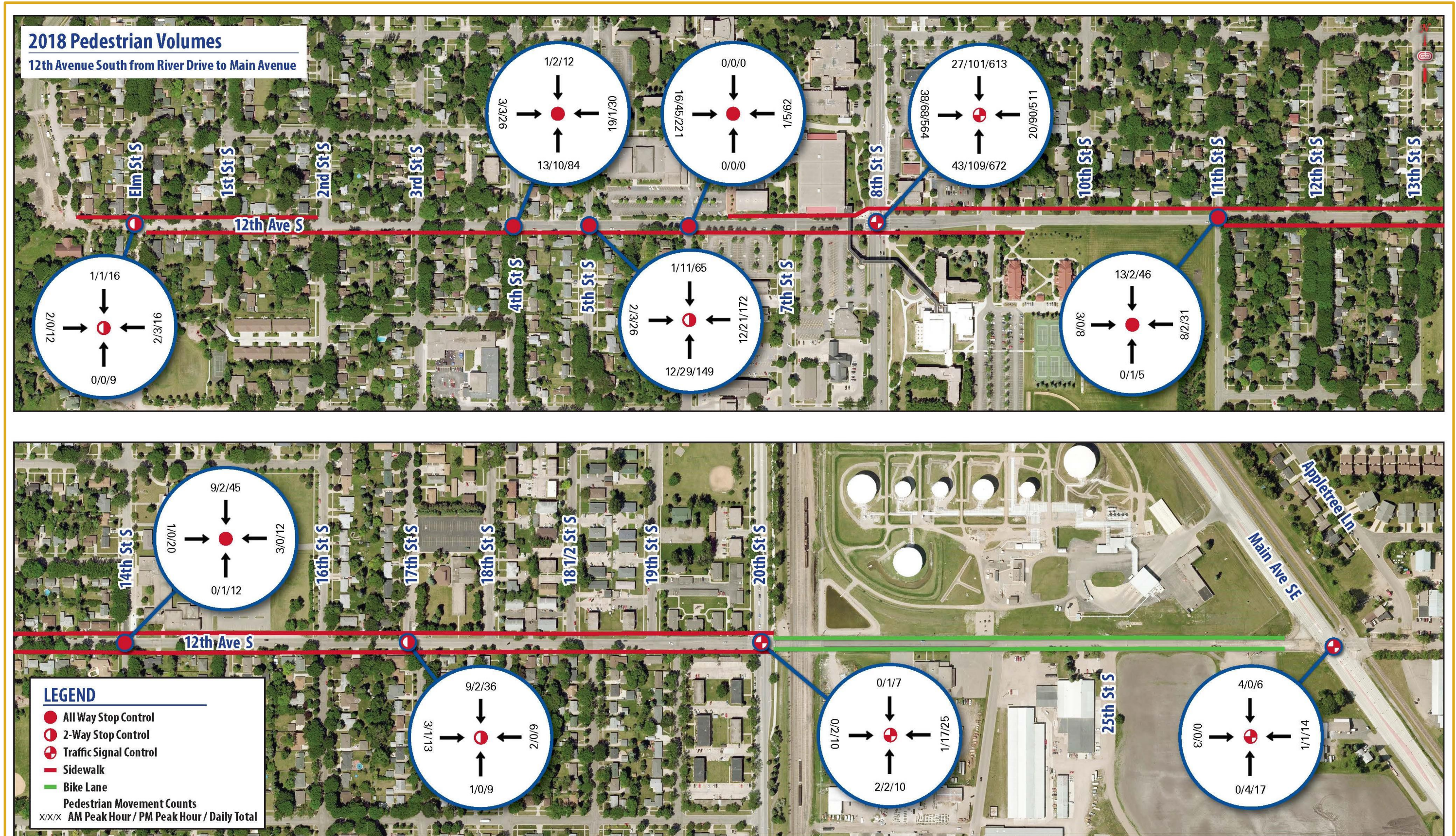
Figure 3.4 shows the existing sidewalk and bike lane facilities along the 12th Avenue South corridor. **Figure 3.5** on the next page shows the existing pedestrian volumes at each intersection for the AM Peak, PM Peak and Daily totals. The signals at the intersections with 8th Street S, 20th Street S and Main Avenue SE accommodate pedestrian crossings in each direction. In addition, throughout the corridor there are either signed or painted crosswalks at the following locations:

- 3rd Street S – signed crosswalk
- 4th Street S – painted crosswalk
- 5th Street S – painted crosswalk
- 6th Street S – signed crosswalk
- 7th Street S – signed and painted crosswalk

Figure 3.4 | Sidewalks and Bike Lanes



Figure 3.5 | 2018 Pedestrian Volumes



3.10 Lighting

Lighting along the 12th Avenue South corridor is summarized as follows:

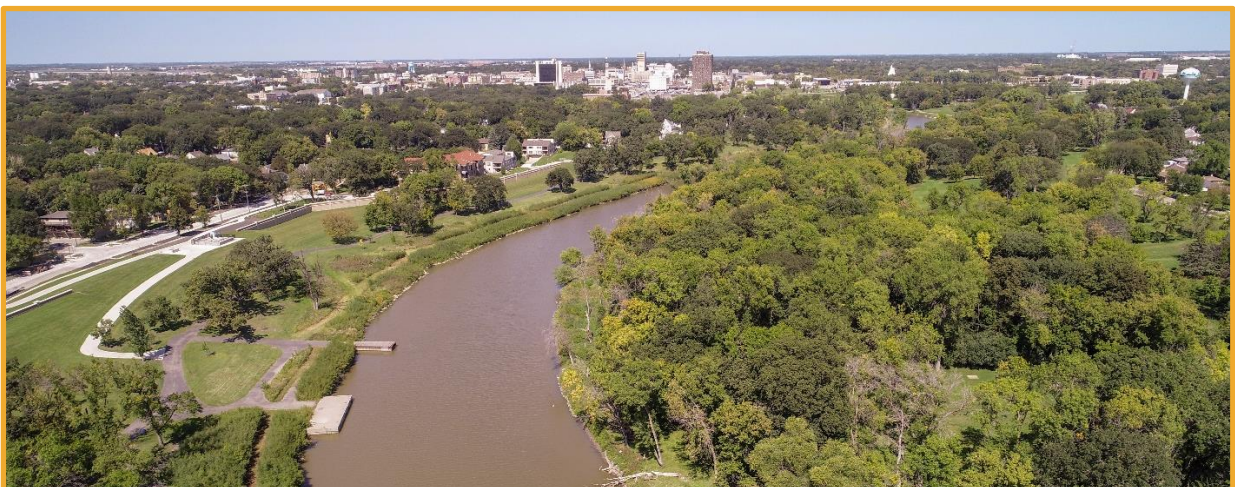
- **River Drive to 6th Street** | Street lights are present on the north side of the roadway at each intersection, attached to utility poles.
- **6th Street to 9th Street** | Traveling through the Concordia College campus area, street lighting is present, occasionally on both sides of the street, and smaller sidewalk/path lighting are also present.
- **9th Street to 20th Street** | Street lights are present on the north side of the roadway at each intersection, attached to utility poles, with the occasional light in between intersections.
- **20th Street to Main Avenue SE** | Street lights are present on the north side of the roadway at periodic spacing, attached to utility poles.

3.11 Drainage/Storm Sewer

The storm sewer facilities within the corridor can be summarized as follows:

- **River Drive to 1st Street** | runoff is collected and drains west along 12th Avenue South to an outfall to the Red River.
- **2nd Street to 6th Street** | runoff is collected and drains west to the alley between 2nd and 3rd Street, where it drains south to 16th Avenue South and then west to an outfall to the Red River.
- **7th Street to 8th Street** | runoff is collected and drains west along 12th Avenue South to 7th Street, then south to 14th Avenue South, then west to the alley between 2nd and 3rd Street, where it drains south to 16th Avenue South and then west to an outfall to the Red River.
- **9th Street to 14th Street** | runoff is collected and drains north along 10th Street, eventually working its way to the Red River.
- **15th Street to 20th Street** | runoff is collected and drains south along 16th Street, then west along 13th Avenue South, then south on 13th Street, then west along 16th Avenue South to an outfall to the Red River.
- **20th Street to Main Avenue SE** | runoff is collected and drains south along 25th Street and is discharged through a pumping station into Ditch 47, eventually working its way to the Red River.

Drainage Eventually Works its Way to the Red River



3.12 Utilities

3.12.1 SANITARY SEWER

The City sanitary sewer facilities within the corridor can be summarized as follows:

- **River Drive to 8th Street** | Sanitary sewer lines run along 12th Avenue South from River Drive to 2nd Street and from 5th Street to 8th Street, in the center of the roadway. Sanitary sewer crossings of 12th Avenue South are present at each intersection. Material is primarily vitrified clay pipe (VCP) with sizes ranging from 8 to 12 inches. A 15 inch PVC pipe crosses at 2nd Street.
- **8th Street to 15th Street** | Sanitary sewer lines run along 12th Avenue South from 9th Street to 11th Street on the north side of the roadway, and from 11th Street to 15th Street in the center of the roadway. Sanitary sewer crossings of 12th Avenue South are present at the 10th, 11th, 12th, 14th, and 15th Street intersections. Material is VCP with sizes ranging from 8 to 12 inches.
- **15th Street to Main Avenue SE** | East of 15th Street, there are no sanitary sewer lines that either run along or cross 12th Avenue South.

3.12.2 WATERMAIN

The watermain facilities within the corridor can be summarized as follows:

- **River Drive to 8th Street** | Water lines run along 12th Avenue South from River Drive to 2nd Street, on the north side of the roadway. Water line crossings of 12th Avenue South are present at each intersection except 7th and 8th Street. Material is a mix of cast iron pipe (CIP) and PVC pipe, with sizes ranging from 6 to 8 inches.
- **8th Street to 15th Street** | Water lines run along 12th Avenue South from 8th Street to 20th Street on the north side of the roadway. Water line crossings of 12th Avenue South are present at all intersections. Material is a mix of CIP and PVC pipe, with sizes ranging from 6 to 12 inches. There is a 12 inch asbestos cement pipe (ACP) that crosses at 20th Street.
- **20th Street to Main Avenue SE** | A 6 inch CIP water line (20th to 25th Street) and a 12 inch PVC water line (25th Street to Main Avenue SE) run along 12th Avenue South on the south side of the roadway. Lines of various size and type cross at the side streets.

3.12.3 OTHER PUBLIC AND PRIVATE UTILITIES

Several overhead and underground public and private utilities are present within the corridor, as summarized below. The information provided is based on visual observation and available data.

- **Overhead facilities** | Moorhead Public Service (MPS) operates overhead power lines that run along the north right of way line through virtually the entire 12th Avenue South corridor, from Elm Street to Main Avenue SE. There are also numerous overhead service line crossings from this main line across to the south side of the roadway.
- **Underground facilities** | Several types of underground utilities are known to exist within the corridor. Exact location, ownership, and type of these facilities is undetermined. Some of the underground facilities believed to be present include:
 - Electric lines (MPS, BNSF, OTVR, Concordia College)
 - Gas lines (Xcel Energy)
 - Cable and/or fiber optic lines (Midcontinent Communications, Cable One, 702 Communications)

3.13 Railroad Crossings

Two railroad lines cross 12th Avenue South within the study corridor area:

- ↳ **BNSF Railway (BNSF)**
 - 5-track crossing located just east of 20th Street intersection
 - USDOT Crossing No. 062576Y

- ↳ **Otter Tail Valley Railroad (OTVR)** – This crossing is just east of the Main Avenue SE intersection but is within the functional area of the intersection.
 - 1-track crossing located just east of Main Avenue SE intersection
 - USDOT Crossing No. 080725V

Both crossings are signalized and gated. Photos of each crossing can be found below.

There have been no accidents at either of these crossings since 1990, according to the data provided on the Federal Railroad Administration’s database.

BNSF RR Crossing east of 20th Street



OTVR RR Crossing east of Main Avenue SE



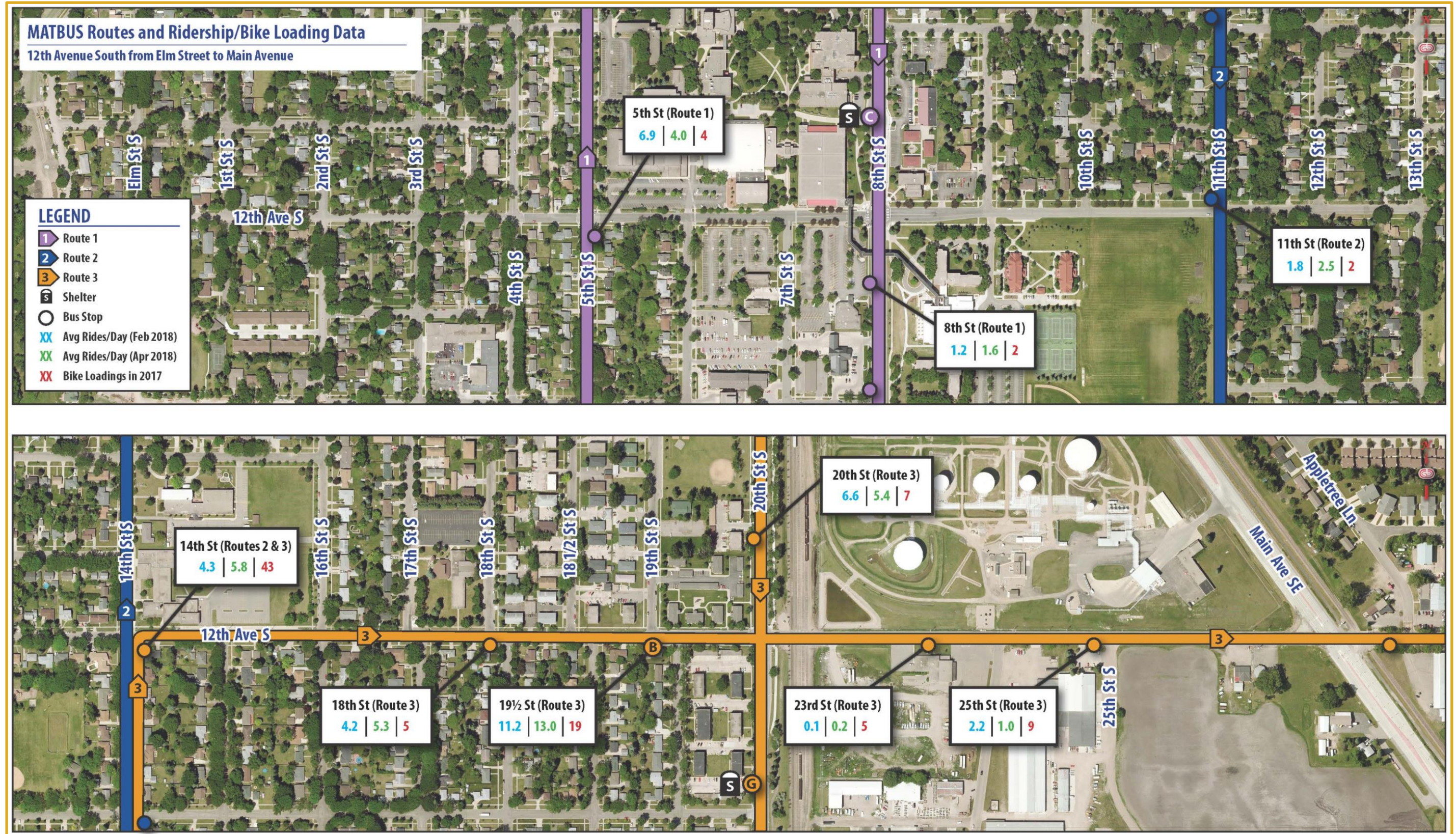
3.14 Transit

MATBUS operates three routes in Moorhead that travel either along or across the 12th Avenue South corridor. **Figure 3.6** shows the routes and designated bus stops, and also lists February 2018 and April 2018 monthly ridership data for certain stops along the routes, as well as bike loading data for the entire year of 2017.

- Route 1 – Crosses 12th Avenue South at the 5th Street and 8th Street intersections.
- Route 2 – Crosses 12th Avenue South at the 11th Street and 14th Street intersections.
- Route 3 – Travels along 12th Avenue South from 14th Street to Main Avenue SE, and also crosses at 20th Street.



Figure 3.6 | MATBUS Routes and Ridership/Bike Loading Data



3.15 Trees and Landscaping

The Street Tree Review is intended to be used as a resource while planning for improvements during the 12th Ave. South corridor study and help determine proposed corridor improvement impacts on the existing street trees. This review is not a recommendation for street tree removals.

Impacts on existing street trees should be carefully evaluated before recommending removals. The City Forester and community should be an integral part of those discussions. Community “ownership” of existing trees is common and often a very sensitive issue to adjacent property owners and the neighborhood.

The Forestry Department for the City of Moorhead has maintained and nurtured these trees to become an aesthetic, safe, integral and valued part of the existing corridor. Although some trees may be identified as ‘not the best tree’ for certain locations as we review these trees today, the site conditions, technology, knowledge and practices may not have been the same as when they were installed. For example, the City Forester is tasked with caring for very large trees beneath powerlines and trees with existing/upcoming problematic disease or pest issues. These trees may have originally been selected out of economy or from much more limited availability. Trees were also selected during times when particular diseases and/or pest issues were not in evidence as they are today.

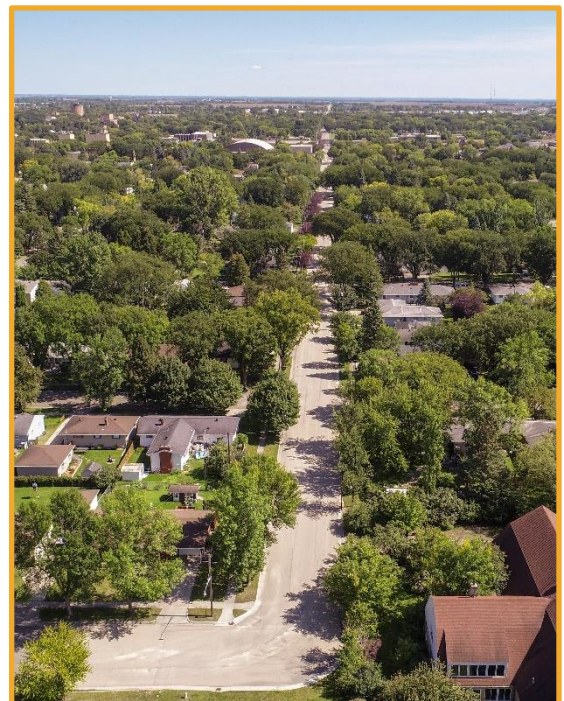
The 12th Avenue South corridor contains existing street trees of the following species:

- American Elm (58)
- Linden (8)
- Lilac Tree (2)
- Chokecherry (34)
- Maple (7)
- Pear (2)
- Crabapple (28)
- Hedges (7)
- Apple (1)
- Ash (26)
- Coffeetree (3)
- Hackberry (1)
- Amur Chokecherry (9)
- Hawthorn (2)

The corridor is dominated by large mature American Elm, Chokecherry, Crabapple, Green Ash, with lesser amounts of Amur Chokecherry, Linden and Maple and others.

The American Elm, Green Ash, Linden and Maple generally appear to be in good condition. Several of these large trees located beneath power lines, appear to be healthy, but have been topped to clear the powerlines. Topping increases the potential for disease by opening wounds, increases the maintenance and impacts the aesthetics.

The Chokecherry, Crabapple and Amur Chokecherry are at or past maturity. These trees are showing evidence of decline and or other health issues. Amur Chokecherry have large trunks, with several trunks/branches that appear to be splitting. Trunk rot is suspected. The Chokecherry are large and appear in generally good shape, but have the fungal disease ‘Black Knot’ in vary degrees from a few to numerous branches. Maintenance of the fungal disease is by frequent pruning, before the disease has a chance to enter main branches or the trunk. The Chokecherry



3.0 EXISTING CONDITIONS

trees located beneath power lines, have been topped, which increases the maintenance and impacts the aesthetics.

Physical constraints on the existing street trees that are affecting the overall condition and evaluation of the trees include the width of the boulevard and overhead power lines. There are trees that are of large size with flare roots grown to the curb and are also lifting adjacent sidewalks. Overhead power lines have required the ‘topping’ of trees to keep branches from interfering with the lines.

Table 3.10 and **Figure 3.7** show a summary of the existing street tree conditions and locations.

The following is a summary of the existing street trees. The summary indicates the street trees as in Condition 1, 2 or 3.

- **Condition 1:** Street Trees that appear healthy and are appropriate size/species for the location.
- **Condition 2:** Street Trees that appear in reasonably good health but may have one or more existing or potential negative issues.
- **Condition 3:** Street Trees that may be inappropriate for the location based on size/species, have evidence of disease, condition issues or already high-maintenance.

Table 3.10
Existing Tree Condition

Species	No. of Trees	Condition			Notes
		1	2	3	
American Elm	58	40	3	15	<ul style="list-style-type: none"> • Cond. 2 - Trees are lifting sidewalks and/or curbs. • Cond. 3 - Trees are beneath powerlines and have been topped.
Chokecherry	34	0	1	33	<ul style="list-style-type: none"> • Cond. 2 - Potential for fungal disease. • Cond. 3- Numerous topping and evident fungal disease.
Crabapple	28	6	5	17	<ul style="list-style-type: none"> • Cond. 2 - Some die-back, size issues for boulevard. • Cond. 3 - Significant trunk/branch issues, size issues.
Ash	26	0	25	1	<ul style="list-style-type: none"> • Cond. 2 - Future potential for Emerald Ash Borer. • Cond 3. – Tree topped.
Amur Chokecherry	9	0	0	9	<ul style="list-style-type: none"> • Cond. 3 - Trees are past maturity with stem/branch issues.
Linden	8	7	0	1	<ul style="list-style-type: none"> • Cond. 3 - Tree is suckering, which may be sign of health issues.
Maple	7	7	0	0	
Hedges	7	0	7	0	<ul style="list-style-type: none"> • Cond. 2 - Hedges are acting as buffers.
Coffeetree	3	3	0	0	
Hawthorn	2	2	0	0	
Lilac	2	2	0	0	
Pear	2	2	0	0	
Apple	1	0	0	1	<ul style="list-style-type: none"> • Cond. 3 - Inappropriate species for street tree.
Hackberry	1	1	0	0	

Figure 3.7 | Existing Tree Locations and Conditions (1 of 2)

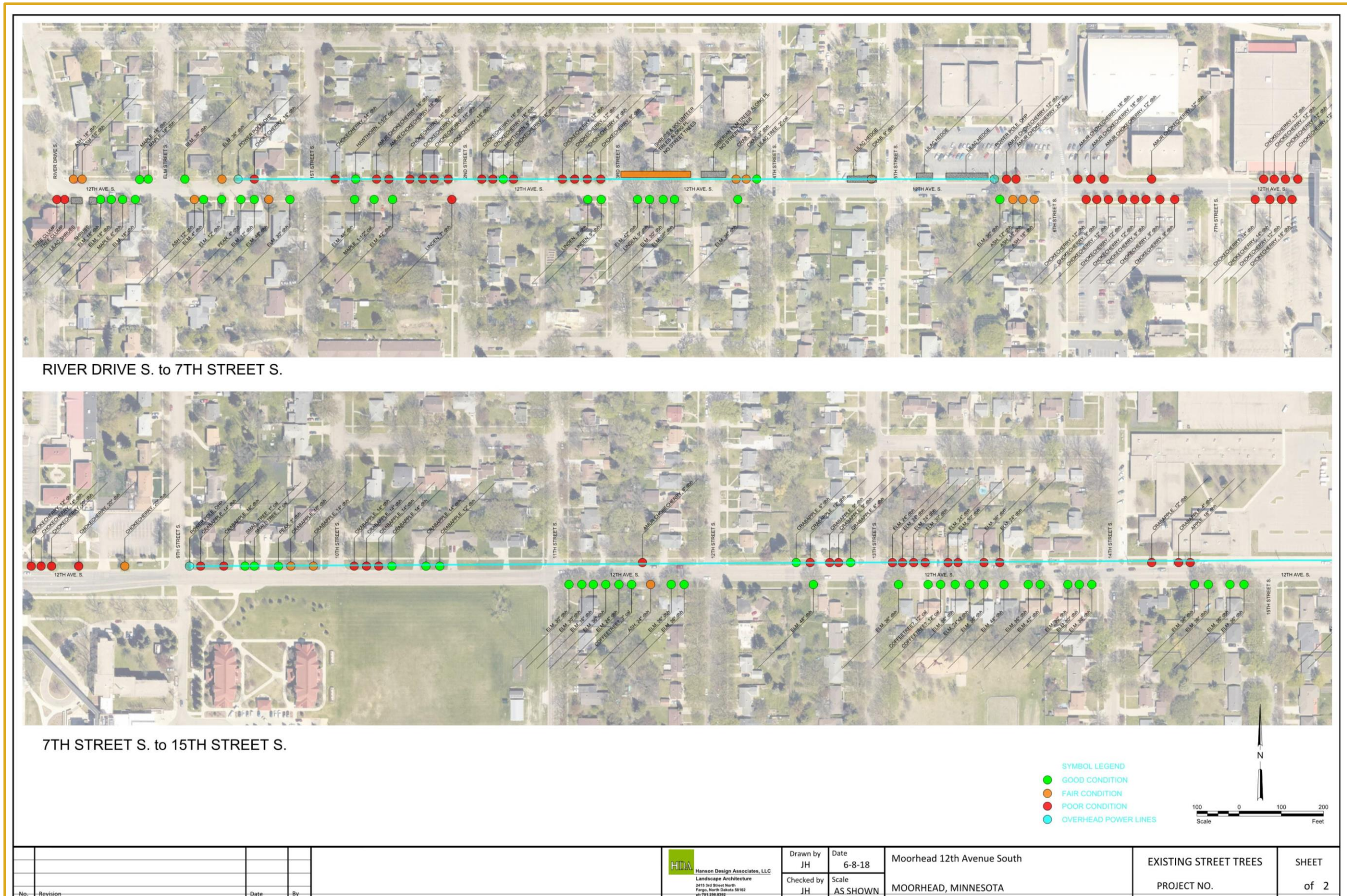
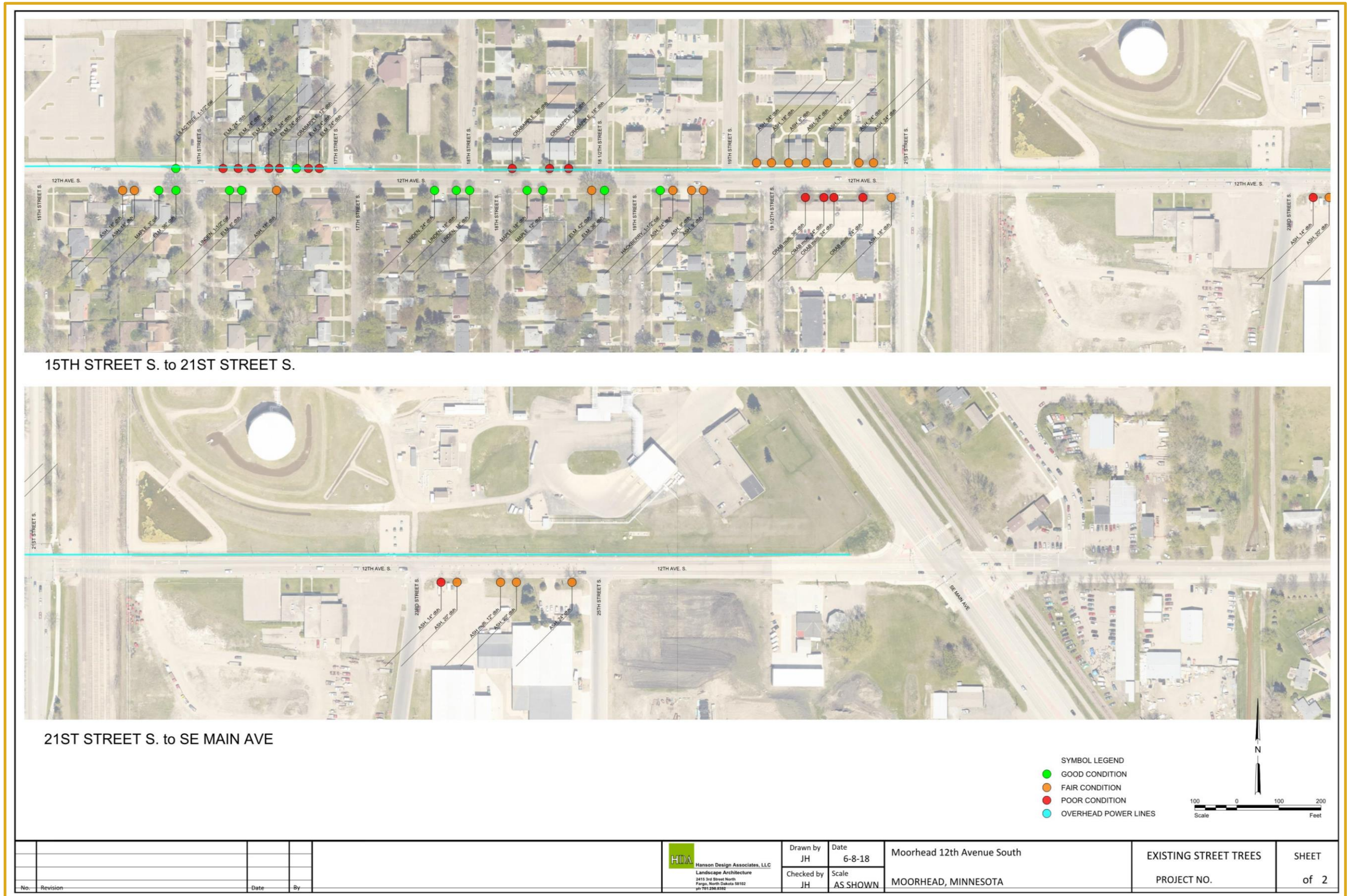


Figure 3.7 | Existing Tree Locations and Conditions (2 of 2)



4.0 FUTURE 2040 NO BUILD CONDITIONS

4.1 Future 2040 No Build Conditions

2040 was chosen as the analysis year so that analysis from this study will be consistent with regional planning. Future 2040 Annual Average Daily Traffic (AADT) were obtained from the Fargo-Moorhead 2040 Long Range Transportation Plan and can be found in **Table 4.1**. Table 4.1 also displays the planning level capacities and shows that the existing roadway sections today have adequate capacity to handle the 2040 projected volumes. Supporting data for the traffic analysis can be found in **Appendix E**.

Table 4.1
2015 and 2040 AADT and Capacity Analysis

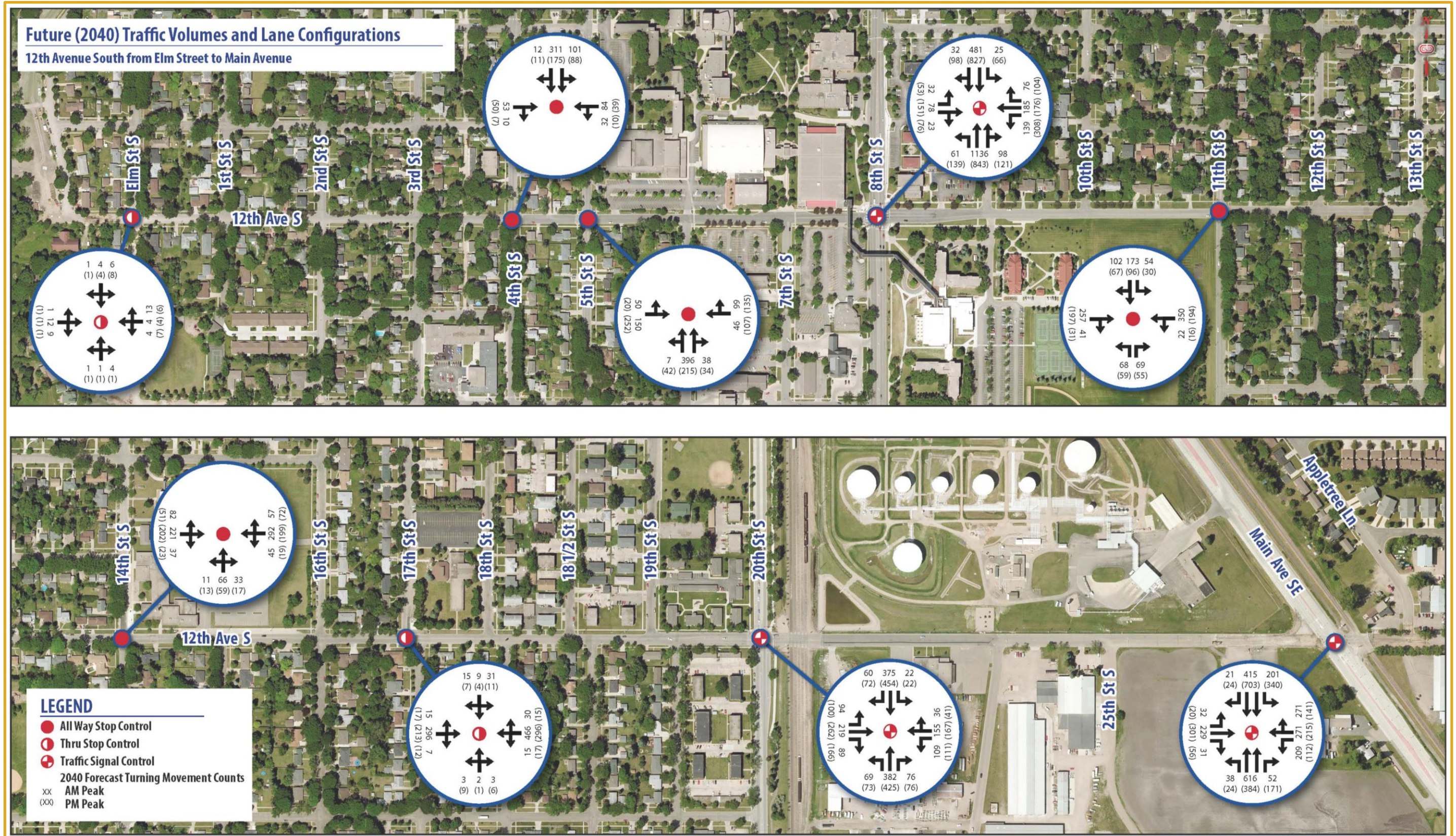
Segment	Existing Roadway Type	Section Capacity ¹	AADT			
			Existing 2015	Forecast 2040	Additional Capacity 2015 ²	Additional Capacity 2040 ²
Elm Street to 4th Street S	Two-Lane Undivided	10,000	3,100	4,700	6,900	5,300
4th Street S to 5th Street S	Two-Lane Undivided	10,000	3,100	4,700	6,900	5,300
5th Street S to 8th Street S	Two-Lane Undivided	10,000	5,200	4,900	4,800	5,100
8th Street S to 11th Street S	Two-Lane Undivided	10,000	7,000	9,700	3,000	300
11th Street S to 14th Street S	Two-Lane Undivided	10,000	5,750	9,500	4,250	500
14th Street S to 17th Street S	Two-Lane Undivided	10,000	4,700	8,700	5,300	1,300
17th Street S to 20th Street S	Two-Lane Undivided	10,000	3,900	9,200	6,100	800
20th Street S to Main Ave SE	Three-Lane	18,000	4,900	9,000	13,100	9,000
Main Ave SE to Ridgeway St	Three-Lane	18,000	4,800	10,600	13,200	7,400

¹ Planning level capacities are highly dependent on assumptions used such as access spacing, peak hour percent, directional distribution, saturation flow rates, etc. Values should not be used for operational analysis or final design.

² Positive numbers indicate that additional capacity is available. Negative numbers indicate over capacity.

Using the 2015 and 2040 AADT volumes from the Fargo-Moorhead Metro COG an annual growth rate was calculated for each section of the corridor and the cross streets. This growth rate was applied to the 2018 existing turning movement counts to determine the future 2040 turning movement counts. **Figure 4.1** on the next page displays the 2040 projected AM and PM turning movement counts and existing lane configuration for the intersections along the corridor.

Figure 4.1 | 2040 Traffic Volumes



4.2 Future 2040 No Build Conditions Operational Analysis

Methodology for operational and queuing analysis was the same as that described in *Technical Memorandum #1 – Existing Conditions*. The geometric characteristics for the 2040 No Build models are the same as the 2018 Existing Conditions. Updated, projected 2040 turning movement volumes were input and model optimizations were completed for signal timings.

Table 4.2 displays a summary of 2040 AM and PM peak hour intersection delay by approach and intersection, as well as their respective Level of Service (LOS). The reported delays for approach and intersections were taken from SimTraffic and is based on the average of five 60-minute simulation runs. LOS E is highlighted in yellow and LOS F is highlighted in red. Note that intersection LOS is not defined by the Highway Capacity Manual (HCM) for thru-stop control intersections. This is because the minor approaches with relatively low percentages of overall traffic could experience excessive delay, while the mainline could experience little or no delay. The result likely would be low overall intersection delay, which on its face would indicate acceptable operations, when individual stop-controlled movements could be failing.

In the **2040 AM peak hour**, all intersections operate with a LOS C or higher.

In the **2040 PM peak hour**, the intersection with 12th Avenue and 8th Street operates at an overall LOS D with the eastbound movements operating at a LOS F. All other intersections operate at a LOS C or higher.

Table 4.2
2040 No Build AM and PM Intersection Delay and LOS

Intersection			AM Peak Hour				PM Peak Hour			
Control	Location	Approach	LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)		LOS by Approach (Sec/Veh)		LOS by Intersection (Sec/Veh)	
			Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
Thru-stop	Elm Street	NB	4	A	2	N/A ²	6	A	2	N/A ²
		WB	2	A			2	A		
		SB	5	A			4	A		
		EB	0	A			0	A		
All-Way	4th Street S	NB	-	-	7	A	-	-	5	A
		WB	6	A			4	A		
		SB	7	A			6	A		
		EB	6	A			6	A		
All-Way	5th Street S	NB	7	A	6	A	7	A	7	A
		WB	4	A			5	A		
		SB	-	-			-	-		
		EB	7	A			9	A		
Signalized	8th Street S	NB	19	B	17	B	32	C	42	D
		WB	18	B			39	D		
		SB	12	B			31	C		
		EB	20	C			126	F		
All-Way	11th Street S	NB	5	A	10	A	5	A	7	A
		WB	12	B			10	A		
		SB	9	A			6	A		
		EB	9	A			7	A		
All-Way	14th Street S	NB	6	A	8	A	6	A	8	A
		WB	8	A			8	A		
		SB	-	-			-	-		
		EB	8	A			8	A		
Thru-Stop	17th Street S	NB	8	A	3	N/A ²	5	A	3	N/A ²
		WB	2	A			3	A		
		SB	9	A			6	A		
		EB	2	A			3	A		
Signalized	20th Street S	NB	15	B	19	B	16	B	22	C
		WB	25	C			30	C		
		SB	19	B			22	C		
		EB	19	B			22	C		
Signalized	Main	NB	24	C	23	C	20	B	22	C
		WB	23	C			21	C		
		SB	17	B			20	B		
		EB	31	C			32	C		

¹ Delay for all movements taken from SimTraffic reports.

² LOS is undefined for two-way stop control intersections

4.3 Future 2040 No Build Conditions Queuing Analysis

Tables 4.3 and 4.4 display storage lengths, average queue lengths, and 95th percentile queue lengths for the 2040 AM and PM Peak Hours, respectively. Queue lengths were taken from SimTraffic output. Red shading indicates average or 95th percentile queue lengths that exceed the available storage length.

Based on the queuing analysis methodology identified in Technical Memorandum # 1 where if the following criteria are met then “queuing issues” are identified:

- Condition 1: 95th percentile queue length exceeds storage length and the movements operate at LOS E or LOS F
- Condition 2: Average queue length exceeds storage length
- Condition 3: 95th percentile queue length blocks upstream full access intersection

And at a stop-controlled intersection if the following was met:

- Condition 4: 95th percentile queue length exceeds 500 feet on a stop-controlled approach

Based on the above criteria there are no intersections that experience queuing issues in the **2040 AM Peak hour**.

The following intersections experienced queuing issues in the **2040 PM Peak hour**:

- 8th Street S: Eastbound thru lane meets Condition 1 and Condition 2; and Eastbound left lane meets Condition 1.

12th Avenue and 20th Street Intersection



Table 4.3
2040 No Build AM Queuing Summary

Scenario		2040								
		No Build								
Intersection	Appr	Storage (ft)			Average Queue (ft) ¹			95th % Queue (ft) ¹		
		LT	TH	RT	LT	TH	RT	LT	TH	RT
Elm Street S (Thru-Stop)	EB	-	225	-	-	0	-	-	0	-
	WB	-	310	-	-	0	-	-	0	-
	NB	-	690	-	-	4	-	-	22	-
	SB	-	330	-	-	10	-	-	34	-
4th Street S (All-Way Stop)	EB	-	340	-	-	29	-	-	52	-
	WB	-	250	-	-	37	-	-	62	-
	NB	-	-	-	-	-	-	-	-	-
	SB	340	-	340	55	-	31	80	-	50
5th Street S (All-Way Stop)	EB	-	250	-	-	44	-	-	73	-
	WB	-	350	-	-	42	-	-	70	-
	NB	690	-	690	53	-	38	78	-	65
	SB	-	-	-	-	-	-	-	-	-
8th Street S (Signalized)	EB	130	315	-	23	55	-	58	104	-
	WB	160	390	160	67	76	45	115	133	92
	NB	130	710	710	50	215	189	130	355	330
	SB	120	670	670	20	85	50	56	146	113
11th Street S (All-Way Stop)	EB	-	530	-	-	62	-	-	97	-
	WB	-	340	-	-	72	-	-	114	-
	NB	645	-	645	29	-	32	53	-	50
	SB	650	-	650	27	-	64	49	-	100
14th Street S (All-Way Stop)	EB	-	545	-	-	52	-	-	75	-
	WB	-	350	-	-	72	-	-	109	-
	NB	-	645	-	-	37	-	-	56	-
	SB	-	-	-	-	-	-	-	-	-
17th Street S (Thru-Stop)	EB	-	315	-	-	8	-	-	36	-
	WB	-	240	-	-	5	-	-	26	-
	NB	-	645	-	-	8	-	-	30	-
	SB	-	1045	-	-	28	-	-	54	-
20th Street S (Signalized)	EB	170	300	170	51	91	28	108	169	80
	WB	180	885	-	59	86	-	114	158	-
	NB	200	645	200	35	119	18	69	207	54
	SB	220	1450	175	22	155	30	96	250	92
Main Avenue SE (Signalized)	EB	130	800	130	21	120	21	71	217	90
	WB	220	220	220	111	120	62	200	223	140
	NB	180	1250	500	15	155	102	48	232	199
	SB	240	530	500	67	84	52	121	147	108

¹ Queue for the movements taken from SimTraffic reports (60 min run)

**Table 4.4
2040 No Build PM Queuing Summary**

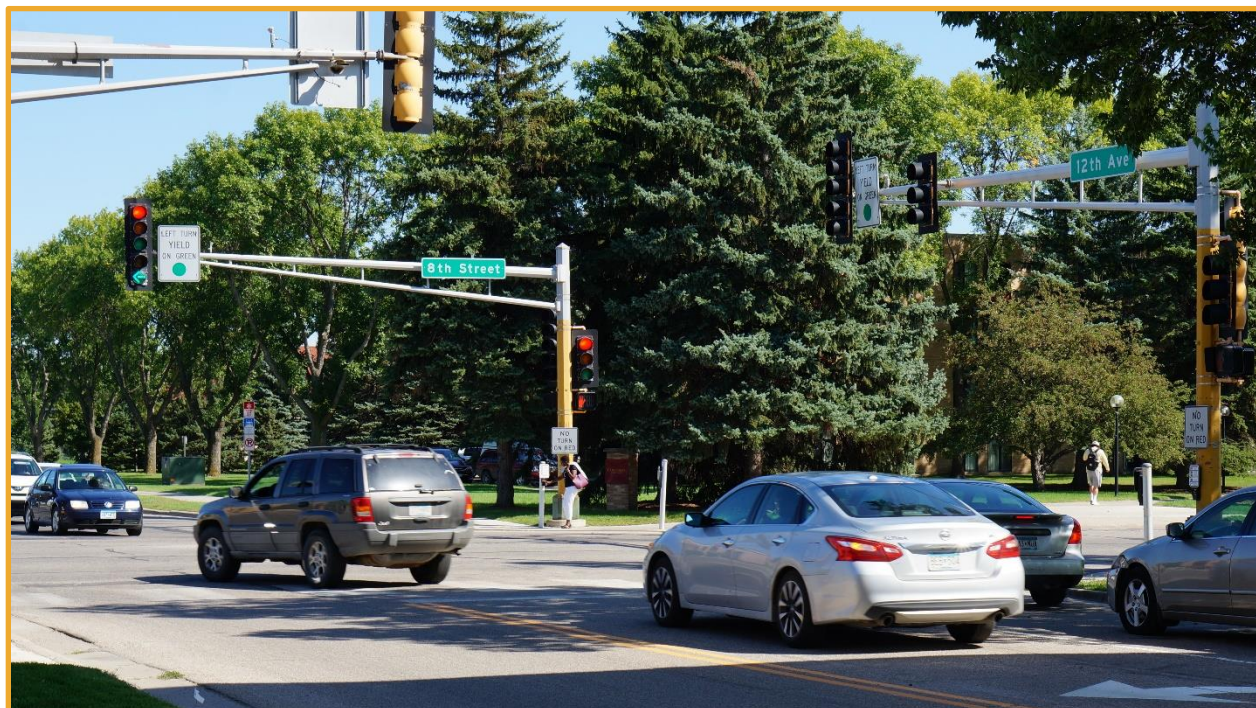
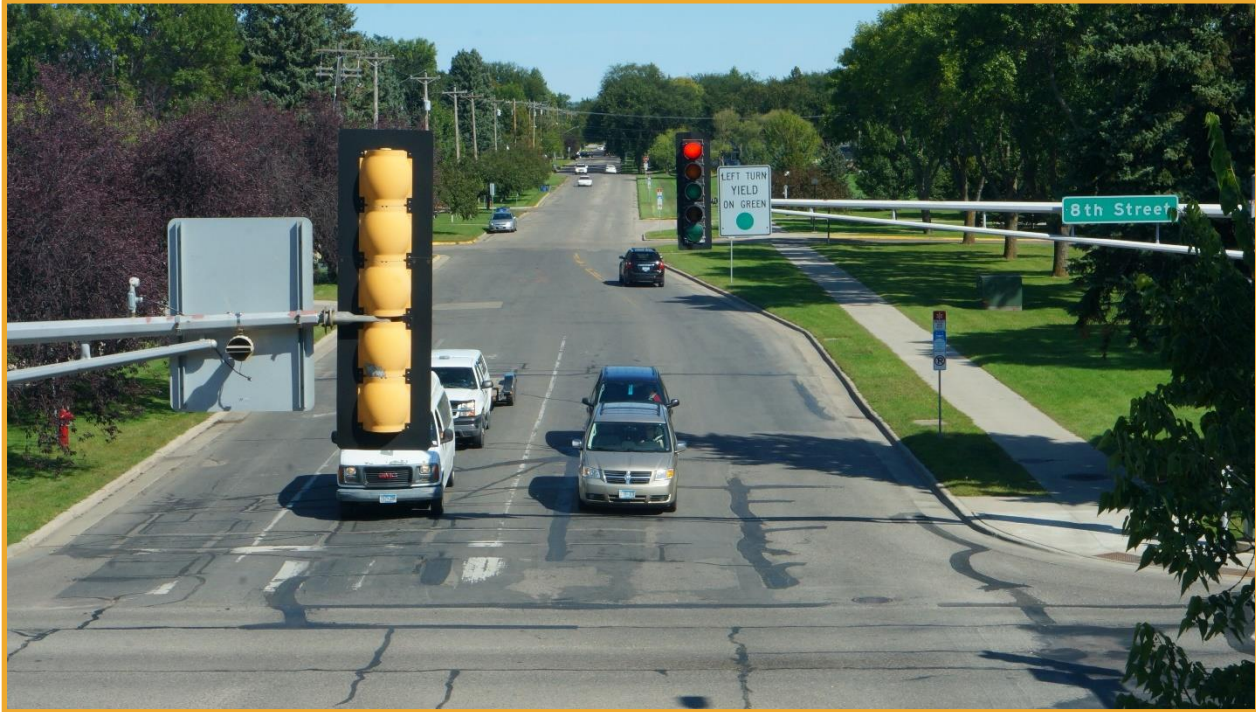
Scenario		2040								
		No Build								
Intersection	Appr	Storage (ft)			Average Queue (ft) ¹			95th % Queue (ft) ¹		
		LT	TH	RT	LT	TH	RT	LT	TH	RT
Elm Street S (Thru-Stop)	EB	-	225	-	-	0	-	-	0	-
	WB	-	310	-	-	0	-	-	0	-
	NB	-	690	-	-	2	-	-	14	-
	SB	-	330	-	-	10	-	-	33	-
4th Street S (All-Way Stop)	EB	-	340	-	-	28	-	-	50	-
	WB	-	250	-	-	26	-	-	48	-
	NB	-	-	-	-	-	-	-	-	-
	SB	340	-	340	49	-	22	74	-	46
5th Street S (All-Way Stop)	EB	-	250	-	-	59	-	-	104	-
	WB	-	350	-	-	56	-	-	86	-
	NB	690	-	690	46	-	30	70	-	57
	SB	-	-	-	-	-	-	-	-	-
8th Street S (Signalized)	EB	130	315	-	73	318	-	176	749	-
	WB	160	390	160	150	185	63	212	455	133
	NB	130	710	710	119	241	226	189	378	352
	SB	120	670	670	69	215	198	155	325	303
11th Street S (All-Way Stop)	EB	-	530	-	-	54	-	-	87	-
	WB	-	340	-	-	50	-	-	74	-
	NB	645	-	645	29	-	28	53	-	51
	SB	650	-	650	21	-	43	46	-	68
14th Street S (All-Way Stop)	EB	-	545	-	-	46	-	-	71	-
	WB	-	350	-	-	63	-	-	96	-
	NB	-	645	-	-	33	-	-	51	-
	SB	-	-	-	-	-	-	-	-	-
17th Street S (Thru-Stop)	EB	-	315	-	-	5	-	-	26	-
	WB	-	240	-	-	7	-	-	38	-
	NB	-	645	-	-	11	-	-	36	-
	SB	-	1045	-	-	17	-	-	44	-
20th Street S (Signalized)	EB	170	300	170	55	117	54	109	221	134
	WB	180	885	-	63	101	-	122	188	-
	NB	200	645	200	39	144	24	98	256	89
	SB	220	1450	175	16	193	48	44	330	146
Main Avenue SE (Signalized)	EB	130	800	130	19	148	38	71	250	125
	WB	220	220	220	56	93	26	110	158	62
	NB	180	1250	500	7	119	65	24	183	142
	SB	240	530	500	132	126	104	233	274	220

¹ Queue for the movements taken from SimTraffic reports (60 min run)

4.4 Traffic Operations Conclusion

The 12th Avenue S corridor will be below planning level capacity thresholds for the Existing and Future No-Build conditions but will experience traffic operational failures for the eastbound movements at 8th Street S due to increased traffic volume and delay that will be generated by the year 2040.

12th Avenue S and 8th Street Intersection





5.0 ISSUE IDENTIFICATION AND NEEDS ASSESSMENT

Technical Memorandum #3 included the identification of issues along the 12th Avenue South corridor, and the development and analysis of a range of alternatives that address those issues. The Study Review Committee (SRC) participated in the development, review, evaluation, and refinement of these concepts throughout the study. Comments and input from the public were also considered during the process. The existing conditions and future no-build conditions were documented in Technical Memorandums 1 and 2.

Because the corridor is characterized by three unique segments 1) River Drive South to 8th Street South, 2) 8th Street South to 20th Street South, 3) 20th Street South to Main Avenue Southeast, most improvement alternatives have been grouped by segment. Each improvement is listed based on the primary need or issue being addressed, estimated cost, and impacts. The improvements which apply generally to the entire corridor are listed separately at the end under “corridor-wide improvements”

The following issues have been identified along the corridor based on factors including stakeholder input, public input, existing conditions, and the 2040 projected traffic volumes. The study review committee met on several occasions to discuss the existing conditions, public input received, and streetscaping. Public input was gathered through an open-house format meeting that included a formal presentation, as well as an online survey.

5.1 Traffic Operations and Roadway Geometrics

Of the nine intersections evaluated along the corridor, all provided an acceptable Level of Service (LOS) of D or above in the existing and future condition analysis except the 8th Street South intersection. Here, the eastbound traffic experienced queuing issues and operated at a LOS F in the future 2040 PM Peak hour.

The intersections at 11th Street South and 20th Street South could be improved to provide more desirable geometric features including horizontal or vertical alignment adjustments. At the intersection of 12th Avenue South and 11th Street South, 12th Avenue is offset 10 feet horizontally across the intersection. Moorhead City Code 11-5-7 prohibits intersection jogs with centerline jogs of less than 150 feet. There are several streets intersecting 12th Avenue South with a centerline jog, though the impacts of realigning those streets would be significant.

11th Street South Intersection, Facing East



At the 20th Street South intersection, there is a 3 foot vertical profile change between the intersection and the BNSF Railroad tracks 60 feet to the east. This vertical grade change combined with steep cross slopes can cause buses and other large vehicles stopped at the railroad tracks to lose traction and slide off the roadway in winter conditions.

The BNSF Railroad crossing east of 20th Street South should also be considered for quiet zone improvements. This location was evaluated in the City’s previous *Quiet Zone Study*. Future improvements should be reflective of the recommendations of that study, accounting for any changes in current conditions.

20th Street South Intersection, Facing North



5.2 Pedestrian and Bicycle Mobility

Providing a safe and connected system for pedestrians and bicycle users was a clear concern from the respondents to the online survey for public input. Nearly all respondents agreed that a continuous sidewalk on both sides of the roadway, or a continuous shared use path on one side of the roadway would be an enhancement to the corridor. Over half of the respondents also noted the need for an improved crossing at the BNSF Railroad tracks east of 20th Street South.

Most of the sidewalk curb ramps throughout the corridor do not meet current ADA design guidelines. There are also curb ramps that could be moved to improve crossing locations, and some that could be removed as there is no connecting ramp on the other side of the roadway.

Many Sidewalk Curb Ramps Do Not Meet Current ADA Guidelines or Do Not Align



A theme of the 2014 *Moorhead River Corridor Master Plan* is to support enhanced recreational opportunities for the Red River corridor through enhanced connectivity to the river. This need was further supported through public input gathered in the 2016 *FM Metropolitan Bicycle and Pedestrian Plan* with two of the most common comments received relating to “better connectivity” and “more bike lanes”. As a result, the study team prioritized a short-term project for bike facilities on 12th Avenue South between the Red River and 20th street.

5.3 Transit Facilities

The current MATBUS stop locations were evaluated for improvements. MATBUS considers shelters for locations meeting a variety of criteria including open areas, available parking, surrounding amenities, commercial/educational/government/medical facility areas, high density, low income, and high ridership areas. The stop at 19 ½ Street South has the highest ridership but is near private property and not a good candidate for a shelter. Many public input comments were received regarding the stop at 25th Street South. Although there is not currently high enough ridership to warrant a shelter at this location, other enhancements can provide better access and mobility at the stop.

MATBUS Riders Boarding Near 25th Street



5.4 Parking and Access Management

Current Moorhead City Code 11-5-7 states the desired number of full access points for a Minor Arterial is 4 per mile with up to 8 per mile under conditional situations, and up to 16 per mile within the urban core at the discretion of the City Engineer. There are 106 access points within the two-mile corridor study area of 12th Avenue South, many of them being a private driveway or garage access. The consolidation or elimination of access points reduces the number of conflict points between motor vehicles, pedestrians, and bicycles. While it is not realistic to expect significant changes to private driveway access points, parking lot access and bus parking areas within the corridor can be improved.

The 2012 Moorhead Neighborhood Parking Study indicated that most areas east of 8th Street South have less than 25% on-street parking utilization. Over 20% of the respondents to the online public input survey said

that less on-street parking would improve the safety of the corridor, while only one percent desired more parking.

5.5 Streetscaping and Trees

The City of Moorhead has been working to incorporate arts and culture into community development and improvement projects. While artwork may not be appropriate for all areas, consideration should be given to areas of opportunity including both new development and redevelopment of existing neighborhoods. Artwork can be part of a successful formula to transform areas considered industrial or blighted.

5.5.1 STREETSCAPING AND ART

In 2016, CenturyLink commissioned seven works of art through the CenturyLink Moorhead Box Art Project contest that invited creatives to submit original works of art with a technology theme to be selected to wrap a CenturyLink utility box. There are 3 CenturyLink Box Art locations on 12th Avenue South. Additional locations should be encouraged whenever opportunities arise. Traffic signal cabinets and other City owned equipment should be considered and would be supported by the City of Moorhead.

The 2015 Sidewalk Art and Poetry Project selected two poems, “Sugar Beet Baby” and “Dreams are Precious”, to stamp into the sidewalk at two locations within the study corridor. This should be considered for incorporation with improvement work on the corridor.

Sidewalk Poem Stamp



The industrial area from 20th Street South to Main Avenue Southeast is a good opportunity to incorporate landscape enhancements. An enhanced pedestrian, bicycle, and landscape linkage would create a safer and more aesthetic access. Public comments reinforce this concept as this section of the corridor could become a much-improved connection to residential areas east of Main Avenue Southeast.

5.5.2 CONCORDIA COLLEGE

The Concordia College Campus is a significant portion of the 12th Avenue Corridor Study area. Roadway improvements are an opportunity to enhance the campus visibility and pedestrian circulation across 12th Avenue South. This can be accomplished by incorporating campus site elements into the design of the corridor such as colored/stamped concrete sidewalks or crosswalks, light poles, monuments and signage, plantings, and artwork.

The 2010 Concordia College Campus Master Plan by EYP/Architecture Engineering P.C. includes features to enhance the visitor’s progression through campus and heighten the sense of campus aesthetics, and to ensure consistent visual imagery of Concordia College. Improvements identified along the 12th Avenue South corridor include:

- Primary Pedestrian Gateway Crossing at the intersection of 8th Street South
- Pedestrian Gateway & Crossway at 6th Street South and 7th Street South

- Campus Identification at 5th Street South and 11th Street South
- Vehicular Gateway to parking lots between 8th Street South and 9th Street South
- Landscape Improvement from 5th Street South to 11th Street South

Figure 5.1 | Concordia Master Plan at 12th Avenue South and 8th Street South



5.5. TREES

There is a very old willow tree that is a community landmark on the Concordia grounds located outside the right-of-way on the south side of 12th Avenue South just west of 11th Street South. The tree was likely planted sometime in the early 1950's.

The "Crazy Tree" is a Local Landmark



The very large, multi-trunk tree is very popular in the community because of its unusual form, size and age. The trunks are very large diameter and are laying in a nearly horizontal configuration that makes for a unique and interesting form. The tree is visited often, is popular for photography, and is frequently climbed on.

The tree is in a lawn area, with a low levee located directly to the southwest of the tree. There are soccer fields located further southwest. The tree was pruned in 2017 to remove dead wood.

There were several large trunks removed on the southwest side that were impacted from the installation of the levee in the early 2000's. The tree is probably in decline and additional impact to the surrounding area around the tree will likely speed up the decline. Further development in the area surrounding the tree should be minimized to preserve the tree. Foot traffic from visitors, as it currently occurs, creates a certain amount of soil compaction, which can be detrimental to the tree. Activity from equipment, changes to grades, and increases in visitation from pedestrians will further compact the soil surrounding the tree. Since the tree has always existed in lawn, the lawn should remain.

Concordia has expressed an interest in having a path or sidewalk that can be utilized by their equipment between 9th Street South and 11th Street South. The area on top of the levee would be a preferred location since this area has already been disturbed. If a path must be located within the right-of-way and continuous along 12th Avenue South, it should be located as far away from the tree as possible.

The City Forester indicated a preference to keeping all existing viable trees along the corridor. Results from the public input survey showed that over half of survey respondents noted that existing boulevard trees should be preserved, while many also agreed that new streetscape improvements such as landscaping, lighting, or special paving/artwork would enhance the corridor. Representatives from Concordia College expressed a preference for replacing all chokecherry trees along campus if possible.

A final issue that impacts not only trees, but also several other areas of need, is the presence of overhead power lines owned by Moorhead Public Service in the north boulevard along over 80% of the corridor. Existing trees require continual trimming to prevent limbs from damaging the lines. The location of the poles in the boulevard also limits the feasibility of any significant improvements or changes to the north side of 12th Avenue.

Overhead Power Lines are Strung through Mature Trees Along the 12th Avenue South Corridor



6.0 ALTERNATIVE DEVELOPMENT AND EVALUATION

Based on the 2040 projected traffic volumes, the existing lane configurations of the 12th Avenue South corridor meet the planning-level capacity requirements. As such, the future build alternatives assume that the existing lane configurations will be maintained, and the improvement alternatives developed for this study focus more on improving the specific issue/need areas addressed within each segment. The costs presented are planning level construction estimates and do not include engineering fees, right of way purchase, extensive utility relocations, or other unknown design details. Detailed cost estimates can be found in **Appendix F**.

6.1 River Drive South to 8th Street South

Table 6.1 Segment 1: River Drive South to 8 th Street South				
Improvement Alternative	Issue/Need Addressed	Estimated Cost	Impacts	SRC Recommendation
1A1: Install shared lane markings (Sharrows)	Bike Route Connectivity	\$7,500	Low: Pavement markings	Not Preferred
1A2: Replace existing south sidewalk with an 8' shared-use path from 5 th St to 8 th St and install Sharrows from River Dr to 5 th St Figure 6.1	Bike Route Connectivity	\$90,000	Medium: Right of way; 2 driveways; up to 16 existing trees	Preferred – Short Range
1B: Install 5' sidewalk on north side between 2 nd St and 6 th St Figure 6.1	Pedestrian Route Connectivity	\$110,000	High: Right of way, 8 driveways; up to 17 existing trees; overhead power lines and other private utilities	Not Preferred
1C: Close parking lot access points near 5 th St and 8 th St, and shift parking area near 7 th St Figure 6.1	Parking and Access Management	\$50,000	Medium: Reduced parking lot access/ increased access congestion; existing trees; private utilities	Preferred – Short Range
1D: Install curb bump-outs at 6 th St and 7 th St intersections Figure 6.1	Parking and Access Management	\$75,000	Medium: Reduced parking; pavement, curb, and sidewalk reconstruction	Preferred – Short Range
1E1: Reassign eastbound lanes at 8 th St intersection with a shared left/thru and a designated right by shifting curb Figure 6.1	Traffic Operations	\$185,000	Medium: Traffic signal revisions, signal controller/cabinet; pavement, curb, and sidewalk reconstruction; drainage	Preferred – Short Range
1E2: Widen 12 th Ave to install designated eastbound right turn lane at 8 th St. Figure 6.2	Traffic Operations	Dependent on Skyway Pier impacts	High: The widening would impact a pier for the Concordia Skyway. This pier would need to be relocated and the skyway may need to be redesigned. Impacts to the pier could be limited by installing a 50' turn lane with 30' taper.	Not Preferred

Figure 6.1 | River Drive to 8th Street

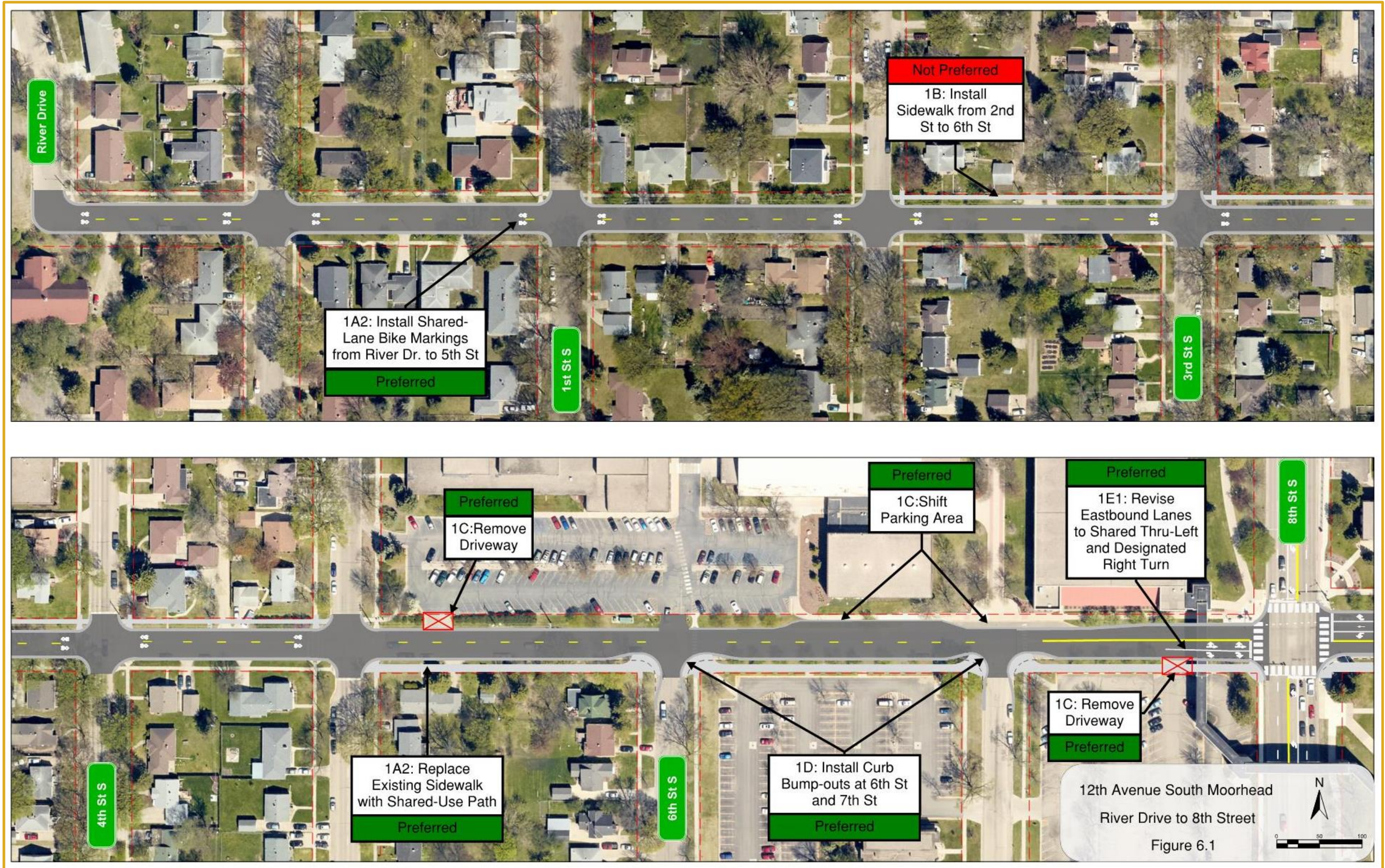
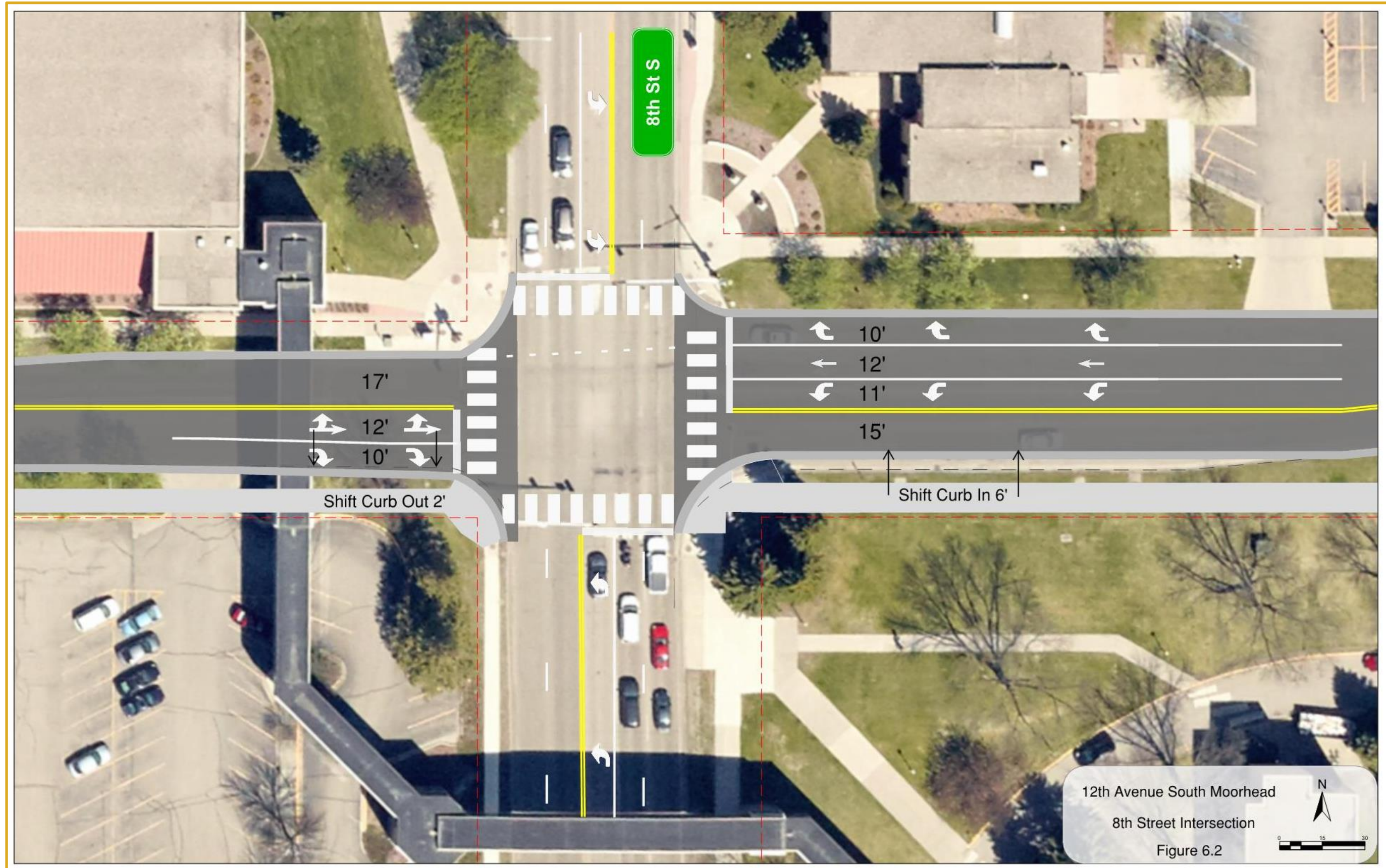


Figure 6.2 | 8th Street Intersection



6.2 8th Street South to 20th Street South

Table 6.2 Segment 2: 8 th Street South to 20 th Street South				
Improvement Alternative	Issue/Need Addressed	Estimated Cost	Impacts	SRC Recommendation
2A: Install 8' shared-use path on south side from 9 th St to 11 th St, staying south of the "Crazy Tree" Figure 6.3	Bike Route Connectivity	\$100,000	Low: Right of way; Concordia College property	Preferred – Short Range
2B1: Install shared lane markings (Sharrows)	Bike Route Connectivity	\$10,000	Low: Pavement markings	Not Preferred
2B2: Add 6' designated on-street bike lanes on each side of 12 th Ave Figure 6.3 & 6.4	Bike Route Connectivity	\$30,000	Medium: Pavement markings; signs; elimination of parking along 12 th Ave could place additional stress on side-street parking	Preferred – Short Range
2B3: Replace existing south sidewalk with an 8' shared-use path from 11 th St to 20 th St Figure 6.3 & 6.4	Bike Route Connectivity	\$305,000	High: Right of way, 20 driveways; up to 49 existing trees; private utilities	Not Preferred
2C: Install crosswalk at 19½ St Figure 6.4	Pedestrian Route Connectivity	\$5,000	Low: Pavement markings	Preferred – Short Range
2D: Remove parking area on south side near 9 th St realign approach into campus lots, remove driveway to parking lot Figure 6.3	Access Management	\$45,000	Low: Temporary access restrictions	Preferred – Short Range
2E: Realign 11 th St intersection to improve horizontal alignment Figure 6.3	Roadway Geometrics	\$150,000	High: Right of way; driveways; pavement; drainage; curb; existing trees; private utilities; drainage	Preferred – Short Range
2F: Construct grade raise of 20 th St intersection to improve vertical profile with BNSF RR Tracks Figure 6.4	Roadway Geometrics	\$1,250,000	High: Right of way; apartment driveway and parking lot; drainage; traffic signals; pavement; curb; sidewalks; existing trees; private utilities	Preferred – Long Range

Figure 6.3 | 8th Street to 13th Street

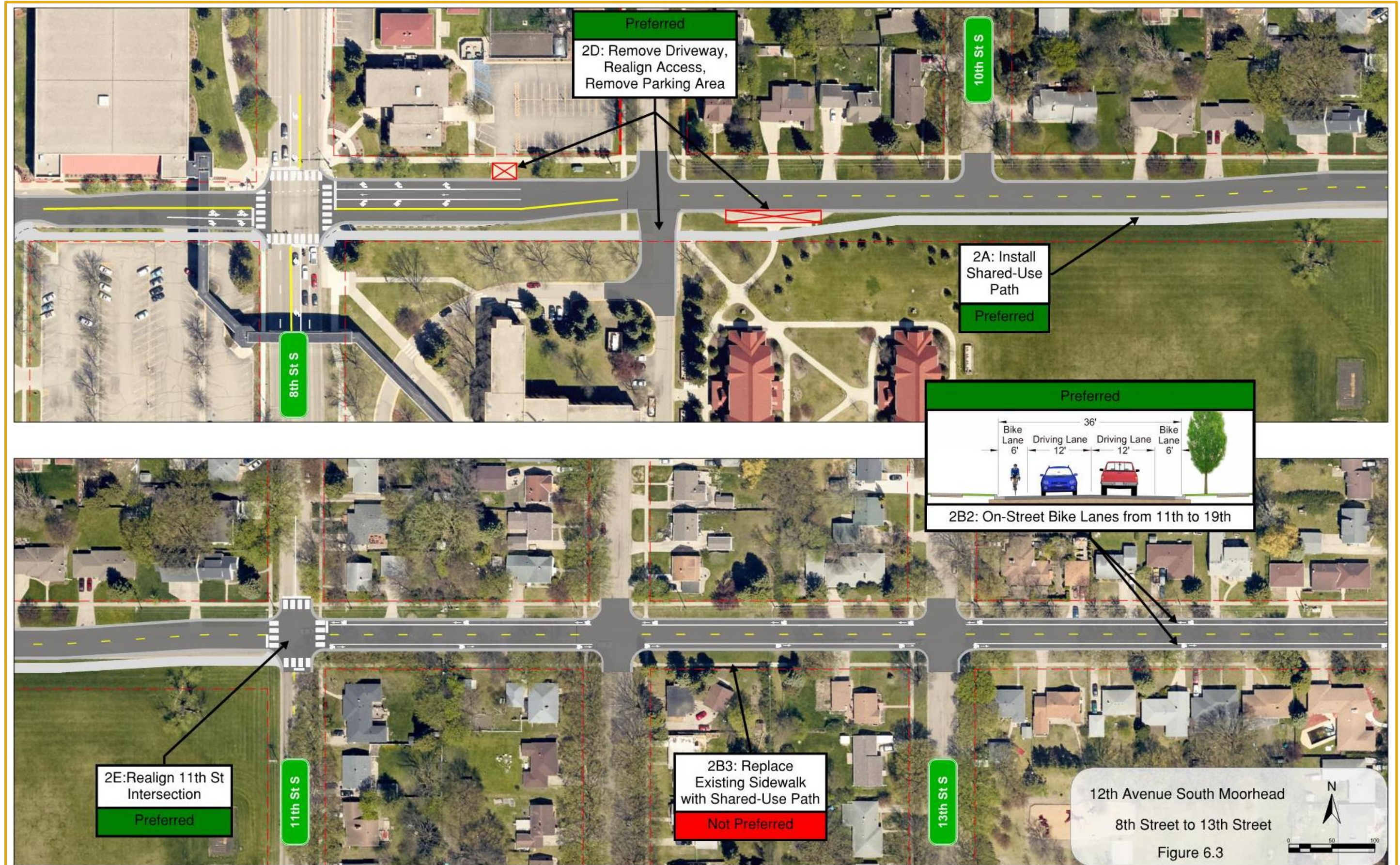
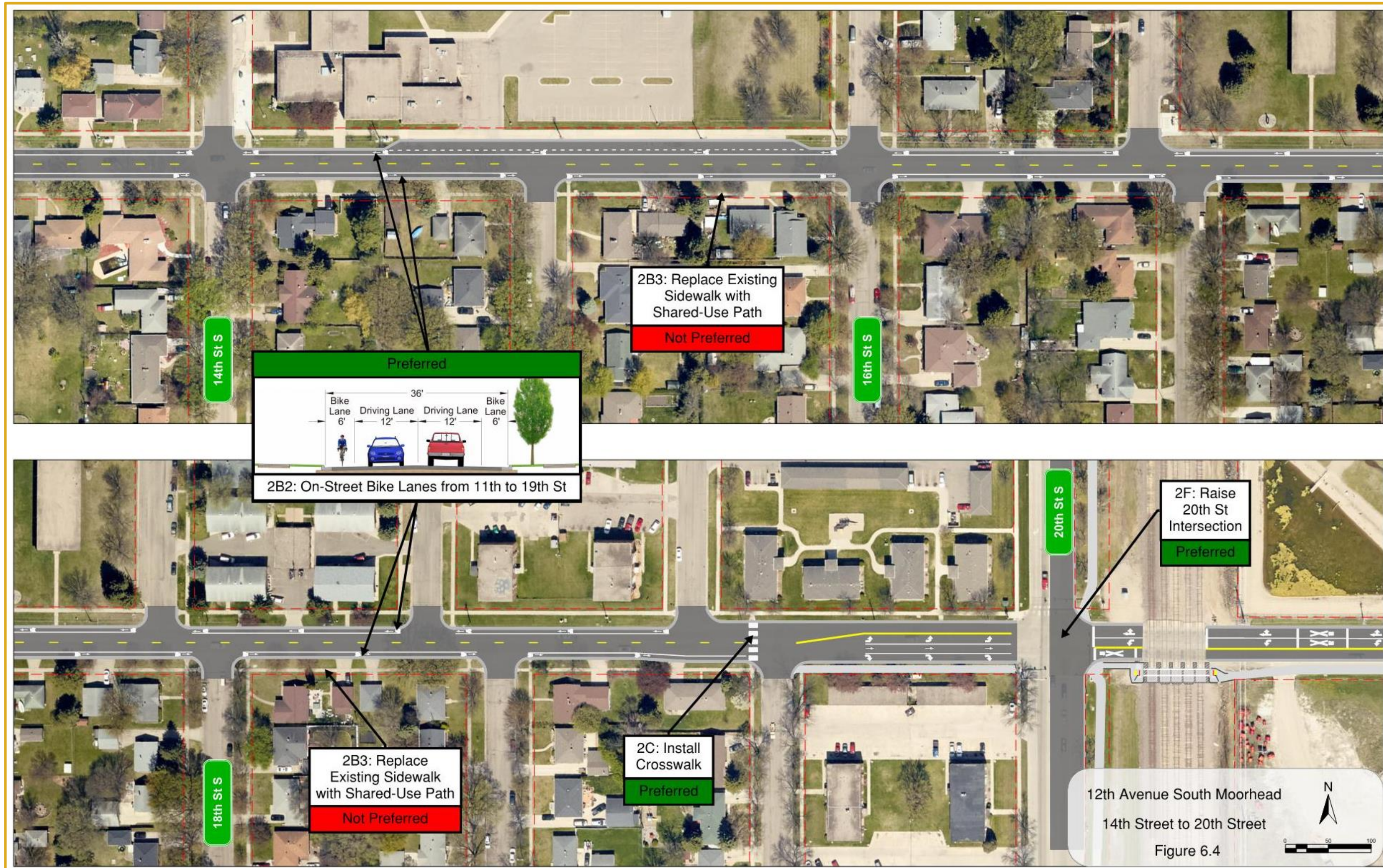


Figure 6.4 | 14th Street to 20th Street



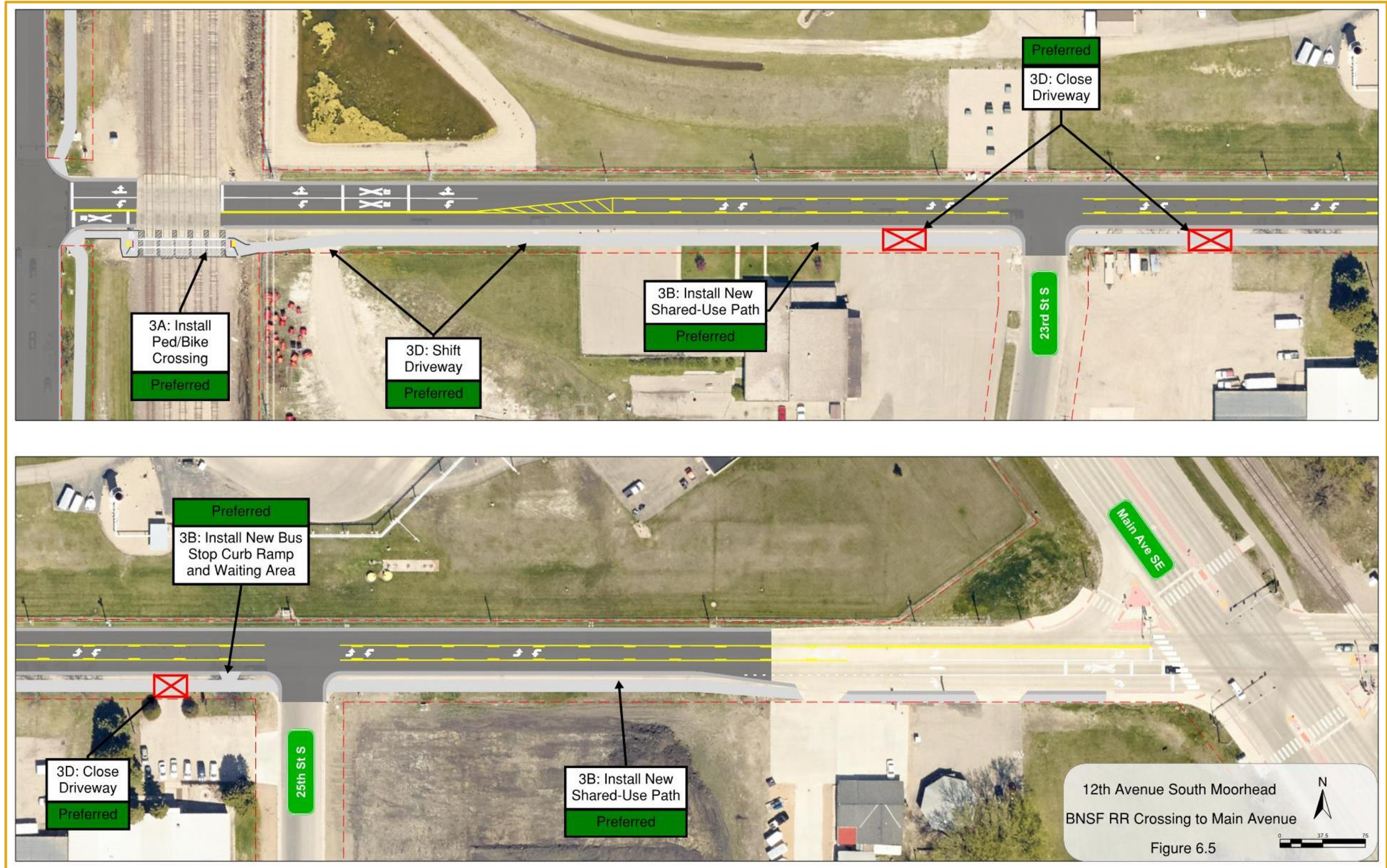
6.3 20th Street South to Main Avenue Southeast

Table 6.3 Segment 3: 20 th Street South to Main Avenue SE				
Improvement Alternative	Issue/Need Addressed	Cost	Impacts	SRC Recommendation
3A: Construct pedestrian/bicycle crossing on east side of 20 th Street South at BNSF Railroad tracks <i>Figure 6.5</i>	Bike and Pedestrian Route Connectivity	\$200,000	High: Right of way/private property; railroad crossing; drainage; private utilities	Preferred – Short Range
3B: Add new 10' shared-use path on south side (remove existing on-street bike lanes, shift south curb line 10' north to accommodate off-street path) <i>Figure 6.5</i>	Bike Route Connectivity	\$250,000	Medium: Right of way/private property; existing trees; drainage	Preferred – Short Range
3C: Install curb ramp and concrete waiting area at 25 th Street South bus stop <i>Figure 6.5</i>	Transit Facilities	\$5,000	Low	Preferred – Short Range
3D: Shift private business driveway east of the BNSF Railroad tracks <i>Figure 6.5</i>	Parking and Access Management	\$15,000	Low	Preferred – Short Range

Railroad Crossing at 20th Street



Figure 6.5 | BNSF RR Crossing to Main Avenue SE



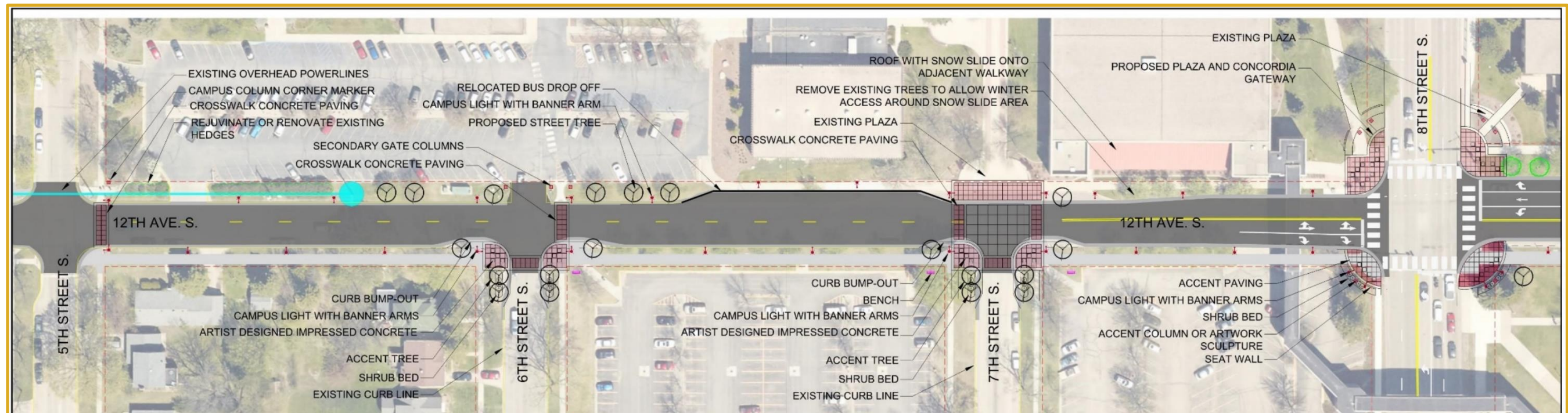
6.4 Corridor-Wide Improvements

Improvement Alternative	Issue/Need Addressed	Cost	Impacts	Recommendation
4A: Upgrade existing sidewalks & paths to current ADA standards	Bike and Pedestrian Route Connectivity	\$200,000	Medium: Curb & gutter; drainage; up to 99 curb ramps	Preferred – Short Range
4B: Review and enforce parking policies, paint curb to restrict parking near accesses	Parking and Access Management	\$15,000	Low: Changes in parking policy may cause confusion; additional parking on side-streets	Policy Changes – Not Preferred; Curb Painting – Preferred Short Range
4C: Streetscaping improvements <i>Figure 6.6 & 6.7</i>	Trees and Streetscaping	*See Below	Low: Improvements can be incorporated with roadway improvements	Preferred – Short & Long Range
4D: Bury overhead electric lines <i>Figure 6.6 & 6.7</i>	Trees and Streetscaping	\$1,350,000	High: Right of way; driveways; existing trees; sidewalks	Supported -Long Range

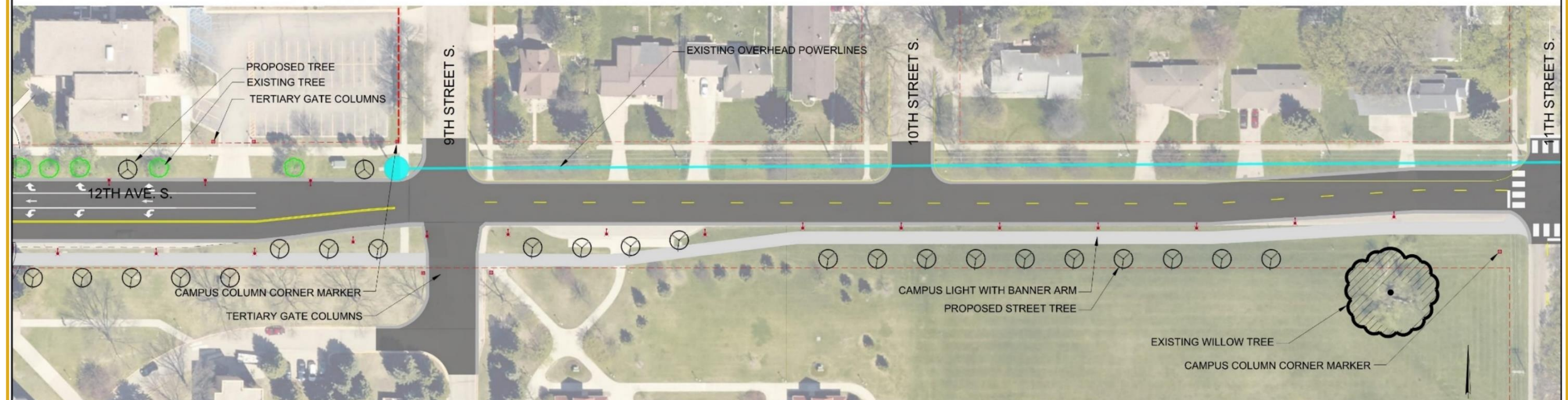
*Typical Streetscape Improvement Costs

- 1 1/2" Cal. Deciduous Tree = \$400/ea
- #5 Deciduous Shrub = \$65/ea
- #2 Deciduous Shrub = \$45/ea
- #1 Perennial = \$25/ea
- Wood Mulch with Weed Barrier Fabric = \$125/cy
- Rock Mulch with Weed Barrier Fabric = \$175/cy
- Rock Mulch Special with Weed Barrier Fabric = \$225/cy
- Precast Concrete 'Bullet' Edging = \$8/lf
- Steel Bench = \$1,600/ea
- Bike Rack = \$800/ea
- Colored Concrete with Medium Broom Finish = \$10/sf
- Colored with Stamped Concrete Finish = \$20/sf
- 6' bench on a concrete pad = \$2,000
- Accent Planting bed (24'x6') = \$3,000
 - Includes 2 ornamental trees, 12 shrubs, 24 perennials, rock mulch, and precast concrete edging
- Accent Planting Bed (24'x6') with Bench = \$5,00

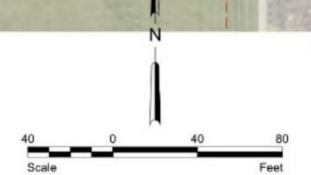
Figure 6.6 | Corridor-Wide Landscaping/Streetscaping



CONCEPT #1- CONCORDIA COLLEGE FRONTAGE- 5th Street S. to 8th Street S.

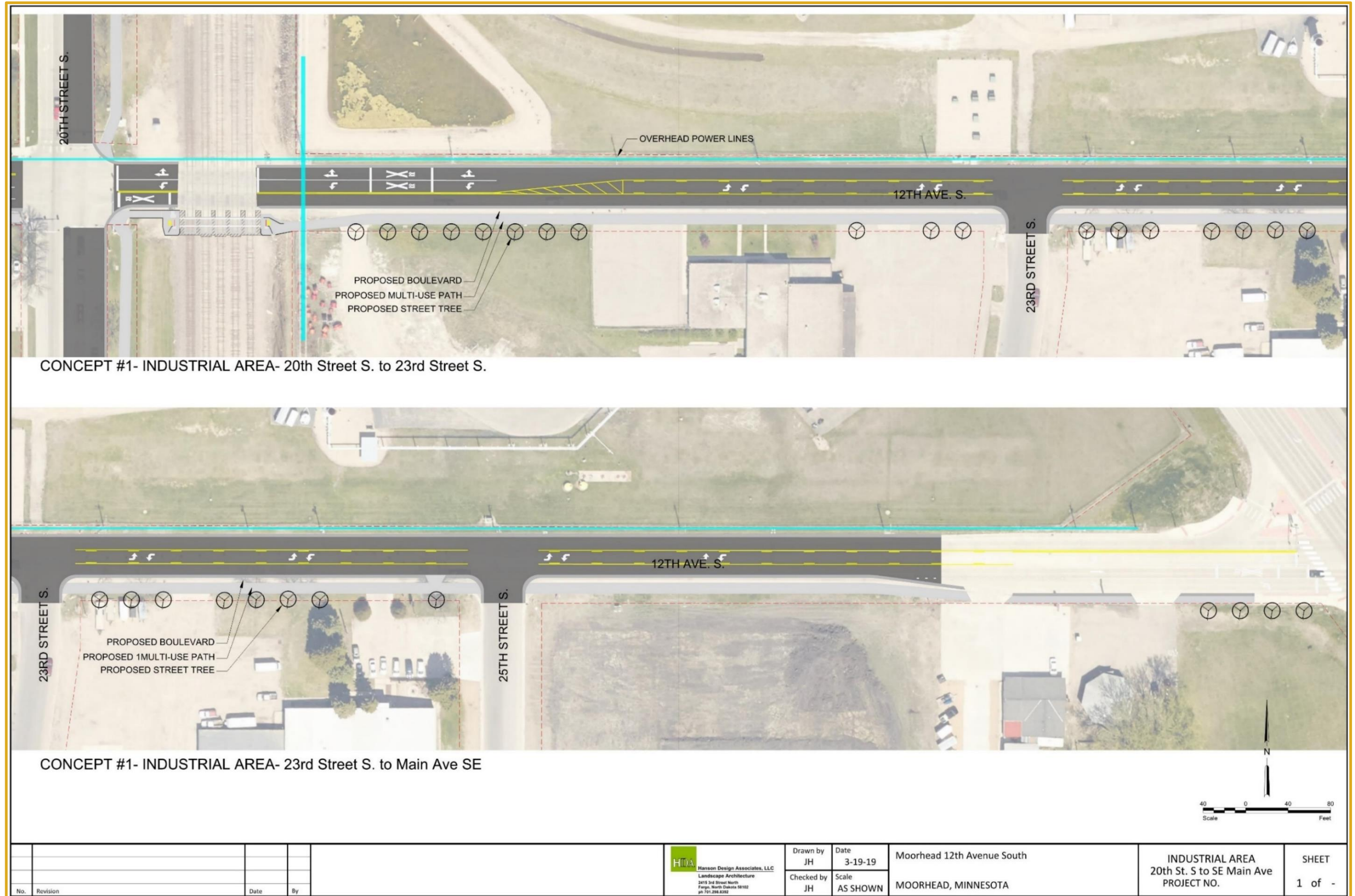


CONCEPT #1- CONCORDIA COLLEGE FRONTAGE- 8th Street S. to 11th Street S.



No.	Revision	Date	By		Drawn by	Date	Moorhead 12th Avenue South MOORHEAD, MINNESOTA	CONCORDIA COLLEGE 5th St. S to 11th St. S. PROJECT NO.	SHEET 1 of -
					Checked by	Scale			
					JH	3-19-19			
					JH	AS SHOWN			

Figure 6.7 | Corridor-Wide Landscaping/Streetscaping



7.0 ENVIRONMENTAL DOCUMENTATION

7.1 Scope of Environmental Impact Analysis

This corridor study did not include an in-depth evaluation of the environmental impacts or coordination with potentially affected agencies typically involved in implementing transportation projects. The following information is presented for discussion and as a reference for identification of potential future environmental impacts.

7.2 Natural Resources

7.2.1 LAND USE AND RIGHT OF WAY

As documented in the “Existing Conditions” portion of the study, the land use throughout the corridor is a mix of low to moderate density residential, mixed-use, institutional, and light and heavy industrial zoning. It is not anticipated that any of the proposed alternatives would significantly impact the existing land use so this aspect was not analyzed further.

The existing right of way varies throughout the corridor. The proposed improvement alternatives are generally designed to stay within the existing right of way, although alternatives that include removing and replacing the existing sidewalk with a wider shared-use path, or installing a new path where one does not exist, may require temporary construction easements or purchase of permanent easements or right of way. These areas include:

- South side of 12th Avenue S from 5th Street S to 8th Street S
- 20th Street S to Main Avenue SE.

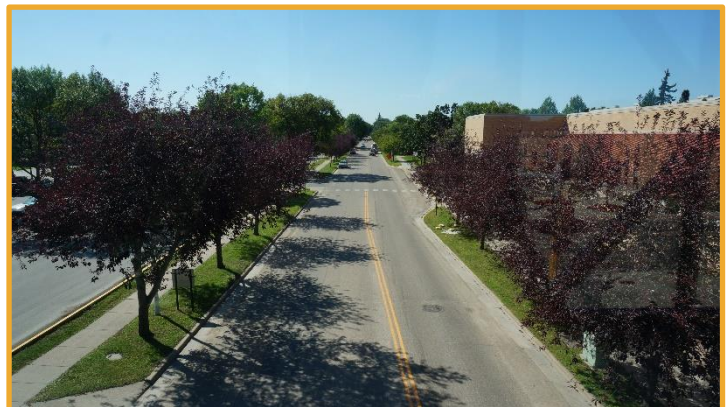
The properties in these areas will need to be further evaluated if these alternatives are implemented.

7.2.2 WETLANDS AND WILDLIFE

According to the US Fish and Wildlife Wetlands Mapper application, there are no wetlands within the corridor study area. The nearest bodies of water include the Red River which is approximately 750 feet west of the study area and a county drain approximately 1000’ east of the study area. It is not anticipated that any of the proposed alternatives would significantly impact those water bodies or other potentially unknown wetlands.

7.2.3 TREES

There are many existing boulevard trees throughout the corridor study area, most notably from River Drive to 20th Street SE. These trees are discussed more in-depth in the “Existing Conditions” and “Issue Identification and Needs Assessment” sections of this study. The majority of these trees are mature American Elm, Chokecherry, Crabapple, and



Green Ash. Overall there are 70 trees in good condition, 41 trees in fair condition, and 77 in poor condition. Many of the trees in poor condition are Crabapple trees near Concordia College campus that are past maturity and showing evidence of health decline or other health issues. Concordia has indicated that they would like to replace these trees.

The “Crazy Tree” is a local landmark located in the southwest corner of 12th Avenue South and 11th Street. Because of the historical and social nature of this tree, the alternatives were developed for that area focused on reducing or eliminating impacts to the tree.

Some of the improvement alternatives include removing and replacing existing sidewalks in the boulevard with a wider shared-use path. These improvements to the bicycle and pedestrian facilities would have negative impacts to the existing boulevard trees either traumatizing the root structure or requiring the tree to be removed completely. While this could be an opportunity to replace large overgrown trees with a more appropriately sized tree for a boulevard environment, the City Forester indicated a desire to keep all existing trees. The trees also have sentimental value to the public, especially the residents along the corridor and removal would likely not be favorable.

7.3 Utility Impacts

The major private utilities identified in the “Existing Conditions” analysis include overhead power lines owned by Moorhead Public Service (MPS) and several underground utilities. The exact location and ownership of the underground utilities is unknown and further analysis would be required on any alternatives chosen that would potentially impact these utilities.

The overhead power lines owned by MPS extend through 80% of the corridor. The City expressed a desire to bury these lines for aesthetic and maintenance concerns. MPS was contacted to discuss the possibility of burying these lines and they indicated that these lines serve a large population along the corridor and burying them would take a significant effort. The impacts of such an undertaking would include temporary service disruptions, localized earthwork, and traffic impacts. MPS estimated a cost of \$1,350,000 to bury the power lines throughout the corridor.

7.4 Section 4(f)

Section 4(f) of the U.S. Department of Transportation (USDOT) Act of 1966 prohibits federal transportation agencies from using land from publicly owned parks, recreation areas (including recreational trails), wildlife and water fowl refuges, or public and private historic properties, unless there is no feasible and prudent alternative to that use and the action includes all possible planning to minimize harm to the property resulting from such a use.

Potential Section 4(f) properties include:

- Parks and recreation areas
- Wildlife or waterfowl refuges and wildlife management areas
- Cultural and archeological resources and sites
- Historic sites, bridges, and highways
- Landscapes
- School playgrounds
- Fairgrounds
- Public multiple-use land holdings
- Wild and scenic rivers
- Planned facilities
- Bikeways (recreational) and trails
- Public golf courses

There are properties along the corridor that would likely be protected under Section 4(f). City parks including Alm Park, Lamb Park, and Romkey Park are not directly adjacent to 12th Avenue South but are within one city block. Concordia College has recreational facilities directly south of 12th Avenue South east of 8th Street.

The 2014 Moorhead River Corridor Master Plan provides a vision for developing recreational and habitat enhancement to the area along the Red River. The Plan included potential future projects that may be within the area of future improvements on 12th Avenue South.

This study did not include an analysis of possible historical, archeological, or cultural resources.

7.5 Section 6(f)

The purpose of Section 6(f) of the Land and Water Conservation Act (LAWCON) is to develop and provide accessibility to outdoor recreation resources. It prohibits use of any land purchased with LAWCON funds for any purpose other than recreational use unless replacement land with equal usefulness is provided.

A search of the listing of park lands purchased with LAWCON funds indicates that there are currently no Section 6(f) protected lands within the corridor study area.

7.6 Environmental Justice and Social Considerations

In accordance with Executive Order 12898 “Federal Actions to Address Environmental Justice Minority Populations and Low-Income Populations”, environmental justice must be addressed to the greatest extent practicable and permitted by law in all federal planning and programming activities. The intent of the order is to promote nondiscrimination in federal programs that affect human health and the environment, as well as provide minority and low-income populations access to public information and public participation. Future projects along the corridor could have federal funding and may be considered a federal project required to comply with this order.

A review of 2010 census data shows a high concentration of low-income and minority households along certain areas of the 12th Avenue South corridor, particularly between 17th Street and 20th Street. It is not expected that the proposed improvements would negatively impact a particular area of the corridor more than another, however there will need to be further analysis with any future project.



8.0 STUDY RECOMMENDATIONS

8.1 Summary of Recommendations

Based on input and analysis of the Study Review Committee, along with public and stakeholder input, the following improvement alternatives are recommended for future implementation. Most of the recommendations are expected to be implemented with projects scheduled for 2020 and 2021. Some improvements are indicated as “long-range” as they will require a longer project development process and/or additional funding. Further environmental documentation or study may be required depending on the funding sources used by the City of Moorhead for future projects.

The following is a summary of the preferred recommendations for the corridor.

8.1.1 BICYCLE, PEDESTRIAN, AND TRANSIT ROUTE IMPROVEMENTS

- Install shared-lane markings “sharrows” from River Drive to 5th Street
- Install a shared-use path on the south side of 12th Avenue S from 5th Street to 8th Street S and from 9th Street S to 11th Street S.
- Shift south curb to the north between 20th Street S and Main Avenue SE to create a boulevard wide enough to install a shared-use path along the south side
- Install on-street dedicated bike lanes on the north and south side of 12th Avenue S between 11th Street S and 19 ½ Street S.
- Install a crosswalk at 19 ½ Street south
- Install a curb ramp and waiting area at the MATBUS stop west of 25th Street S
- Install pedestrian/bicycle crossing on east side of 20th Street South at BNSF Railroad tracks
- Improve curb ramps throughout the corridor to meet current ADA guidelines

8.1.2 PARKING AND ACCESS MANAGEMENT

- Close parking lot driveways
 - North side of 12th Avenue S directly east of 5th Street S
 - South side of 12th Avenue S directly west of 8th Street S
 - North side of 12th Avenue S directly east of 8th Street S
 - South side of 12th Avenue S directly west of 23rd Street S
 - South side of 12th Avenue S directly east of 23rd Street S
 - South side of 12th Avenue S directly west of 25th Street S
- Shift parking-area on north side of 12th Avenue S near 7th Street S farther west, away from the intersection
- Remove parking area on south side of 12th Avenue S directly east of 9th Street S
- Shift parking lot driveway on south side of 12th Avenue S directly east of the BNSF Railroad tracks farther to the east, away from the railroad tracks
- Install curb bump-outs around the southeast and southwest corners of the 6th Street S and 7th Street S intersections
- Paint curb near access points to deter parking in the access line of sight

8.1.3 ROADWAY GEOMETRICS AND TRAFFIC OPERATIONS

- Reassign eastbound lanes at 8th Street S intersection with a shared thru/left turn lane and a designated right turn lane
- Realign 11th Street S intersection to eliminate horizontal offset and align the curb lines
- Construct a grade raise at the 20th Street S intersection by adjusting the cross-slope on the east half of the intersection to improve the vertical profile of 12th Avenue S at the BNSF Railroad tracks (*this is supported as a long-range improvement*)

8.1.4 STREETSCAPING AND TREES

- Incorporate improvements throughout the corridor as roadway improvements are implemented
- Bury overhead power lines (*this is supported as a long-range improvement*)

8.2 Estimated Cost for Recommended Improvement Alternatives

The cost estimates do not include the base cost for the planned mill and overlay from River Drive to 20th Street S, or the planned pavement rehabilitation from 20th Street S to Main Avenue SE. All costs are in 2019 dollars.

**Table 8.1
Long-Range Improvement Alternative Estimated Costs**

12th Avenue South Long-Range Improvement Estimated Costs River Drive to Main Avenue SE	
<i>Alternative</i>	<i>Estimated Cost</i>
2F - 20th St Intersection Grade Raise	\$1,250,000.00
4D - Bury Overhead Power Lines	\$1,350,000.00
Long Range Total	\$2,600,000.00

Table 8.2
Short-Range Improvement Alternative Estimated Costs

12th Avenue South Short-Range Improvement Estimated Costs River Drive to Main Avenue SE	
<i>Alternative</i>	<i>Estimated Cost</i>
Bicycle, Pedestrian, and Transit Improvements	
1A2 - Sharrows and Shared-Use Path from River Dr to 8th	\$90,000.00
2A - Shared-Use Path from 9th to 11th	\$100,000.00
2B2 - On-Street Bike Lanes from 11th to 19 1/2	\$30,000.00
2C - Crosswalk at 19 1/2	\$5,000.00
3A - RR PED Crossing East of 20th	\$200,000.00
3B - 10' Shared Use Path from 20th to Main Ave SE	\$250,000.00
3C - Bus Stop Ramp at 25th St	\$5,000.00
4A - Corridor-Wide Sidewalk ADA Upgrades	\$200,000.00
<i>Subtotal</i>	<i>\$880,000.00</i>
Parking and Access Management	
1C - Access and Parking Area Removal & Realignment from 5th to 8th	\$50,000.00
1D - Curb Bump Outs at 6th and 7th	\$75,000.00
2D - Access and Parking Area Removal & Realignment from 8th to 10th	\$45,000.00
3D - Access Removal and Relocation from 20th to 25th	\$15,000.00
4B - Corridor-Wide Curb Painting to Restrict Parking	\$15,000.00
<i>Subtotal</i>	<i>\$200,000.00</i>
Roadway Geometrics and Traffic Operations	
1E1 - 8th St Intersection Lane Reconfiguration	\$185,000.00
2E - Realign 11th St Intersection	\$150,000.00
<i>Subtotal</i>	<i>\$335,000.00</i>
Streetscaping Improvements	
4C - Corridor-Wide Streetscaping Improvements	<i>Varies</i>
Short Range Total	
\$1,415,000.00	

