ENGINEERING ■ ARCHITECTURE ■ SURVEYING ■ PLANNING

Pine Street Extension
Traffic Study

Dakota City, NE
JEO Project No. 210067.00

Prepared for:
SIMPCO
City of Dakota City

Prepared by:
JEO Consulting Group

Date:
September 7, 2021

PROFESSIONAL CIVIL ENGINEER
LONNIE J. BURKLUND
E-10824
9/7/21
STATE OF NEBRASKA

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

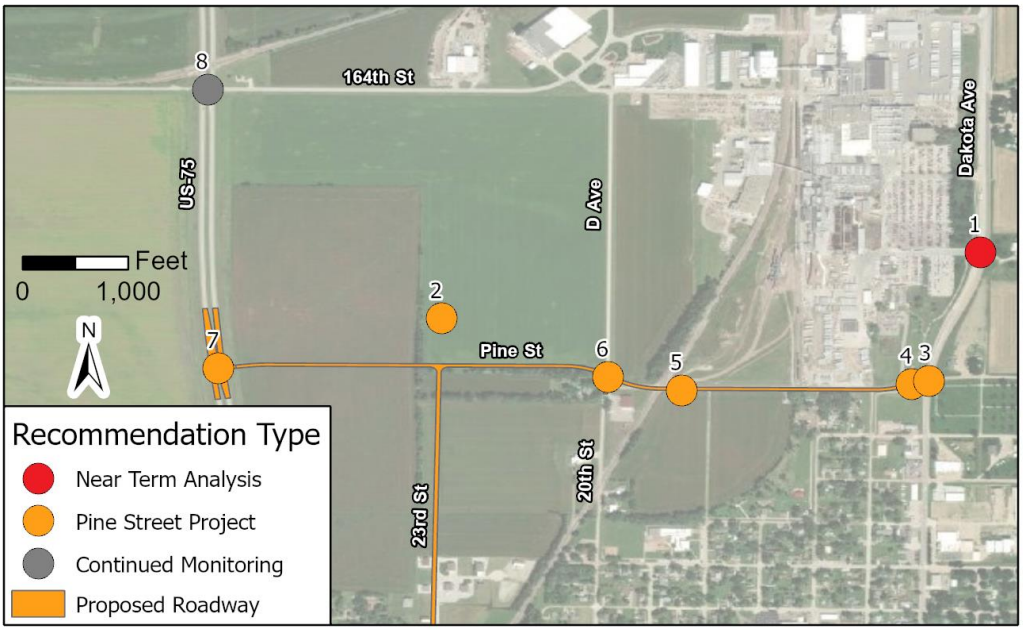
Executive Summary

The purpose of this traffic study is to evaluate the impact of the proposed Pine Street enhancement and extension from US-75 to Dakota Avenue. The Siouxland Interstate Metropolitan Planning Council (SIMPCO) and the City of Dakota City, Nebraska commissioned this study examining Pine Street and additional study area intersections along US-75, and Dakota Avenue. Existing traffic turning movement counts were collected and analyzed with regional trend data and proposed development traffic. Subsequently, existing and future traffic demand was generated for traffic analysis.

The study area Traffic analysis determined that most intersections would operate at an acceptable Level of Service (LOS) with future identified improvements. Additionally, environmental impacts were evaluated with preliminary results indicating no substantial resources affected.

A planning level Opinion of Probable Cost (OPC) is currently estimated at slightly under $6 million. In addition, a planning level project implementation schedule highlights a completion timeline of just over three years from design kickoff to final construction. A summary of project recommendations are shown in the table and figure below:

#	Recommendation	Support Sect.
1	Conduct Signal Warrants Study, Evaluate Dual Left Turns	2.1.7, 2.1.8, 6.2
2	Perform Full Environmental Analysis	4
3	Maintain Two-way Stop Control at Pine St / Dakota Ave	6.1
4	Construct Sidewalk Along Pine, Relocate Trail Crossing at Dakota Ave	2.3, 6.4
5	Design Two-lane Paved Roadway on Pine St from US-75 to Dakota Ave	6.1, 7
6	Evaluate Implementation of Roundabout at Pine St & D Ave/20th	6.3
7	Improve Intersection Geometry	6.1
8	Retain Existing Lane Configuration / Continued Monitoring	6.2



1.0 Introduction

This study documents the results of a traffic study conducted for the Siouxland Interstate Metropolitan Planning Council (SIMPCO) and City of Dakota City, Nebraska to study the traffic and environmental impacts of a potential Pine Street improvement and extension from Dakota Avenue to US Highway 75/77 (US-75).

1.1 Project Description and Objective

The primary objective of this traffic study was to evaluate the proposed Pine Street enhancement (Dakota Avenue to 20th Street) and extension between US-75 and 20th Street in Dakota City, Nebraska. Specifically, this study was conducted to assess the traffic impact on adjacent streets and intersections, and provide data related to the potential future improvement and extension of Pine Street. An overview of the study area and surrounding transportation network is illustrated in **Figure 1**.

2.0 Data Gathering

This section of the study summarizes the existing study area conditions.

2.1 Existing Geometries

The Pine Street Extension study area includes the following streets:

2.1.1 US Highway 75/77

US Highway 75/77 (US-75) is a four-lane divided expressway classified as a Major Arterial according to the Nebraska Department of Transportation (NDOT) State Functional Classification. The roadway has a posted speed limit of 65 mph in the vicinity of the project.

2.1.2 N-35

Nebraska Highway 35 / Broadway Street (N-35) is a two-lane road classified as “Other” Arterial according to the NDOT State Functional Classification. The roadway has a posted speed limit of 40 mph near the intersection of US-75 and lowers to a 35 mph speed limit through the Dakota City urban limits.

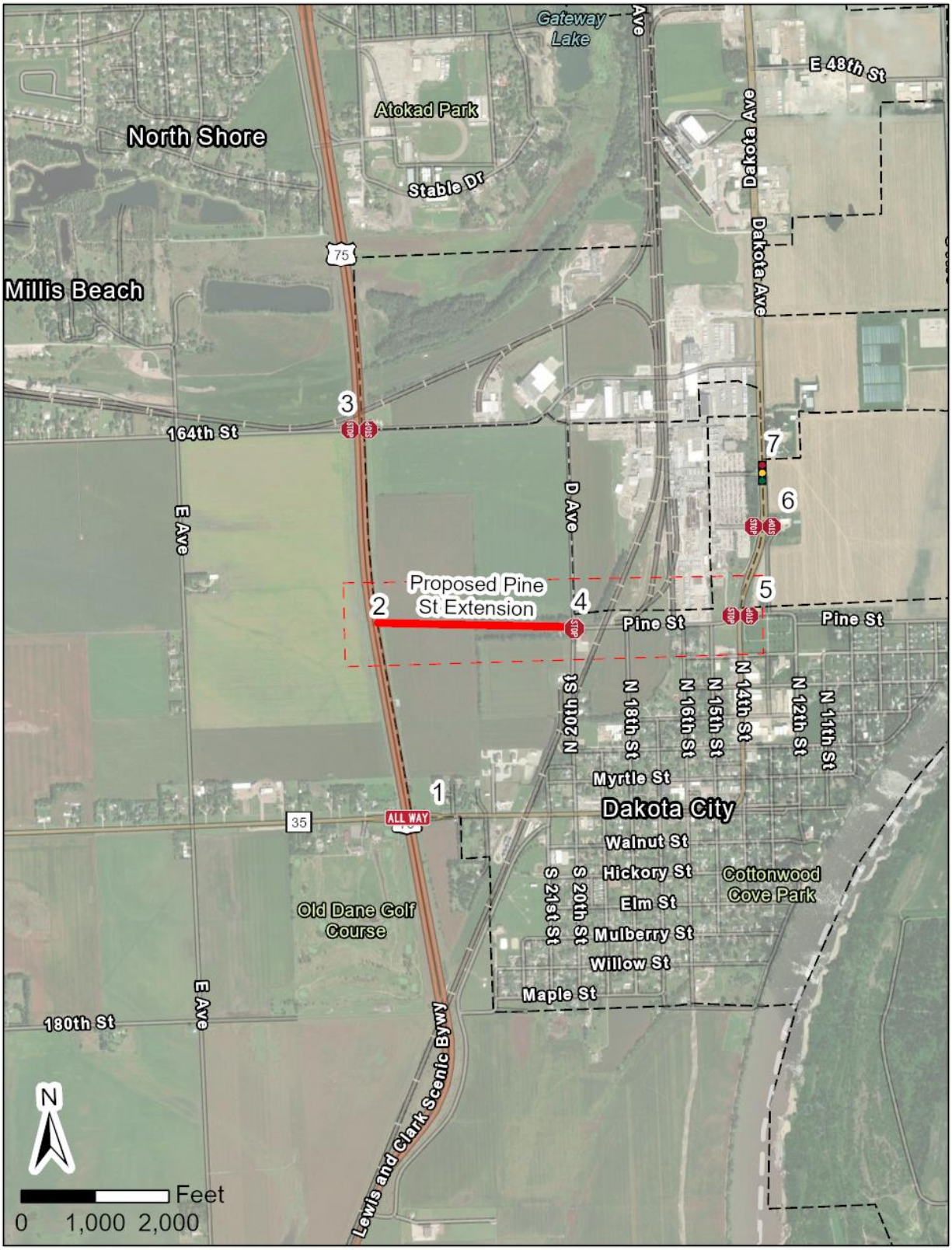
2.1.3 Dakota Avenue

Dakota Avenue is a four-lane road classified as “Other” Arterial according to the NDOT State Functional Classification. The roadway has a posted speed limit of 35 mph along the corridor near the vicinity of Pine Street and transitions to 45 mph north of the study area in the direction of I-129/US-20. Only local truck traffic is permitted south of the Tyson plant along this road.

2.1.4 Pine Street

Pine Street is currently a two-lane, gravel road classified as a collector according to the NDOT State Functional Classification. The roadway has a posted speed limit of 25 mph and currently terminates at 20th Street.

Figure 1: Project Overview



2.1.5 164th Street

164th Street is a two-lane road classified as a collector according to the NDOT State Functional Classification. The roadway has a posted speed limit of 45 mph. This road connects the Roth Industrial park to US-75.

2.1.6 20th Street

20th Street is a two-lane road classified as a collector according to the NDOT State Functional Classification. The roadway has a posted speed limit of 15 mph for a two-block section to the north of Broadway Street from the Dakota City Elementary School to Myrtle Street. It is posted at 25 mph for other existing sections.

2.1.7 South Tyson Entrance

The South Tyson Entrance is a private drive located between Pine Street and the Signalized Tyson Entrance along Dakota Avenue. It is located opposite of a private driveway on the east side of Dakota Avenue. This entrance serves as the truck entrance for the Tyson plant. It is 65-ft wide and functionally serves three lanes of traffic. One entering and two exiting lanes are provided approaching the stop-controlled Dakota Avenue intersection. While unmarked, the lanes serve as a de facto dual left-turn from the drive onto Dakota Avenue, particularly during shift changes at the plant. A screenshot of this instance is shown below in **Figure 2**.

Figure 2: Video Capture of Dual-left Turns from South Tyson Entrance

2.1.8 Signalized Tyson Entrance

The signalized entrance to Tyson is a private drive located over a quarter mile north of Pine Street along Dakota Avenue. This entrance serves as the primary employee entrance to the plant with access to the large parking areas. It is 42-ft wide and functionally serves three lanes of traffic. One entering and two exiting lanes are provided at the signal. This intersection experiences similar dual eastbound left turn behavior as the south entrance, particularly around shift change times.

2.2 Existing Traffic Volumes

Data was collected at the following four locations on Thursday, June 3rd, 2021:

- Pine Street & 20th Street
- Dakota Avenue & Pine Street
- Dakota Avenue & South Tysons Entrance
- Dakota Avenue & Signalized Tysons Entrance

Counts were collected via video cameras and analyzed over a 24-hour period for total vehicle count as well as heavy vehicle and pedestrian counts in 15-minute intervals. A summary of entering vehicles is shown in **Table 1**. The colors in the table represent the entering vehicle and truck frequency for 15-minutes intervals. A figure of turning movement counts for peak hour periods is show in **Figure 3**. Supplemental counts were provided by the Nebraska DOT (NDOT) at the intersections of US-75 & 167th Street and US-75 & N-35. Raw data for all counts is shown in **Appendix I**.

The morning (AM) peak hour traffic interval was determined to be from 7:30am – 8:30am. The afternoon (PM) peak hour traffic interval was determined to be from 2:30pm – 3:30pm. Traffic patterns for the area, particularly in the vicinity of the Tyson plant, are driven by shift change times as shown in **Table 1.**

2.3 Pedestrian and Bicycle Volumes

The volume of pedestrians and bicycles were collected at the signalized Tyson Entrance as mentioned in **Section 2.2.** The counts indicated that 10 pedestrians and vehicles used the intersection during the 24-hour collection period. There were six pedestrians counted of which five were collected at night between 7:30pm and 1:15am. Four bicycles were reported entering the intersection, all arriving between 3:30pm and 4:30pm.

While not collected with vehicle movement counts, pedestrian activity was observed in the vicinity of the Pine Street and 20th Street intersection.

Figure 3: Existing 2021 Turning Movement Traffic Volumes – AM (PM)

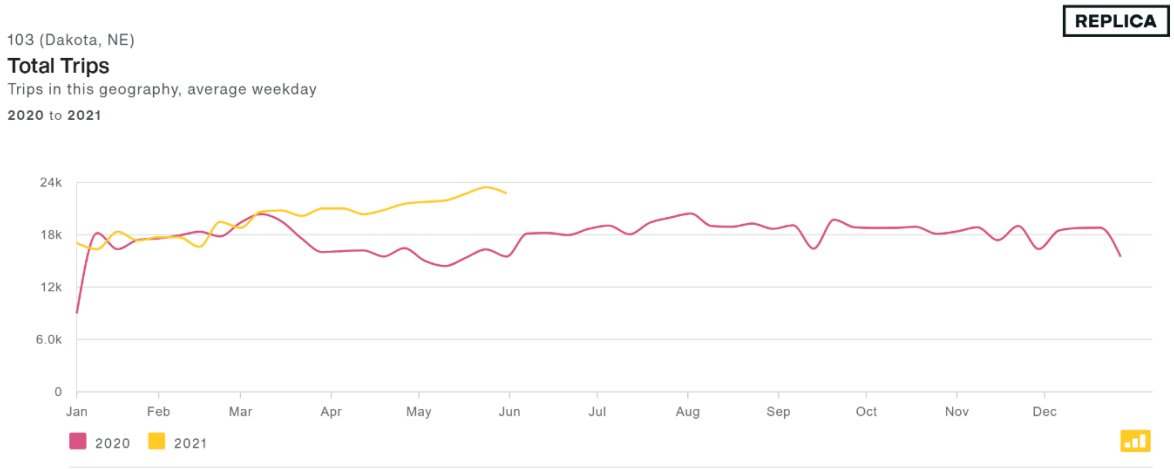
Table 1: Existing Traffic Volumes by Entering Vehicle Count

	Total Entering Vehicles (15 Minute Intervals)						Heavy Vehicles (15 Minute Intervals)			
Time / INT	US-75 & N-35	US-75 & 164th	Pine & 20th	Dakota & Pine	Dakota & Tyson Signal	Dakota & Tyson South	Pine & 20th	Dakota & Pine	Dakota & Tyson Signal	Dakota & Tyson South
12:00 AM			2	11	46	18	0	0	2	2
12:15 AM			2	26	180	92	0	0	1	1
12:30 AM			4	29	282	131	0	0	0	0
12:45 AM			1	15	129	45	0	0	0	0
1:00 AM			1	11	108	39	0	1	1	2
1:15 AM			1	10	41	25	0	0	0	0
1:30 AM			1	6	29	11	0	0	0	0
1:45 AM			0	5	15	11	0	0	4	4
2:00 AM			2	9	27	14	1	1	2	2
2:15 AM			1	8	25	13	0	0	1	1
2:30 AM			2	5	7	8	1	0	2	2
2:45 AM			0	3	15	7	0	0	2	2
3:00 AM			0	3	9	5	0	0	2	2
3:15 AM			1	8	16	8	0	0	1	0
3:30 AM			1	10	22	12	0	0	0	1
3:45 AM			3	12	36	14	0	0	1	1
4:00 AM			1	13	48	14	0	1	1	1
4:15 AM			3	14	71	18	0	1	4	4
4:30 AM			0	18	121	27	0	3	3	4
4:45 AM			2	28	148	46	0	0	2	2
5:00 AM			1	30	202	71	0	0	1	1
5:15 AM			6	41	303	147	1	0	0	0
5:30 AM			6	51	242	164	1	0	1	1
5:45 AM			6	36	119	84	0	0	4	4
6:00 AM			4	23	71	39	1	0	1	1
6:15 AM			9	47	61	51	1	1	2	4
6:30 AM			3	55	82	60	0	0	2	2
6:45 AM			5	57	81	60	0	1	6	6
7:00 AM	195	259	9	61	119	80	0	3	11	11
7:15 AM	214	279	2	57	92	71	0	0	10	9
7:30 AM	191	217	4	100	120	116	0	0	7	9
7:45 AM	116	181	2	106	122	113	0	2	10	9
8:00 AM	118	167	6	94	104	99	2	1	11	11
8:15 AM	111	156	5	73	85	76	1	2	7	6
8:30 AM	105	153	1	61	78	74	0	3	13	14
8:45 AM			10	68	85	83	0	2	15	14
9:00 AM			9	74	79	79	2	4	12	13
9:15 AM			3	61	75	81	0	2	17	19
9:30 AM			7	49	67	63	0	5	17	16
9:45 AM			6	61	77	73	1	2	14	13
10:00 AM			7	54	72	64	0	2	14	13
10:15 AM			5	63	74	73	0	5	11	13
10:30 AM			7	64	84	80	2	6	15	16
10:45 AM			7	81	99	96	3	4	10	12
11:00 AM	98	155	4	62	79	72	0	0	12	12
11:15 AM	87	181	8	84	93	89	1	1	7	6
11:30 AM	106	179	4	85	97	89	0	3	6	6
11:45 AM	94	179	4	105	114	108	0	4	7	8
12:00 PM	101	202	18	104	113	105	1	1	6	6
12:15 PM	128	203	5	90	103	93	0	3	6	5
12:30 PM	114	165	5	80	105	87	0	1	6	6
12:45 PM	109	166	8	84	115	88	0	0	5	4
1:00 PM	117	167	5	83	128	90	1	2	4	5
1:15 PM	116	144	8	97	142	111	1	1	8	7
1:30 PM	118	208	7	93	158	108	1	2	6	5
1:45 PM	156	190	11	90	176	104	0	0	6	7
2:00 PM		213	11	112	218	135	1	2	7	8
2:15 PM		240	13	110	252	152	0	3	12	12
2:30 PM		235	11	127	503	304	2	5	8	9
2:45 PM		223	9	126	477	288	0	1	6	6
3:00 PM	135	312	15	129	389	227	0	3	11	11
3:15 PM	168	276	4	110	319	196	0	0	13	12
3:30 PM	146	294	12	122	221	147	1	4	10	10
3:45 PM	144	301	3	109	141	120	1	2	6	6
4:00 PM	170	291	7	87	130	105	0	2	7	6
4:15 PM	129	247	7	94	111	106	1	4	11	12
4:30 PM	161	267	9	123	136	129	2	1	8	8
4:45 PM	153	269	12	98	111	106	0	1	10	9
5:00 PM	144	293	3	83	110	103	1	1	16	17
5:15 PM	169	247	6	96	106	104	0	1	9	10
5:30 PM	144	225	2	78	95	87	0	0	8	9
5:45 PM	111	155	6	66	74	72	0	0	7	7
6:00 PM			10	81	95	88	0	1	8	8
6:15 PM			1	69	87	77	0	0	8	8
6:30 PM			6	73	96	92	0	3	15	17
6:45 PM			2	79	84	83	0	0	6	6
7:00 PM			2	73	84	84	0	0	6	5
7:15 PM			3	63	68	68	0	0	7	8
7:30 PM			3	58	76	69	0	0	9	9
7:45 PM			1	59	69	61	0	0	2	2
8:00 PM			3	40	50	43	0	0	4	4
8:15 PM			5	49	60	51	0	0	0	0
8:30 PM			5	55	63	59	0	0	1	2
8:45 PM			3	51	75	62	0	0	1	1
9:00 PM			2	45	65	55	0	1	4	4
9:15 PM			3	41	78	49	0	1	3	2
9:30 PM			4	47	66	56	0	0	3	4
9:45 PM			0	33	63	42	0	0	6	6
10:00 PM			4	34	59	37	0	1	2	2
10:15 PM			4	27	64	37	0	0	5	5
10:30 PM			5	28	49	33	0	0	2	2
10:45 PM			1	16	42	21	0	0	1	1
11:00 PM			2	14	53	20	0	0	1	1
11:15 PM			1	18	57	25	0	0	1	1
11:30 PM			2	20	38	21	0	1	1	1
11:45 PM			3	18	46	25	0	0	2	2
Total			450	5,529	10,371	7,338	31	108	566	578

2.4 Data Integrity During COVID Pandemic Conditions

Traffic counts obtained from NDOT were collected on Tuesday, September 10th, 2019 and Wednesday, January 6th, 2021 respectively. The 167th Street count was conducted pre-COVID during regular school times while the N-35 count was conducted in the midst of the COVID pandemic timeframe during which many changes to normal business and personal trips were occurring. This January count was also conducted while the South Sioux City Community School District was off due to PK-12 professional development days. According to the automated traffic counting report published by NDOT (https://dot.nebraska.gov/media/7569/autotrfrecorddata.pdf) the traffic volumes in January 2021 dropped by 4.9 percent when compared against January 2020 at the US-20 counting location located west of South Sioux City (Station 7). Additionally, the I-129 station at the Nebraska-Iowa State line (Station 36) experienced a drop of 3.5 percent from the previous year. However, overall traffic volumes across Nebraska in June remain similar to pre-COVID volumes. The following figure shows a year over year comparison from 2020 to 2021 for Dakota City, NE. By June, trips in 2021 have increased by nearly 50 percent against the same time in 2020 as shown in **Figure 4**. As a result, the traffic counts from 2019 and June 2021 were used unadjusted while the January 2021 count at N-35 was adjusted to balance with trips at the US-75 & 164th Street intersection.

Figure 4: Tract Trips for 2020 and 2021



2.5 Pine Street & 20th Street Intersection Volumes

The intersection at Pine Street & 20th Street experiences 450 vehicles entering per day according to the most recent traffic count. This data also includes 108 heavy vehicles. Assuming these vehicles are all coming from outside the City or industrial park area, these vehicles would be likely to utilize the Pine Street extension due the route's connectivity out to the higher speed facility of US-75 thus avoiding a more constrained urban environment to the east and south.

2.6 US-75 & N-35 PM Peak Hour Volume Gap

As shown in **Appendix I** and **Table 1** there is a 1-hour gap from 2:00pm – 3:00pm in the previous data collected by NDOT. Typically these times are uncollected in standard NDOT 8-hr traffic count periods as they are untraditional peak hours; however, in this case due to the Tyson shift change the peak hour from 2:30pm-3:30pm falls in this time range. Since counts were taken during these times at the US-75 and 164th Street intersection, it was assumed that the ratio of 2:00pm to 3:00pm volumes would be the same with the N-35 intersection. While interpolation introduces room for error, this method provides a reasonable estimate of actual conditions due to similar traffic patterns between the two intersections. These turning movement volumes (TMV) can be expressed in the following formula with an example (rounding up):

$$TMV_{2pm\ @\ N-35} = TMV_{3pm\ @\ N-35} * \frac{TMV_{2pm\ @\ 164th}}{TMV_{3pm\ @\ 164th}}$$

$$Example: NBT_{2pm\ @\ N-35} = 42 * \frac{70}{108} = 28$$

2.7 Existing Studies

The Siouxland Interstate Metropolitan Planning Council (SIMPCO) produced a Long Range Transportation Plan (LRTP) projecting 2045 conditions in the metro area. This document assumes the reconstruction of Pine Street from Dakota Avenue to D Avenue from gravel to pavement. Additionally, the document assumes the extension of Pine Street to US-75 by 2035. Planned usage of the proposed roadway includes a proposed development by JST Global which would produce an estimated 310-350 trucks per month along the extended Pine Street. Furthermore, the extension would open approximately 145 acres of vacant land for new development. SIMPCO includes the Pine Street extension as a 2036-2045 planned project. The extension project had a previous opinion of probable cost in the $3.95 million range as shown in the LRTP financial summary.

The other regional study for the area was a Comprehensive Plan developed by SIMPCO for the city of Dakota City in 2017. This plan shows the zoning of the region between 20th Street and US-75 and 164th Street zoned for heavy industrial use. Furthermore, it shows the region north of Pine Street and east of Dakota Avenue zoned for light industrial use. These areas would all make use of the proposed Pine Street Extension.

In addition, the Dakota City Strategic plan written in 2013 includes under objective #1 Action step #8 to “Study the feasibility of extending Pine Street to US Highway 77.”

2.8 Study Methodology

The peak hour volumes for the study area intersections were analyzed using the signalized and unsignalized intersection capacity analysis procedures outlined in the Highway Capacity Manual, 6th Edition (HCM). Per the HCM, Level of Service (LOS) is presented as a letter grade (A through F) based on the calculated average delay for an intersection or movement during a specific period (such as the AM and PM peak hours). LOS A represents free flow movement with little to no delay, while LOS F represents congested flow at or exceeding the capacity of the roadway. Further explanations and detail about the LOS methodology can be found in **Table 3**. Additional metrics including 95th percentile queue lengths and volume to capacity (V/C) ratios provide further information about an approach. The 95th percentile queue is a statistical metric that defines the length at which 95 percent of queues will be shorter. The V/C ratio is a measure of how close a movement is to its capacity. A ratio above one would indicate that the movement is over capacity. These items were reviewed when evaluating the impacts of the Pine Street extension project.

3.0 Existing Conditions Analysis

The existing weekday AM and PM peak hour traffic conditions were analyzed using the existing traffic volumes and intersection geometrics. As shown in **Table 2**, all intersections and approaches were shown to operate acceptably at LOS D or better with most operating at LOS C or better during peak traffic conditions. More detailed reports are seen in **Appendix III**.

Table 2: Existing 2021 Intersection LOS (Delay, Sec)

Intersection Name	AM	PM
US-75 & N-35	B(13)	B(11)
US-75 & Pine Street	A(0)	A(0)
US-75 & 164th Street	C(22)	D(29)
Pine Street & 20th Street/D Avenue	A(9)	A(9)
Dakota Avenue & Pine Street	B(11)	B(13)
Dakota Avenue & Tyson South Ent.	B(12)	D(29)
Dakota Avenue & Tyson Signalized Ent.	A(2)	A(9)

Key: LOS D – LOS E – LOS F

Table 3: Level of Service Interpretation

Level of Service	Description	Signalized Intersection Delay (seconds per vehicle)	Stop-Controlled Intersection & Roundabout Delay (seconds per vehicle)
A	Free-flow operations. Vehicles are almost completely unimpeded in their ability to maneuver within the traffic stream.	< 10	< 10
B	Reasonably free flow. The ability to maneuver within the traffic stream is only slightly restricted.	>10 and < 20	>10 and < 15
C	At or near free flow. Freedom to maneuver within the traffic stream is noticeably restricted.	>20 and < 35	>15 and < 25
D	Speeds begin to decline slightly. Freedom to maneuver within the traffic stream is noticeably limited.	>35 and < 55	>25 and < 35
E	At capacity. Maneuverability within the traffic stream is extremely limited.	>55 and < 80	>35 and < 50
F	Breakdown. Vehicles are jammed. Generally, queues form behind the breakdown condition.	> 80	> 50

Source: Highway Capacity Manual, Special Report 209, Transportation Research Board, Washington, D.C., 2000.

4.0 Existing Conditions Environmental Scan

Environmental data were evaluated to assist with determining the existing environmental constraints within the environmental study area. Identified environmental constraints help in determining potential corridor improvements by indicating which areas to avoid. The environmental study area includes the Pine Street extension and surrounding network.

Environmental data were collected from various data sources, including:

- U.S. Fish and Wildlife Service (USFWS)
- Federal Emergency Management Agency (FEMA)
- United States Environmental Protection Agency (EPA)
- U.S. Geological Survey (USGS)
- U.S. Department of Agriculture (USDA)
- Nebraska Game and Parks Commission (NGPC)
- Nebraska State Historic Preservation Office (NeSHPO)
- Nebraska Department of Environment and Energy (NDEE)

4.1 Historical Resources

National Register of Historic Place (NRHP) listed and eligible structures and historic districts are protected under Section 106 of the National Historic Preservation Act and Section 4(f). Cultural resource data was obtained from the NeSHPO History Nebraska database. Based on the data provided, no historic structures that are eligible for listing on the NRHP exist within the environmental study area

4.2 Section 4(f) and Section 6(f) Land and Water Conservation Fund Properties

Section 4(f) applies to projects undertaken by the Department of Transportation and requires consideration of park, recreation, refuge, and historic areas. Section 6(f) of the Land and Water Conservation Fund (LWCF) prohibits the conversion of property acquired or developed with these grants without the approval of the Department of the Interior's National Park Service.

No wildlife refuges or management areas were identified within the environmental study area. Current mapping identified several parks, trails, and recreation areas within the study area. These include:

- Dakota City Cemetery
- Cottonwood Cove Park
- Beermann Park
- Lundberg Field (also a Section 6(f) property)
- Sportsmanship Field
- Jim Cahill Memorial Trail
- Old Dane Golf Club

It was determined that there are Section 6(f) properties within Dakota City; however, they are either outside or lack adjacency to the environmental study area and no impacts are anticipated to these properties.

4.3 Floodplain and Wetlands

The proposed environmental study area is outside FEMA designated 100-year and 500-year floodplains or floodways exist within the environmental study area as shown in **Figure 5**. In accordance with the USFWS National Wetland Inventory (NWI), there is an intermittent seasonally flooded streambed feature within the environmental study area, and several wetland features are located within the surrounding area, including the Missouri River. This is shown in **Figure 6**.

4.4 Soils and Prime Farmland

According to the Web Soil Survey, five mapped soil units were identified within the environmental study area as shown in **Figure 7**:

- Owego silty clay, occasionally flooded
- Albaton silty clay, 0 to 2 percent slopes, occasionally flooded
- Haynie silt loam, 0 to 2 percent slopes, occasionally flooded
- Luton silty clay, thin surface, rarely flooded
- Modale silt loam, occasionally flooded

Four of the five mapped soil units are classified as hydric soils except for Modale silt loam, occasionally flooded. Prime farmland was identified within environmental study area; therefore, if the future project would convert farmland to a nonagricultural use it would be subject to the Farmland Protection Policy Act. Furthermore, additional coordination would be required with the USDA as well as an analysis of the farmland conversion impact rating.

4.5 Hazardous Materials

Existing data collected from the NDEE GIS web portal, known regulated material releases and aboveground and underground storage tanks indicates that there are several known releases of regulated materials and storage tanks within and around the environmental study area.

Figure 5: FEMA Floodplains

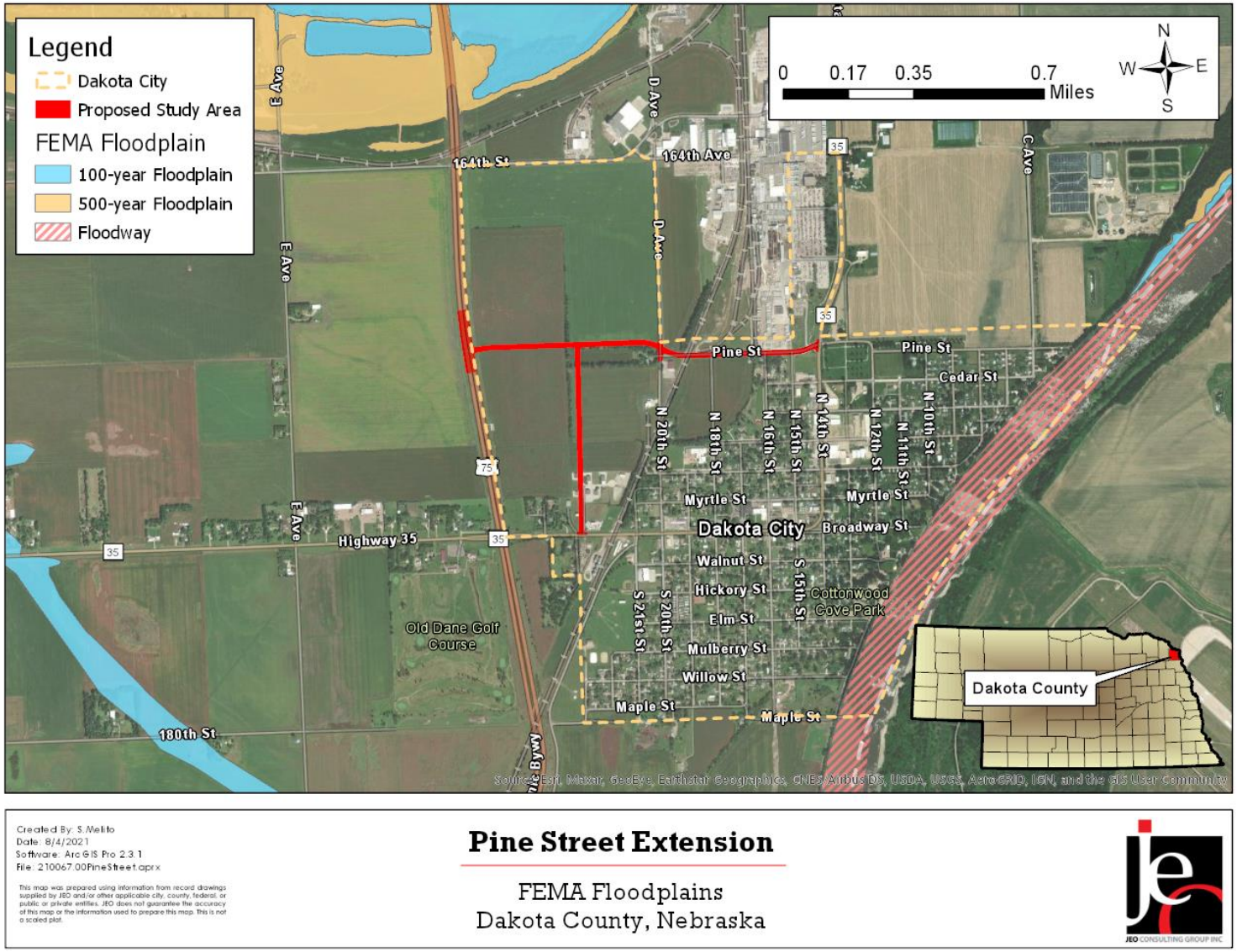


Figure 6: National Wetlands Inventory

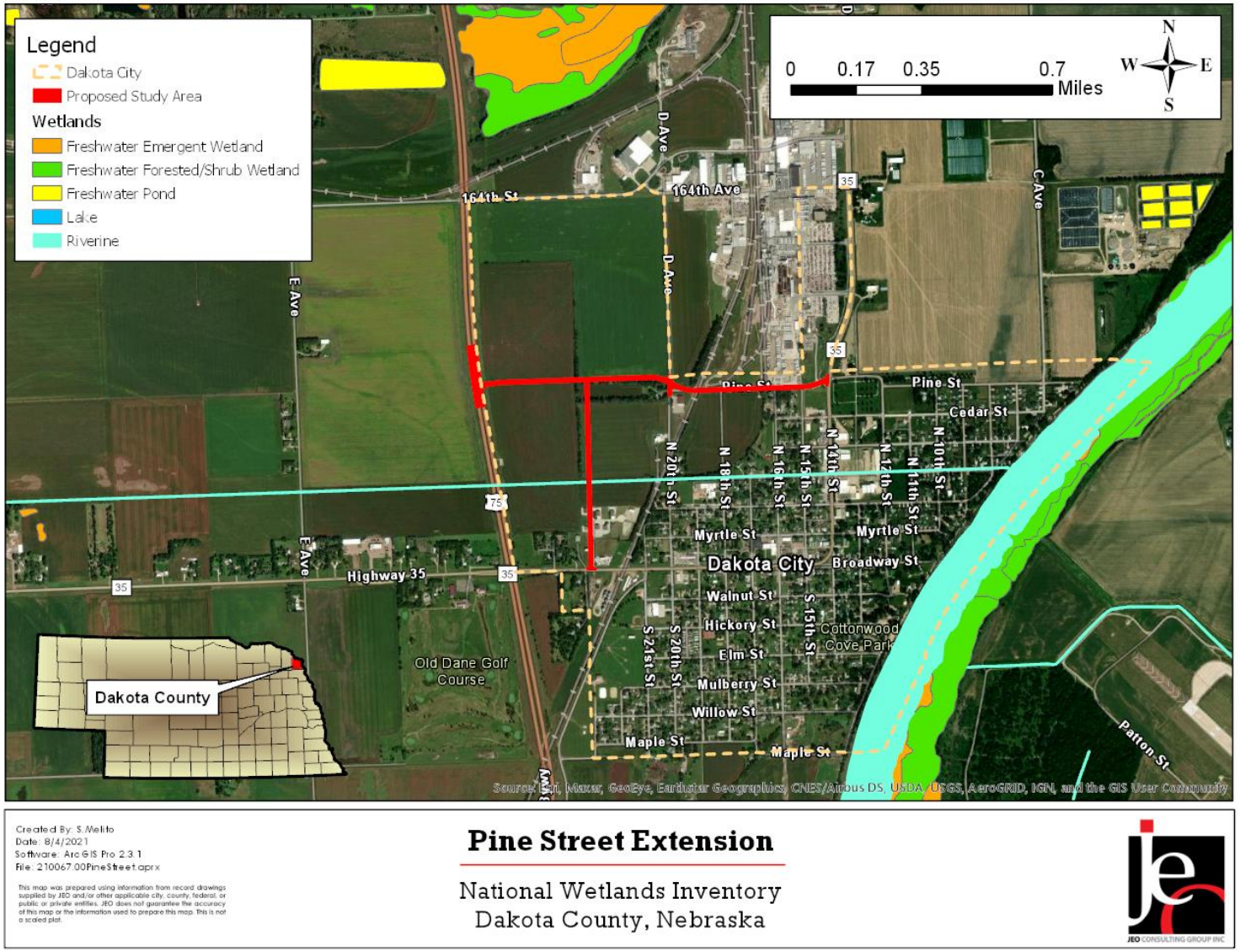
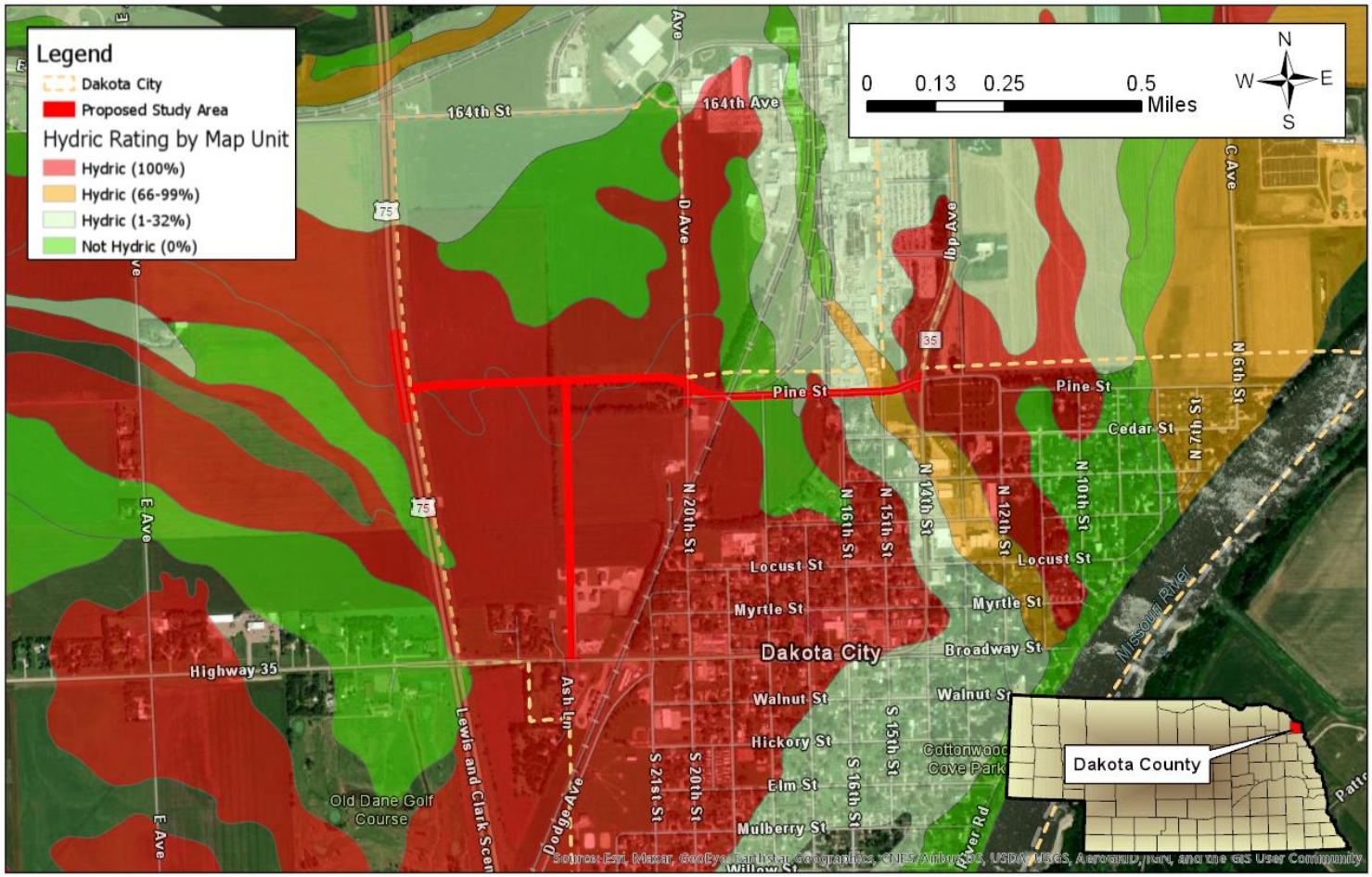


Figure 7: Hydric Soil Rating



Created By: S.Mellito
Date: 8/4/2021
Software: ArcGIS Pro 2.3.1
File: 210067.00PineStreet.aprx

This map was prepared using information from record drawings supplied by JEO and/or other applicable city, county, federal, or public or private entities. JEO does not guarantee the accuracy of this map or the information used to prepare this map. This is not a scaled plat.

Pine Street Extension

Hydric Soil Rating Map
Dakota County, Nebraska

5.0 Future Alternative Network Development

This section of the study discusses the development of the future street network. The evaluation of this future system presents potential geometric and operational changes due to the Pine Street Extension; trip generation estimates to and from the future developments, site trip assignment, and development of buildout traffic volumes within the study area.

5.1 Street Network

A concept of the Pine Street Extension and surrounding network is shown in **Figure 8.** This concept shows improvements to the following areas:

- US 75 & Pine Street Extension | Intersection Improvement
- Pine Street – Highway to 20th Street | Roadway Construction
- 23rd Street – N-35 to Pine Street | Roadway Construction
- Pine Street – 20th Street to Dakota Avenue | Roadway Reconstruction

5.2 Traffic Volumes

The standard travel demand modeling (TDM) process as laid out in the Institute of Transportation Engineers (ITE) Traffic Engineering Handbook, 7th Edition is four steps including trip generation, trip distribution, mode choice and trip assignment. This model is used to estimate future travel demand. In the context of this study, the mode choice process will be omitted due to limited non-vehicle trips. Furthermore, travel demand will be estimated only for the AM and PM weekday peak hours. The following sections describe the methodology of each process and results of the analysis.

Figure 8: Proposed Future Network Concept

5.2.1 Trip Generation

Trip generation activity in the vicinity of the Pine Street corridor were further developed to evaluate future growth impacts of traffic. The trip generation calculations at the site were derived from expected development in proximity of the proposed Pine Street Extension. According to the SIMPCO LRTP, this includes 145 acres of industrial park development. It was assumed the 10 percent of the total developable area would be used for the building footprints. This resulted in a total of 632 thousand square feet of Gross Floor Area (GFA) for industrial park use. Following ITE Trip Generation Manual, 10th Edition methodology, the trip generations of this development for the peak hour of a typical weekday are shown in **Table 4** and **Table 5.**

Table 4: AM Weekday Peak Hour Trip Generation

ITE Land Use Code	Usage	#	Trip Generation		Directional Dist			External Trips	
			Unit	Rate	In	Out	Total	In	Out
130	Industrial Park	632	1000 SF GFA	0.4	81%	19%	253	205	48
---	JST Global	23	Trucks/Day	---	50%	50%	4	4	4
---	JST Global	8	Emp/Shift	1	100%	0%	8	8	0
Total:							**269**	**217**	**52**

Table 5: PM Weekday Peak Hour Trip Generation

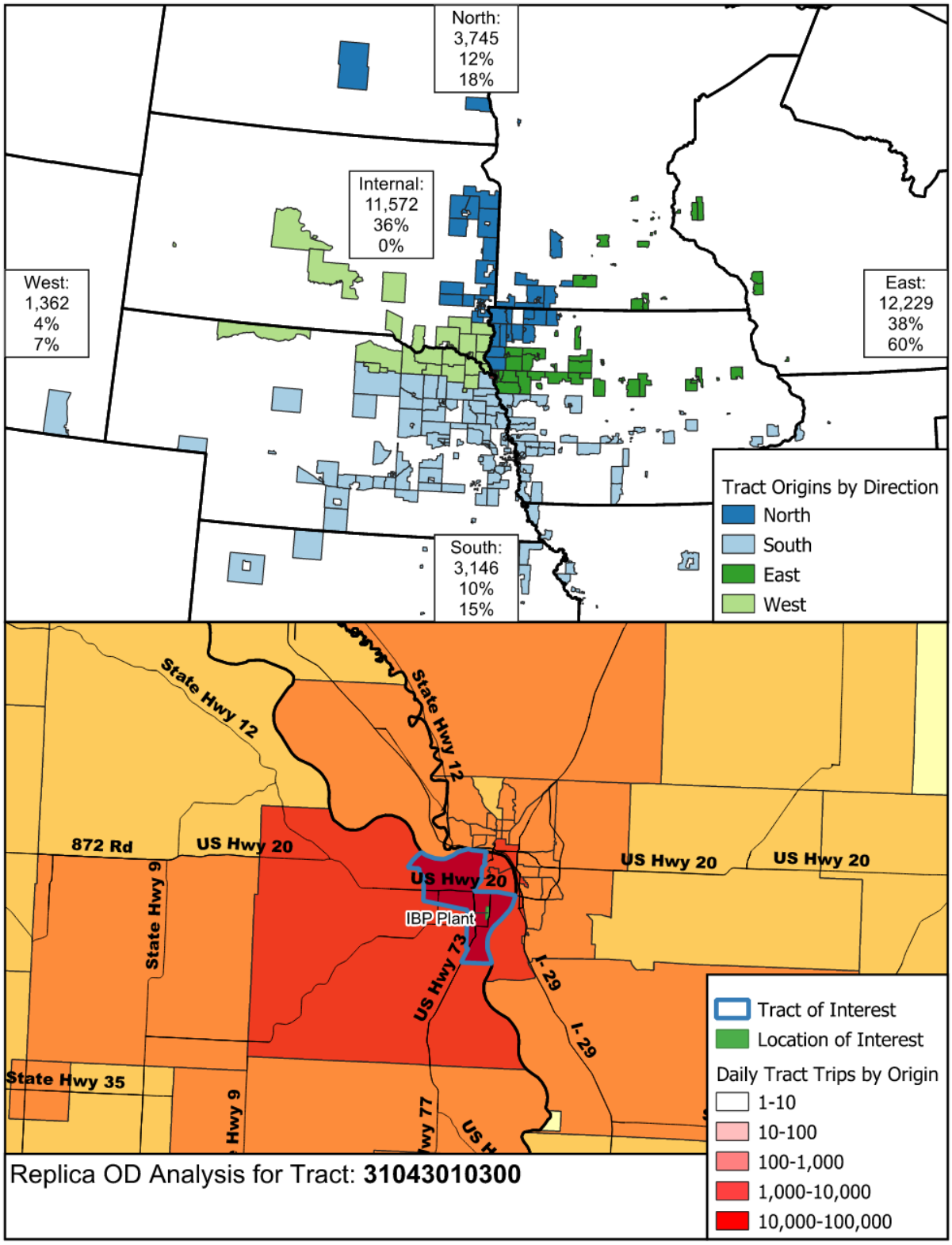
ITE Land Use Code	Usage	#	Trip Generation		Directional Dist			External Trips	
			Unit	Rate	In	Out	Tot	In	Out
130	Industrial Park	632	1000 SF GFA	0.4	21%	79%	253	53	200
---	JST Global	23	Trucks/Day	---	50%	50%	4	4	4
	JST Global	8	Employees/Shift	1.00	0%	100%	8	0	8
Total:							**269**	**57**	**212**

5.2.2 Trip Distribution

Trip patterns for vehicles expected to utilize the proposed Pine Street Extension were established using Replica data. This data incorporates various mobile location data calibrated against traffic location counts to produce trip origin and destination pairs for a region. The smallest aggregate zone available through this product is the US Census Tract. Running this analysis produced a regional map of trips which arrived in the Dakota census tract. Grouping trips by cardinal direction are shown in **Figure 9**.

This analysis shows that 36 percent of all trips occur within the census tract. Excluding these trips, 60 percent of the trips originate to the east, primarily from Iowa but also including some regional origins elsewhere. Only 15 percent of external trips originate from the south. These southern trips come primarily from Nebraska and the southern half of

Figure 9: Travel Patterns to Dakota Tract by Cardinal Direction Including Internal Trips and Excluding Internal Trips



Iowa but also includes limited trips from other neighboring states and regional areas. Trips from the west constitute only 7 percent of external trips. These originate from tracts in northern Nebraska and South Dakota. Considering the proximity of the Tyson plant to the I-129 interchange with Dakota Avenue, only trips originating to the south and west were considered likely to utilize the Pine Street Extension.

5.2.3 Trip Assignment

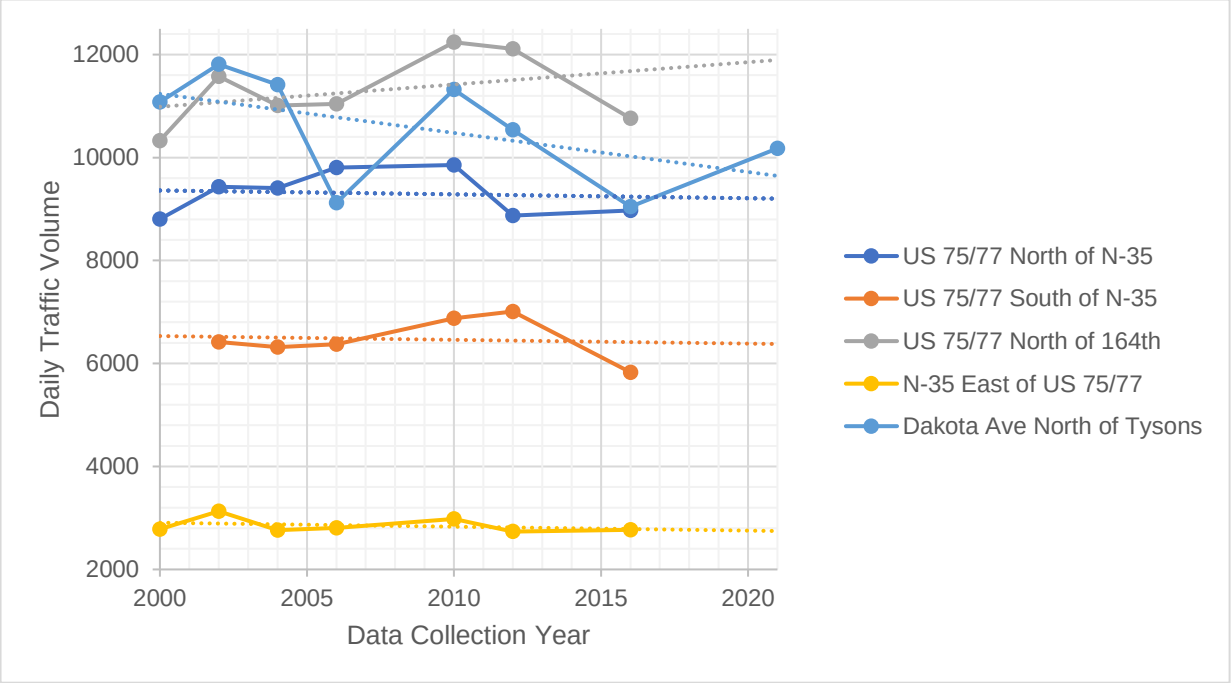
Trip assignment is the process of assigning trips based on their origin and destination onto specific links of the transportation network and further breaking those down into individual intersection turning movement volumes. A more detailed view of trip assignments conducted for the project is shown in **Appendix II**.

In addition to the trip assignment for newly generated trips, existing trips were rerouted along the proposed Pine Street Extension. Projected traffic volumes were utilized to evaluate the number of trips. It was assumed that among existing trips to/from Dakota City, 25 percent of trips from the north and 25 percent of trips from the south will utilize the Pine Street Extension. This assumption is based on the geographic distribution of the city relative to the Pine Street and N-35/Broadway Street.

5.2.4 Background Growth Rates

In addition to the trips generated by the site, future traffic scenarios will include some level of background traffic volume. Two data sources were used to determine traffic growth rates. The first is historic traffic volumes as collected by NDOT. Historic data from the year 2000 – 2016 is available for various roadway segments around the study area as shown in **Figure 10.**

Figure 10: Historic Changes in Regional Daily Traffic Volumes



Historic traffic volumes show generally flat traffic volume growth for most of the sample volume sites. For the most recent data period, only the site north of Tyson on Dakota Avenue had a full day of data collected, the remaining sites had data collected only from 7am – 6pm via NDOT counts.

The second data source is change in local population. According to the US Census Bureau the city of Dakota City, NE experienced a compound annual growth rate (CAGR) of 0.58 percent from 2000 to 2010; however, preliminary results of the 2020 census show a -0.30 percent CAGR decrease.

Although local population and traffic remains relatively steady, the Siouxland region experienced a 1.33 percent CAGR increase from 2000 to 2020 according to the SIMPCO LRTP. Considering all these factors a 0.5 percent growth rate was used for this project as a reasonable projection of future traffic conditions. Future 2045 traffic volumes without additional site generated trips are shown in **Figure 11.** Future 2045 traffic volumes including the site generated trips previously described are shown in **Figure 12.**

Figure 11: 2045 Baseline Turning Movement Traffic Volumes – AM (PM)

Figure 12: 2045 Full-Build Turning Movement Traffic Volumes – AM (PM)

6.0 Future Conditions Analysis

The future conditions analysis was conducted to evaluate capacity constraints and identify proper typical section requirements for new streets. Signalized and unsignalized intersection operations and queue capacity analyses were completed for the study area following methodology consistent from prior **Section 2.8**.

6.1 Capacity Analysis

The results of the capacity analysis is shown below in **Table 6.** This analysis indicates that most intersections will operate at LOS D or better except for the US-75 & 164th Street and the Dakota Avenue and Tyson Entrance (signalized) intersection during the both the Baseline and Full-Build scenarios. More detailed reports are found in **Appendix III**.

Table 6: Baseline & Full-Build 2045 Intersection LOS (Delay, Sec)

Intersection Name	AM		PM	
	Baseline	Full-Build	Baseline	Full-Build
US-75 & N-35	B(12)	B(13)	B(11)	B(12)
US-75 & Pine Street	B(11)	B(13)	B(11)	B(12)
US-75 & 164th Street	C(20)	D(34)	D(31)	E(43)
Pine Street & 20th Street/D Avenue	A(9)	A(10)	A(10)	B(10)
Dakota Street & Pine Street	B(12)	B(13)	B(14)	C(18)
Dakota Avenue & Tyson South Ent.	B(13)	B(12)	E(37)	E(44)
Dakota Avenue & Tyson Signal Ent.	A(2)	A(2)	A(9)	A(9)

Key: LOS D – LOS E – LOS F

6.2 Traffic Mitigation Strategies

The US-75 & 164th Street intersection experiences the greatest delay for the eastbound direction as shown below in **Table 7.** Further measures to improve LOS are unjustified due to limited traffic volumes as shown in **Figure 11** and **Figure 12**. Additionally, review of crash data did not yield requirements for improvements. According to the NDOT Nebraska Transportation Information Portal (NTIP) The intersection experienced 16 reported crashes from 2016-2020 for an average crash rate of 0.8 crashes/Million Entering Vehicles (MEV) based on NDOT 2016 AADT data.

Table 7: 2045 Movement LOS (Delay, Sec) for US-75 & 164th Street

Movement	AM		PM	
	Baseline	Full-Build	Baseline	Full-Build
Northbound	A(0)	A(0)	A(0)	A(0)
Southbound	A(1)	A(2)	A(2)	A(2)
Eastbound	C(20)	D(34)	D(31)	E(43)
Westbound	B(10)	B(11)	B(13)	B(15)

The Dakota Avenue and Tyson South Entrance experiences the greatest delay on the west approach leg (eastbound traffic) during afternoon shift changes at the Tyson plant. These conditions are experienced during only a short period of the day, but nonetheless presents operations and safety challenges due to the large volumes of vehicles involved. During the peak hour from 2:30pm – 3:30pm the west leg approach carries nearly 500 vehicles (over a third of the total daily vehicles on this leg). However, The NDOT NTIP shows the intersection experienced 9 reported crashes from 2016-2020 for an average crash rate of 0.67 crashes/MEV. This rate is low relative to an average crash rate for similar intersections. Considering the relatively low 35 mph speed limits, low mainline traffic, and highly concentrated peak hour traffic interval, this motorist-developed dual left-turn movement operates efficiently but is unconventional as an unsignalized intersection.

While outside the scope of this planning study, this intersection should be monitored, and a stand-alone signal warrant evaluation should be conducted pending any other on-site changes anticipated with traffic patterns in the near-term. While traffic signal control can be warranted based upon peak-hour warrants as presented in the MUTCD, signals can often result in decreased safety based upon sporadic schedule of operations at locations like this. Other options for staggered traffic release or connectivity to existing signals could be further explored.

In similar fashion, the existing signalized Tyson entrance should have more detailed operational analysis reviewed and identification of signal system needs evaluated. Due to the current motorists using this location with dual left-turn operations, the west leg (eastbound) approach should be implemented with required markings, lane use designations, and signal displays for dual left-turn operations.

6.3 Roundabout Implementation

The intersection of Pine Street and 20th/D Street presents an alignment challenge as the existing Pine Street terminates immediately opposite of a residential parcel. As shown previously in **Figure 8,** the simplest approach would be to skew the intersection to run north of the existing property, avoiding conflicts with driveway access and more substantial property impacts. However, this skew would introduce lane alignment issues traversing east-west and present challenges for turning traffic at the intersection as well. This alignment would introduce potential sight distance concerns for vehicles on Pine Street to see other vehicles turning from 20th/D Street. The sight distance concerns would be especially problematic for heavy vehicles entering the intersection.

One option to largely mitigate these issues would be to construct a single lane roundabout at this intersection. The traffic volumes are sufficiently below thresholds for installation required to simply reduce delays or congestion; however, a roundabout would improve the intersection's safety and geometrics while also accommodating heavy vehicle traffic through use of a truck apron and central island. This option could also mitigate potential larger-scale ROW issues and project impacts by allowing the offset roadway alignment east-west, while implementing robust operations and traffic control via a roundabout.

6.4 Pedestrian Facility Implementation

Given the proximity to residential zoning and existing trail network, sidewalk facilities are recommended along the Pine Street extension and enhancements. These improvements could be located on the south side of Pine Street extending west from 20th Street and connecting east into the trail network near Dakota Avenue.

Additionally, the trail crossing near the Dakota Avenue and Pine Street intersection should be moved to the east directly parallel to Dakota Avenue. The location of a mid-block crossing offset too far from the intersection defeats motorist expectations, provides poor crossing lighting as well as presents general safety issues. The realignment of the sidewalk nearer to the intersection will mitigate those issues.

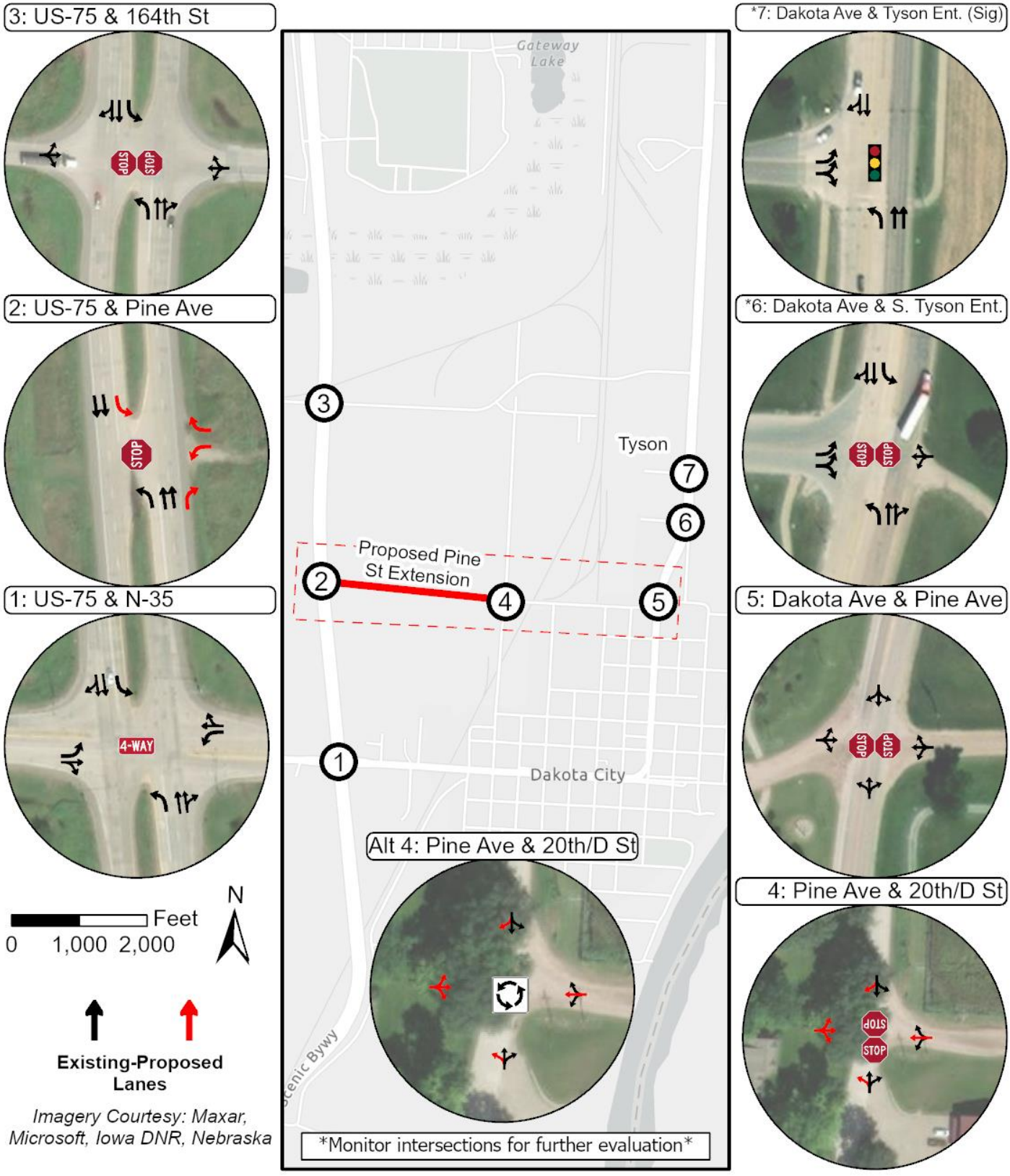
7.0 Pine Street Corridor Implementation

The configuration of the proposed Pine Street enhancement and extension between US-75 and 20th St/D Street was determined based on the traffic volumes from **Section 5.2** and capacity analysis from **Section 6.**

The expected traffic volumes during the AM and PM peak hours for future build can be accommodated with a two-lane roadway cross-section along Pine Street. A rural, concrete cross-section with lane widths and pavement designed for the expected truck traffic should be implemented. The intersection with US-75 & Pine Street would require improvements upon a new connection. These improvements include a minimum of lengthening the existing southbound left-turn lane and implementation of a northbound right-turn lane. Due to the high-speed nature of traffic along US-75, and this current expressway facility status, NDOT may desire to implement other intersection controls. Presently, NDOT is further evaluating Restricted Crossing U-Turn (RCUT) type intersections for at-grade expressway intersections to improve safety. Variations of this intersection solution at the Pine Street and US-75 intersection would need to be confirmed with NDOT during design.

A summary of the proposed lane configurations to be implemented with the Pine Street improvement and at study area intersections is shown in **Figure 13**. The proposed lanes in the figure are shown in red. Additionally, A bubble at the bottom of the figure indicates a proposed alternative for a roundabout at the intersection of Pine Street and 20th St/D Street.

Figure 13: Proposed Lane Configuration for Full-Build Conditions



7.1 Planning Level Opinion of Probable Cost

Based upon the analysis and proposed lane geometry of the Pine Street improvements and extension, a high-level (planning) opinion of probable cost was developed for the project. These costs are in current dollars and do not include unknowns associated with further right-of-acquisition or detailed site constraints to be further evaluated during preliminary design. The opinion of probable cost is illustrated in **Table 8** below.

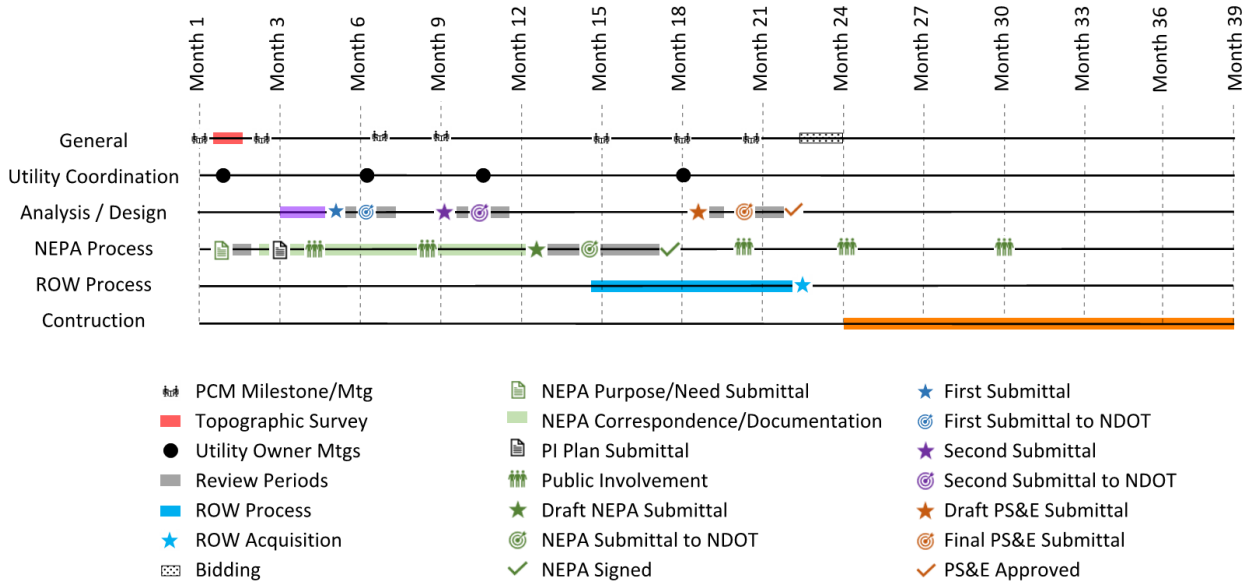
Table 8: Opinion of Probable Project Costs

Pine Street Improvement: US-75 to Dakota Avenue			
Item	**Description**	**Cost**	
1	Mobilization	$	271,950
2	Paving	$	2,750,000
3	Utilities	$	595,000
4	Signing/Marking/RR	$	395,000
5	Misc. (seeding/sodding/silt)	$	80,000
6	Temporary Traffic Control	$	65,000
7	Contingency (20%)	$	831,390
	Subtotal	$	4,988,340
8	PE Design/NEPA	$	498,834
9	Construction Engineering	$	498,834
	Total	**$**	**5,986,008**

7.2 Potential Project Implementation Schedule

A preliminary project implementation schedule was developed based upon anticipated project needs and a standard design/construction timeframe. Source of funds (Federal Aid) and specific project requirements associated with elongated environmental review and/or right-of-way acquisition needs could cause changes to the items below. A proposed project implementation schedule is illustrated in **Figure 14** below.

Figure 14: Project Implmentation Schedule



8.0 **Recommendations**

Following the results of the previous existing conditions, environmental and future conditions analyses, the following recommendations are proposed for the study area. The supporting study sections are listed in **Table 9** together with the proposed year for implementation.

Table 9: Recommendations

#	Recommendation	Sect.	Year
1	Conduct detailed signal warrant and operational analysis study at the intersections of Dakota Avenue and Tyson driveways to evaluate the requirements for dual left-turn lane infrastructure.	2.1.7, 2.1.8, 6.2	Present
2	Perform full environment analysis of roadway as needed following preliminary analysis from this study.	4	Design Stage
3	Maintain two-way stop control at the intersection of Pine Street and Dakota Avenue.	6.1	Present-2045
4	Consider installing sidewalk along the Pine Street enhancements from 20th Street to Dakota Avenue. Additionally, relocate trail crossing along Pine Street closer to the intersection with Dakota Avenue.	2.3, 6.4	Design Stage
5	Proposed Pine Street expansion and enhancements should have a two-lane cross-section between US-75 and Dakota Avenue.	6.1, 7	Design Stage
6	Evaluate final roundabout geometrics and associated right-of-way cost comparisons at intersection of Pine Street and 20th/D Street.	6.3	Design Stage
7	Proposed intersection of US-75 & Pine Street should have dedicated left and right turn lanes installed on the east leg of the intersection and a dedicated right turn lane installed on the south approach. The existing southbound left-turn lane on US-75 should be lengthened. In addition, coordination with NDOT is recommended during preliminary programming and design to determine any changes to reduced conflict intersection configurations.	6.1	Design Stage
8	Retain existing lane configuration and traffic control at intersection of US-75 and 164th Street.	6.2	Present-2045

Key: Near Term Analysis Pine Street Project Continued Monitoring