



# SD42 Western Minnehaha County Corridor Study



December 2016

In conjunction with  
Minnehaha County, the City of Sioux Falls, the Sioux Falls MPO and the FHWA



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# **South Dakota Highway 42 Western Minnehaha County Corridor Study**

**December 2016**

**Prepared for**

**South Dakota Department of Transportation**

**Prepared by**



SRF No. 01509040



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# 1.0 Introduction

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The South Dakota Department of Transportation's (SDDOT) pavement management system has identified the portion of SD 42 from the McCook/Minnehaha County Line to SD 17 for either a major rehabilitation or reconstruction project within the next eight years. Figure 1 displays the limits of the study from the McCook/Minnehaha County Line to Ellis Road.

A contributing factor, in addition to the roadway condition, to conducting the study at this time is the corridor's role as a connector from rural areas west of Sioux Falls to 12th Street – the primary east-west route into and through town. As development in many parts of the City continues, volumes along the SD 42 corridor west of town are expected to increase as more travelers are drawn to the area. In addition, residential and commercial development is anticipated to occur along many arterial corridors, including SD 42. Figure 2 displays the increment and location of household and employment development anticipated in the corridor between 2015 and 2040, which was prepared as part of the Sioux Falls MPO 2040 Long Range Transportation Plan.

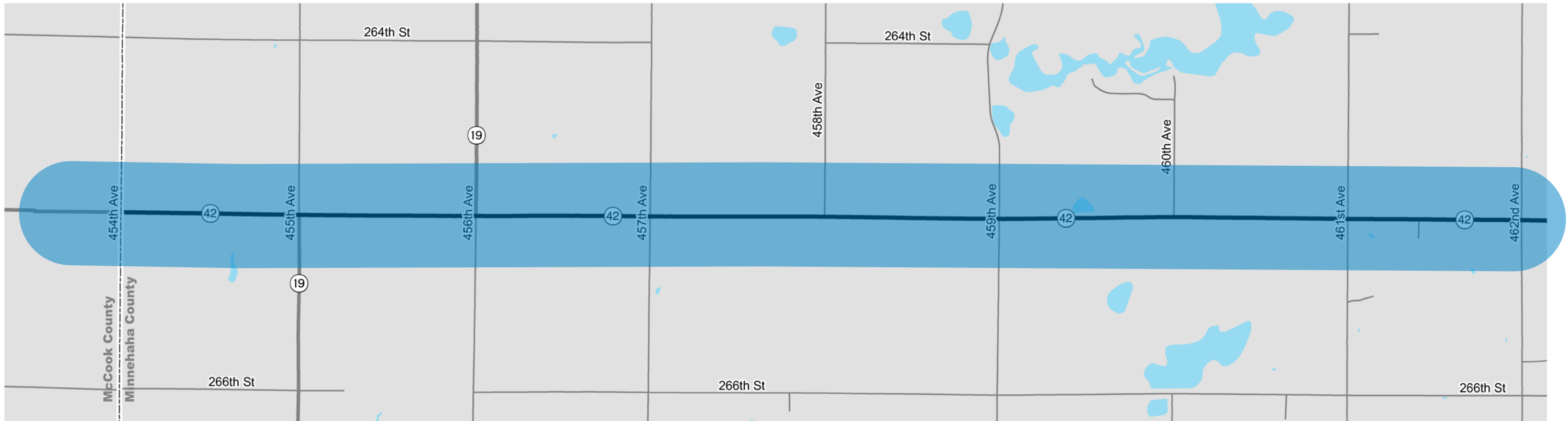
SD 42 from the Sioux Falls city limits to west of County 151 has been identified in the Minnehaha County Comprehensive Plan as an area where future development is anticipated to occur. In the plan, the area adjacent to Wall Lake, including the intersection of SD 42/463rd Avenue (County 151), has been identified as a rural service area. Within rural service areas commercial, residential, and possibly industrial development to serve the rural community. Higher density development, relative to other rural areas of the county, will likely occur at the junction of major routes, such as SD 42 and 463rd Avenue (County 151). Anticipated future development along the corridor influences the need to address the needs along SD 42.

Within the study limits the SDDOT and the City of Sioux Falls share responsibility for maintenance and improvement of SD 42. Currently, Ellis Road forms the dividing line, with the SDDOT being responsible for segments to the west and the city is responsible for areas to the east.

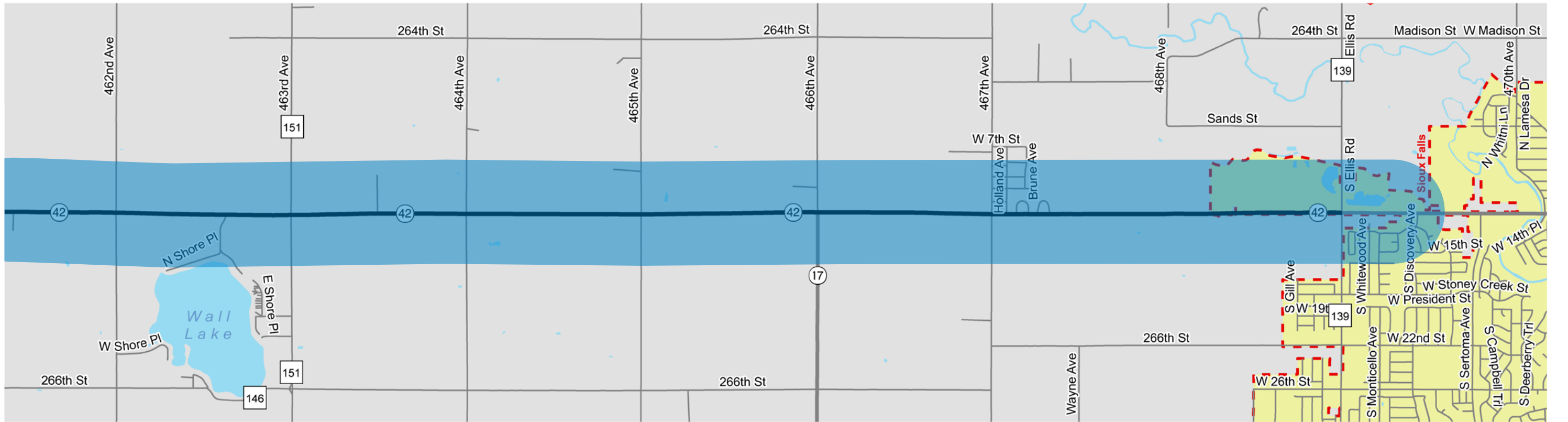
Given the corridor's proximity to the Sioux Falls metropolitan area, it is prudent to:

- Evaluate alternatives to ensure an appropriate roadway cross-section at both intersections and segments is provided to accommodate the anticipated transportation system users for the duration of the service life of the rehabilitated or reconstructed pavement.
- Develop a plan for intersection control based on peak period traffic volumes, vehicle classification (i.e., heavy commercial vehicles), and crash history.
- Identify appropriate locations for public and private access.

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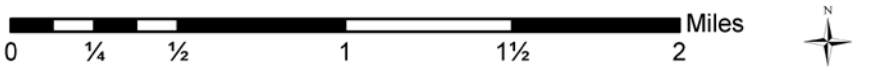


Western Segment



Eastern Segment

 - 1/4 Mile Study Limits



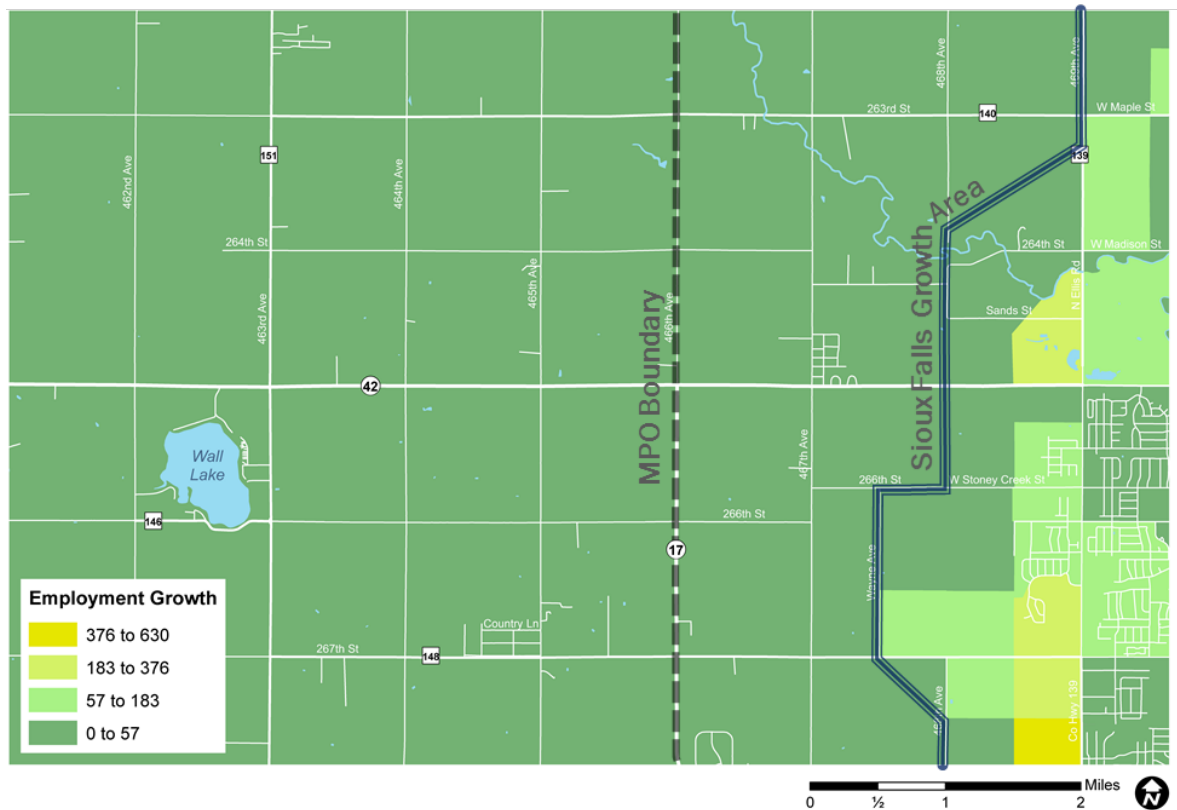
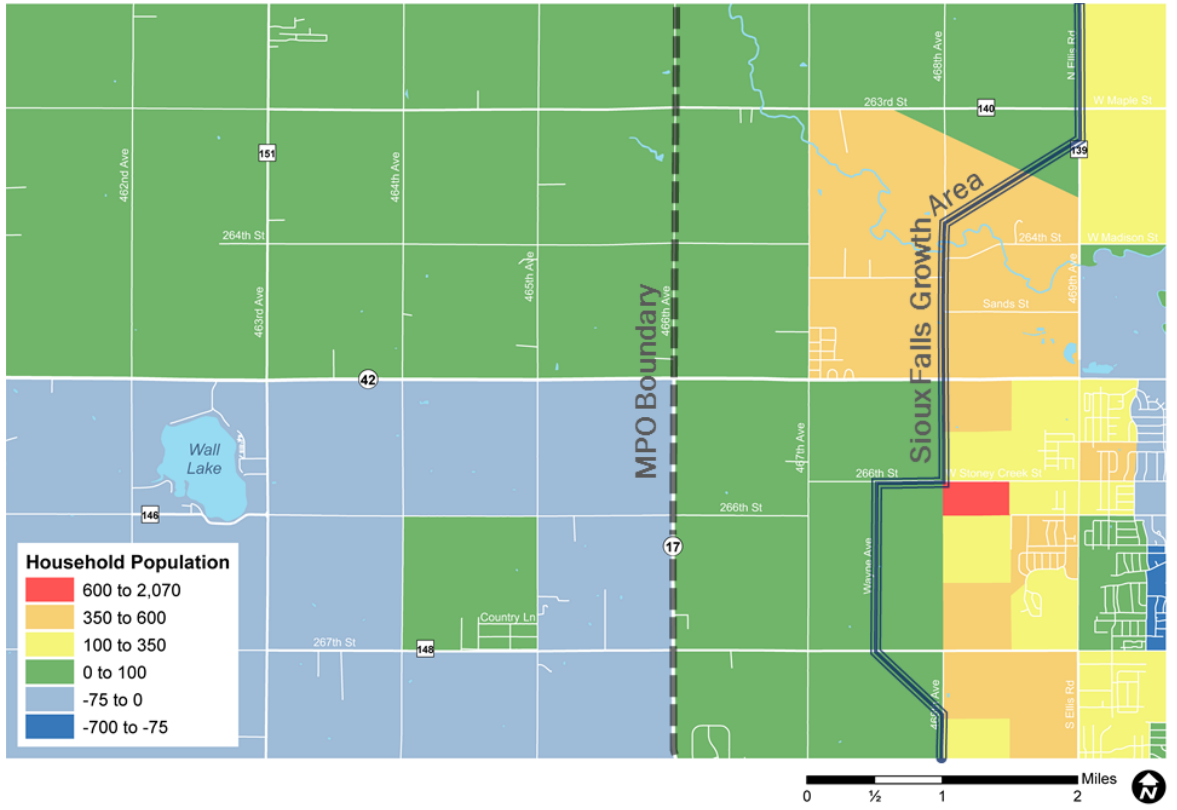
SD 42 Western Minnehaha County Corridor Study

SD 42 Study Limits

Figure 1

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**Figure 2. Sioux Falls MPO – Projected Household and Employment Growth (2015 – 2040)**



## 1.1 Study Approach

The study includes determining the future traffic demand of the corridor and developing conceptual designs for the SD 42 corridor necessary to safely accommodate the projected traffic demand at an acceptable level of service.

As such, the study is expected to fulfill the following objectives for the SD 42 corridor:

1. Complete a list of transportation issues and needs facing the SD 42 corridor within the designated study limits.
2. Develop feasible solutions to address the issues and needs that meet current design standards and/or traffic level of service expectations under both the current and predicted future traffic conditions, while promoting a livable community that will enhance the economic and social well-being of all users of the corridor.
3. Create final products for use by Minnehaha County, the City of Sioux Falls, Sioux Falls MPO and the SDDOT which will provide guidance to implement recommended improvements and react to future development plans within the area.

## 2.0 Existing Conditions

---

The following sections outline the data collection, roadway characteristics, crash review, access inventory, and capacity analysis conducted as part of the existing conditions analysis.

### 2.1 Data Collection

To understand current conditions along the study corridor, various data collection efforts were conducted to gather current and historical information on:

- Traffic volume and vehicle classification.
- Travel speeds.
- Intersection geometrics and traffic control.
- Crashes by location, type, and severity.
- Access locations and density for both public and private purposes.

### 2.2 Traffic Volumes

Weekday morning and evening peak period turning movement counts were collected by SRF the week of November 16, 2015 at the following intersections along the corridor:

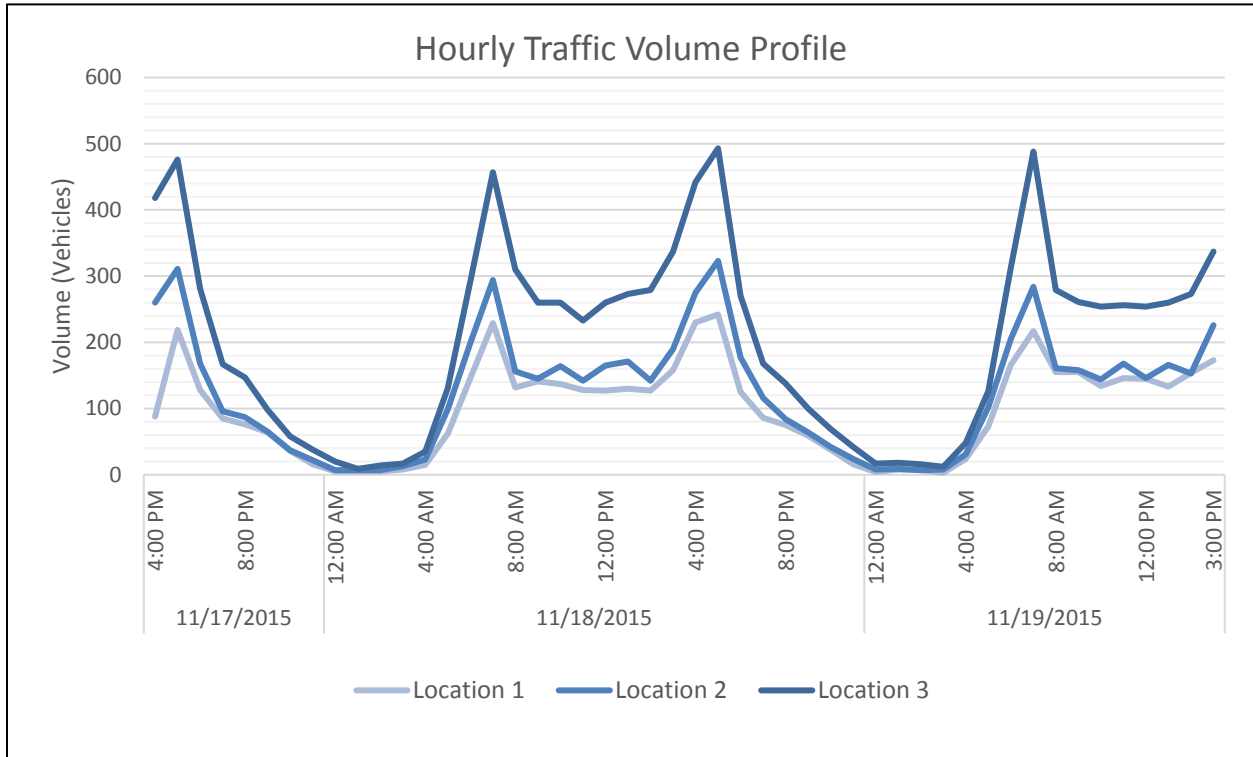
- Ellis Road
- West Lakeside Drive
- South Cherry Lake Avenue
- North Holland Avenue
- 467th Avenue
- 466th Avenue (SD 17)
- 463rd Avenue (County 151)
- 459th Avenue (County 159)
- 456th Avenue (SD 19 North)
- 455th Avenue (SD 19 South)

In addition to the intersection turning movement counts, road tubes were placed at three locations along the study corridor to obtain a daily traffic volume profile, vehicle classification information, and speed information. The three locations were chosen to achieve a representative sample of the entire corridor, and were positioned between the following cross streets:

- Location 1: Between 454th Avenue and 455th Avenue (SD 19 South)
- Location 2: Between 458th Avenue and 459th Avenue (County 159)
- Location 3: Between North Holland Avenue and South Cherry Lake Avenue

The road tubes were positioned according to the South Dakota Department of Transportation (SDDOT) criteria, and data was collected for approximately 48 hours. Data collection occurred during the same week as the intersection turning movement counts. Figure 3 represents the traffic volume profile by hour for the three locations along the corridor. Historical average daily traffic (ADT) volumes within the study area were also provided by the SDDOT.

**Figure 3. SD 42 Hourly Traffic Volume Profile**



### 2.3 Low Volume Cross Routes

Intersections where staff collected morning and evening turning movements represent the traffic critical intersections in the study area, which means they are the locations where either current and/or future traffic may warrant adding through lanes, turn lanes, or changing the intersection control (e.g. going from two-way stop on the cross route to all-way stop). Along the corridor in the study area there are an additional eight section line roads intersecting SD 42 where current volume is less than 100 vehicles per day and where minimal traffic growth is anticipated. All of these routes are located west of 466th Avenue and represent low volume roads where:

- Current and future 2045 turning volumes from/to SD 42 would not warrant turn lanes.
- The single approach lane to SD 42 would provide adequate capacity to reasonably accommodate current and/or 2045 traffic.
- Stop signs on the cross route would provide adequate traffic control without unacceptable delay in the current and future peak conditions.



Based on the information provided above, the low-volume cross routes were not included in the current year or 2045 peak hour traffic operations as it was assumed acceptable operations could be maintained through at least 2045. Additionally, a statement that acceptable operations can be maintained through 2045 with current intersection geometrics and control was included in the Intersection Alternatives described in Chapter 5. The low volume cross routes are:

- 457th Avenue
- 458th Avenue
- 460th Avenue
- 461st Avenue
- 462nd Avenue
- 464th Avenue
- 465th Avenue

## 2.4 Vehicle Classification

As previously mentioned, the road tubes were set with the intent to also collect vehicle classification information. The Federal Highway Administration (FHWA) Vehicle Classifications criteria was used, and is shown in Table 1. Classification numbers 4 through 13 are considered heavy vehicles. 0 presents the daily vehicle classification counts at each of the three data collection locations, as well as the overall corridor average. The data in Table 2 was used to produce an average vehicle classification summary for the corridor, which is presented in Figure 4. Based on the collected information, heavy vehicles represent approximately 10 percent of the vehicles traveling on SD 42.

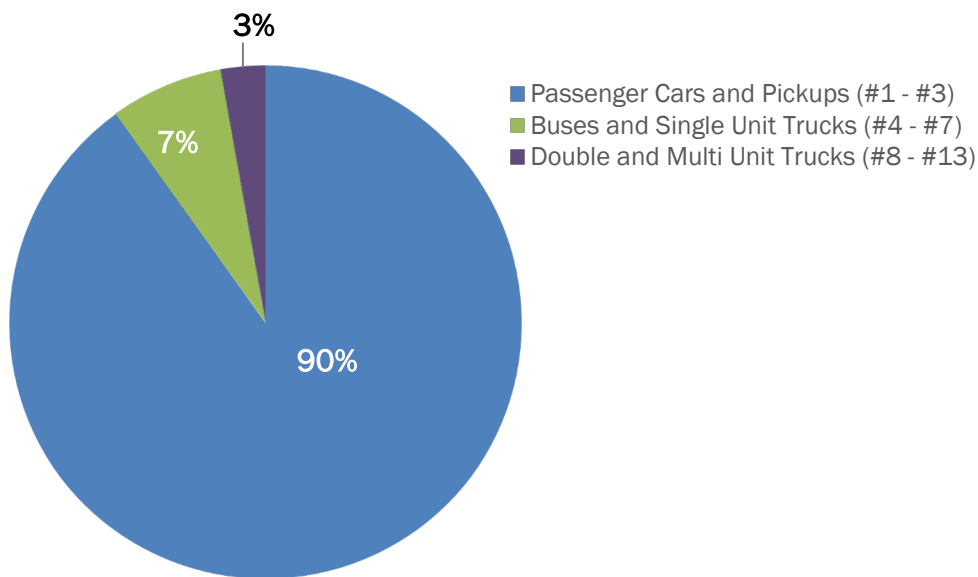
**Table 1. FHWA Vehicle Classifications**

Classification Category	Vehicle Description	Classification Category	Vehicle Description
#1	Motorcycles – 2 axles	#8	Double Unit – 4 axles or less
#2	Passenger Cars – 2 axles	#9	Double Unit – 5 axles
#3	Pickup Trucks, Vans – 2 axles	#10	Double Unit – 6 axles or more
#4	Buses – 2 or 3 axles	#11	Multi-Unit – 5 axles or less
#5	Single Unit – 2 axles, 6 tires	#12	Multi-Unit – 6 axles
#6	Single Unit – 3 axles	#13	Multi-Unit – 7 axles or more
#7	Single Unit – 4 axles or more		

**Table 2. Vehicle Classification by Location**

Location	Classification Category													Total
	Passenger Car/Pickup			Bus/Single-Unit Truck				Double/Multi-Unit Truck						
	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	
Location 1	5	1,498	635	46	116	3	2	105	4	1	1	1	3	2,420
Location 2	2	1,799	951	38	150	2	1	84	1	1	0	0	0	3,029
Location 3	4	2,800	1,484	59	291	12	6	73	3	1	2	0	2	4,737
Average	4	2,032	1,023	48	186	6	3	87	3	1	1	0	2	3,395

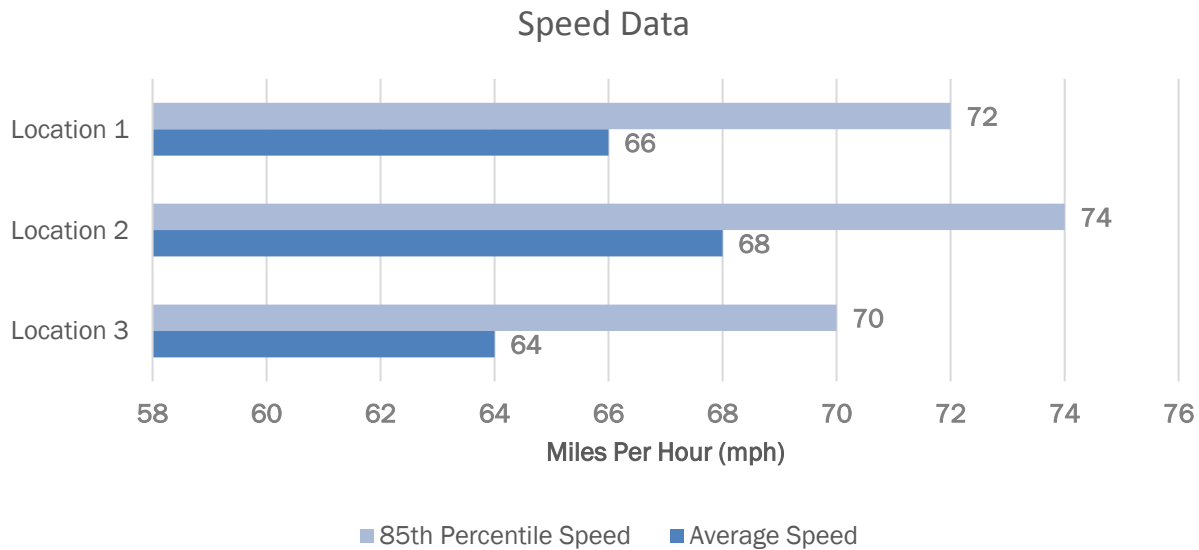
**Figure 4. SD 42 Percentage of Total Vehicles by Vehicle Classification (All Locations)**



## 2.5 Travel Speeds

Vehicular speed data was also collected at the three locations along the corridor. Figure 5 represents a summary of the data collected, which indicates the average observed speeds ranged from 64 to 68 mile per hour (mph), while the 85th percentile speed ranged from 70 to 74 mph. The posted speed limit along the corridor at the three collected locations is 65 mph.

**Figure 5. SD 42 Speed Data Summary**



Note: The posted speed limit in each location was 65 mph. Location 3 was within 1,200 feet of the speed transition to 55 mph.

## 2.6 Roadway Characteristics

In addition to traffic data collection, the following observations were completed to identify roadway characteristics within the study area (i.e., roadway geometry, posted speed limits, and traffic controls).

### 2.6.1 South Dakota Highway 42

SD 42 is a two-lane undivided rural highway that transitions into a three-lane undivided urban roadway with a two-way left-turn lane (TWLTL). This transition occurs as the highway approaches Sioux Falls, approximately one-third mile west of South Cherry Lake Avenue. SD 42, west of the transition, is classified as a rural minor arterial and has a posted speed limit of 65 mph. The portion of the highway that is east of the transition is classified as an urban principal arterial, and has a posted speed limit of 55 mph. The posted speed limit changes to 45 mph as the corridor approaches Ellis Road. The geometry of SD 42 changes to a four-lane undivided urban roadway east of the SD 42/Ellis Road intersection.

Throughout the study area an eight to nine foot wide shoulder is located on the north and south side. The wider, nine foot, shoulder is located west of Ellis Road.

There are no sidewalks along SD 42 in the study area, or along the intersecting cross routes to/from SD 42 in the study area.

### 2.6.2 Cross Routes

SD 19 is a two-lane undivided minor arterial that has a north and south split. SD 19 North is also called 456th Avenue, while SD 19 South is also called 455th Avenue. Ellis Road is a two-lane undivided

minor arterial with turn lanes. County 159, County 151, and SD 17 are classified as major collector roadways. SD 42 is the north terminus of SD 17. The other roadways within the study area are classified as local roadways and are primarily, with the exception of West Lakeside Drive and South Cherry Lake Avenue, constructed as gravel roadways.

### 2.6.3 Intersection Traffic Control

All study intersections have side-street stop control except the SD 42/Ellis Road and SD 42/463rd Avenue (County 151) intersections. The SD 42/Ellis Road intersection is signalized, and the SD 42/463rd Avenue (County 151) intersection has all-way stop control.

## 2.7 Traffic Operations Analysis

Two capacity analyses were conducted to quantify current operations. These analysis focused on both a high-level planning analysis for the corridor, as well as a detailed intersection capacity analysis. The following information summarizes the capacity analyses conducted for the existing conditions.

### 2.7.1 Corridor Operations Analysis

Based on the combination of road tube data and turn movement counts performed by SRF in November 2015, traffic volumes along the study segment of SD 42 range from 2,425 to 5,800 vehicles per day (vpd). Table 3 provides a method to evaluate roadway capacity. For each facility type, the typical planning-level AADT capacity ranges are listed. These volume ranges are based on guidance from the Highway Capacity Manual and incorporate professional engineering judgment. A range is used since the maximum capacity of any roadway design is a theoretic measure that can be affected by its functional classification, traffic peaking characteristics, access spacing, speed, and other roadway characteristics.

**Table 3. Planning-Level Roadway Capacities by Facility Type**

Facility Type	Daily Capacity Ranges (AADT) *
Two-lane undivided urban	8,000 - 10,000
Two-lane undivided rural	14,000 - 15,000
Three-lane urban (two-lane divided with turn lanes)	14,000 - 17,000
Four-lane undivided urban	18,000 - 22,000
Five-lane urban (four-lane divided with turn lanes)	28,000 - 32,000
Four-lane divided rural	35,000 - 38,000

\* Derived from the Highway Capacity Manual 2000

West of the TWLTL transition, SD 42 is a two-lane undivided rural roadway with an ADT volume ranging from 2,425 to 4,750 vpd. East of the transition, SD 42 is a three-lane urban undivided roadway with a TWLTL and an ADT volume ranging from 4,750 to 5,800 vpd. Based on the data presented in Table 3, both of these segments provide sufficient capacity to accommodate current traffic volumes.

## 2.7.2 Intersection Capacity Analysis

An existing intersection capacity analysis was completed to establish baseline conditions to which future traffic operations can be compared. The capacity analysis was completed for the a.m. and p.m. peak hours at the study intersections. The study intersections were analyzed using Synchro/SimTraffic software (V8.0), which is based on the Highway Capacity Manual 2010 (HCM 2010).

Capacity analysis results identify a Level of Service (LOS), which indicates the quality of traffic flow through an intersection. Signal, all-way stop control, and roundabout intersections are assigned a measure from LOS A through LOS F based on the level of delay in seconds experienced per vehicle. Thresholds associated with each letter grade category are shown in Table 4. LOS A indicates the best traffic operation, with vehicles experiencing minimal delays. LOS F indicates an intersection where demand exceeds capacity, or a breakdown of traffic flow. The SD 42 study area includes segments and intersections inside and outside the Sioux Falls urban area. The level of service guidelines as identified in the SDDOT Design Manual are as follows:

- Urban: Desirable LOS – C; Minimum LOS – D
- Rural: Minor Arterial in area of level or rolling terrain – LOS B

**Table 4. Level of Service Criteria for Signalized and Unsignalized Intersections**

<b>LOS Designation</b>	<b>Signalized Intersection Average Delay/Vehicle (seconds)</b>	<b>Unsignalized Intersection and Roundabout Average Delay/Vehicle (seconds)</b>
A	≤ 10	≤ 10
B	> 10 - 20	> 10 - 15
C	> 20 - 35	> 15 - 25
D	> 35 - 55	> 25 - 35
E	> 55 - 80	> 35 - 50
F	> 80	> 50

For two-way stop control conditions, special emphasis is given to providing an estimate for the level of service of the side-street approach. Traffic operations at an unsignalized intersection with two-way stop control were described in two ways. First, consideration was given to the overall intersection level of service. This takes into account the total number of vehicles entering the intersection and the capability of the intersection to support the volumes. This provides a comparison to other intersections along the corridor and helps understand impacts associated with a lack of left-turn lanes.

Second, it is important to consider the delay on the minor approach. Since the mainline does not have to stop, the majority of delay is attributed to the side-street approaches. It is typical of intersections with higher mainline traffic volumes to experience high levels of delay (i.e., poor level of service) on the side-street approaches, but an acceptable overall intersection level of service during peak hour conditions. Therefore, the delay and level of service for the worst minor road approach is considered for two-way stop controlled intersections.

Results of the existing intersection capacity analysis shown in Table 5 indicate that all study intersections currently operate at an overall LOS B or better during a.m. and p.m. peak hours with the existing geometric layout and traffic control. Minor queuing issues were observed on the northbound leg at the SD 42/Ellis Road intersection during the a.m. peak hour, where the northbound through 95th percentile queue distance extends beyond the entrance to the left-turn lane. The average northbound approach delay is approximately 22 seconds (LOS B). Given that the SD 42/Ellis Road intersection is planned to be reconstructed, no mitigation was assumed at this time. All reported delay and LOS is based on the HCM analysis. Detailed traffic operation results are provided in the Appendix.

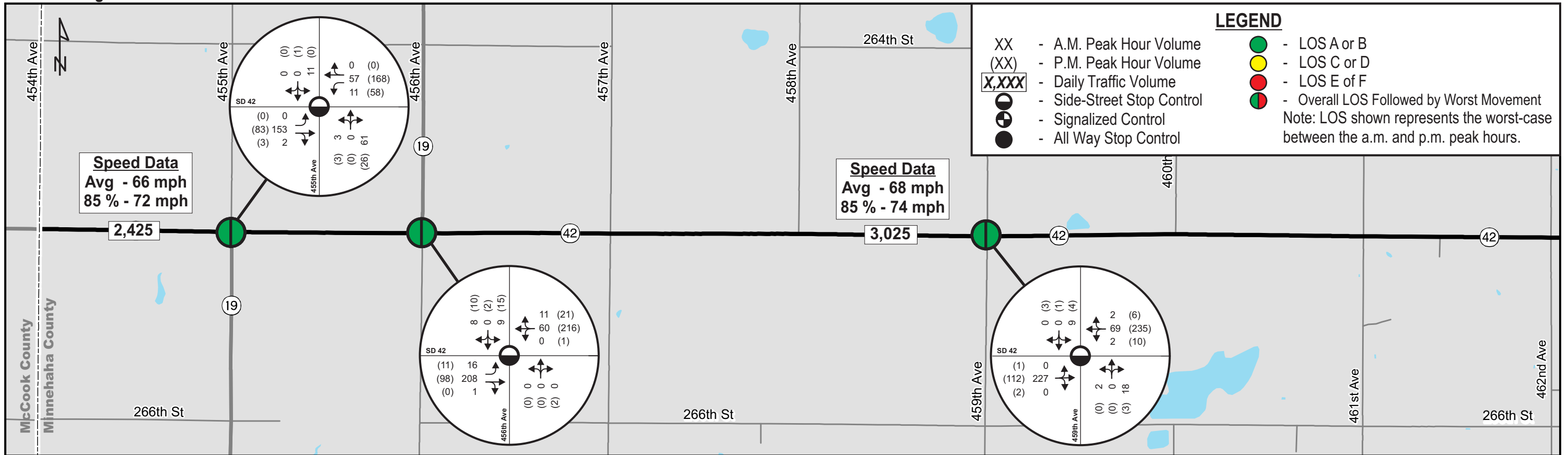
**Table 5. Existing Peak Hour Capacity Analysis – Critical Intersections**

SD 42 Intersection	Level of Service (Delay)	
	AM Peak Hour	PM Peak Hour
455th Avenue (SD 19 South) <sup>(1)</sup>	A/B (11 sec.)	A/B (12 sec.)
456th Avenue (SD 19 North) <sup>(1)</sup>	A/B (10 sec.)	A/B (11 sec.)
459th Avenue (County 159) <sup>(1)</sup>	A/B (11 sec.)	A/B (11 sec.)
463rd Avenue (County 151) <sup>(2)</sup>	A (10 sec.)	B (11 sec.)
466th Avenue (SD 17) <sup>(1)</sup>	A/B (13 sec.)	A/C (16 sec.)
467th Avenue <sup>(1)</sup>	A/B (14 sec.)	A/B (13 sec.)
North Holland Avenue <sup>(1)</sup>	A/B (12 sec.)	A/B (13 sec.)
South Cherry Lake Avenue <sup>(1)</sup>	A/B (13 sec.)	A/B (14 sec.)
West Lakeside Drive <sup>(1)</sup>	A/B (12 sec.)	A/B (12 sec.)
Ellis Road	B (16 sec.)	B (13 sec.)

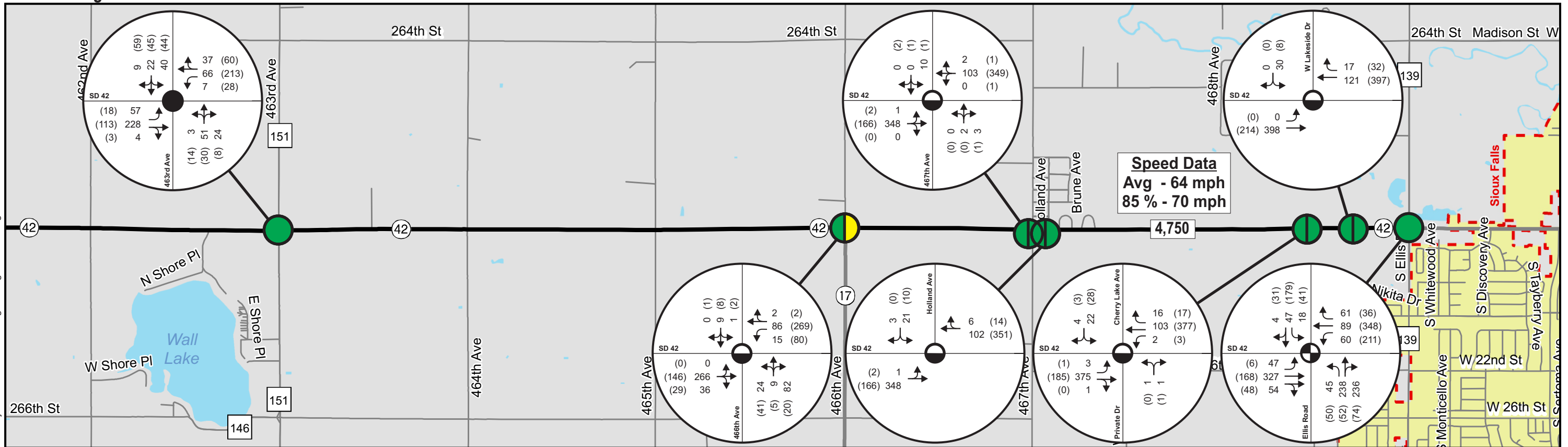
- (1) Indicates an unsignalized intersection with cross-street stop control where the overall LOS is shown followed by the worst approach LOS.
- (2) Indicates an unsignalized intersection with all-way stop control.

Figure 6 displays the existing geometrics, traffic controls, speed data, volumes, and traffic operations within the study area.

**Western Segment**



**Eastern Segment**



H:\Projects\090000\9040\TSP\Figures\Figure 4-Existing Conditions



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### 2.7.3 Sight Distance Evaluation

A sight distance analysis, in conformance with guidelines of American Association of State Highway and Transportation Officials (AASHTO), was performed along the SD 42 mainline and for cross route public and private access points. Speed observations recorded during the data collection task were used to calculate the required stopping sight distance (SSD) and intersection sight distance (ISD).

SSD is the distance required for a vehicle approaching an intersection from either direction to perceive, react, and come to a complete stop without colliding with the exiting vehicle from a driveway or minor street. Within the study limits there are two locations where desirable distances assuming a 70 mph design speed are not satisfied:

- A quarter mile east of 461st Avenue
- 300 feet east of Lakeside Drive/1,000 feet west of Ellis Road

ISD is the distance that is based on the time required for perception, reaction and completion of the desired critical exiting maneuver (in this case, a left turn) once the driver on a minor street approach or driveway decides to enter the mainline corridor. Calculation for the critical ISD includes the time to complete the following maneuvers:

- Turn left, and clear the near half of the intersection without conflicting with the vehicles approaching from the left.
- Upon turning left, to accelerate to the operating speed of the roadway without causing approaching vehicles on the main road to unduly reduce their speed.

Review of the corridor did not identify any intersection sight distance deficiencies.

## 2.8 Corridor Access Locations and Density

To determine the existing level of access along the SD 42 corridor, an access inventory was compiled. Results of the access inventory are presented in Table 6 and Figure 7. In addition to the study intersections previously mentioned, other access locations along the corridor include frontage roads and minor roadways, residential and commercial driveways, and farm fields. The SD 42 corridor (from SD 19 South to Ellis Road) is approximately 15 miles in length and has a total of approximately 200 access locations. Access spacing along the corridor ranges from approximately 50 feet up to one-half mile. The access density also varies along the corridor, with more dense access near Ellis Road.

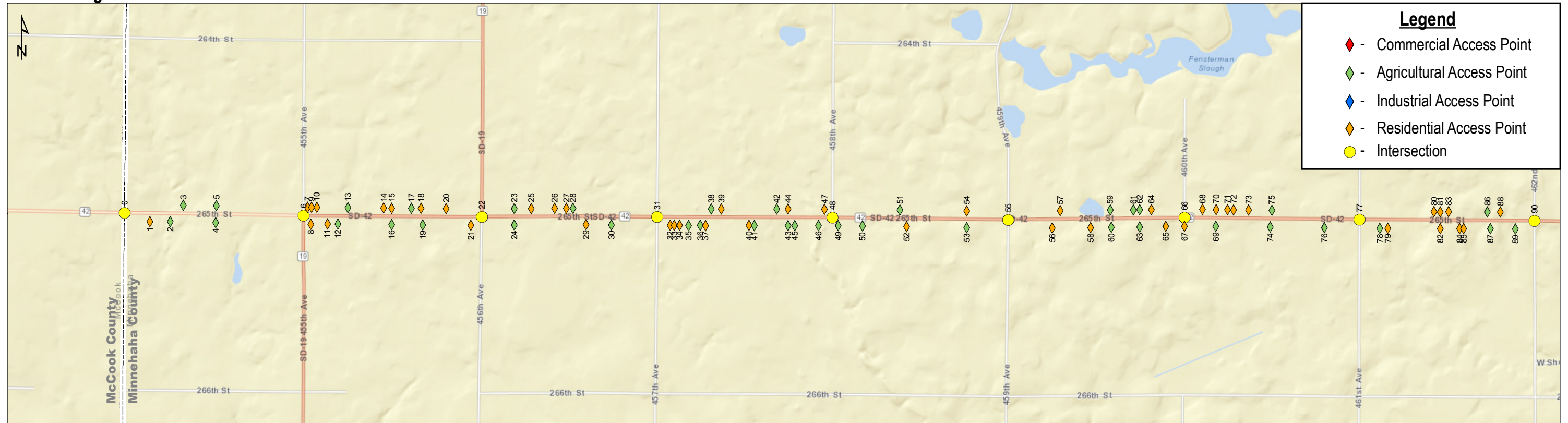
**Table 6. Access Locations Per Mile**

SD 42 Segment	Access Points	
	North Side	South Side
454th Avenue to 455th Avenue (SD 19 South)	3	4
455th Avenue (SD 19 South) to 456th Avenue (SD 19 North)	10	7
456th Avenue (SD 19 North) to 457th Avenue	6	4
457th Avenue to 458th Avenue	6	12
458th Avenue to 459th Avenue (County 159)	3	5
459th Avenue (County 159) to 460th Avenue	6	6
460th Avenue to 461st Avenue	7	4
461st Avenue to 462nd Avenue	6	8
462nd Avenue to 463rd Avenue (County 151)	10	5
463rd Avenue (County 151) to 464th Avenue	8	5
464th Avenue to 465th Avenue	4	3
465th Avenue to 466th Avenue (SD 17)	4	4
466th Avenue (SD 17) to 467th Avenue	3	3
467th Avenue to 468th Avenue	19	5
468th Avenue to Ellis Road	7	26
Total	102	101

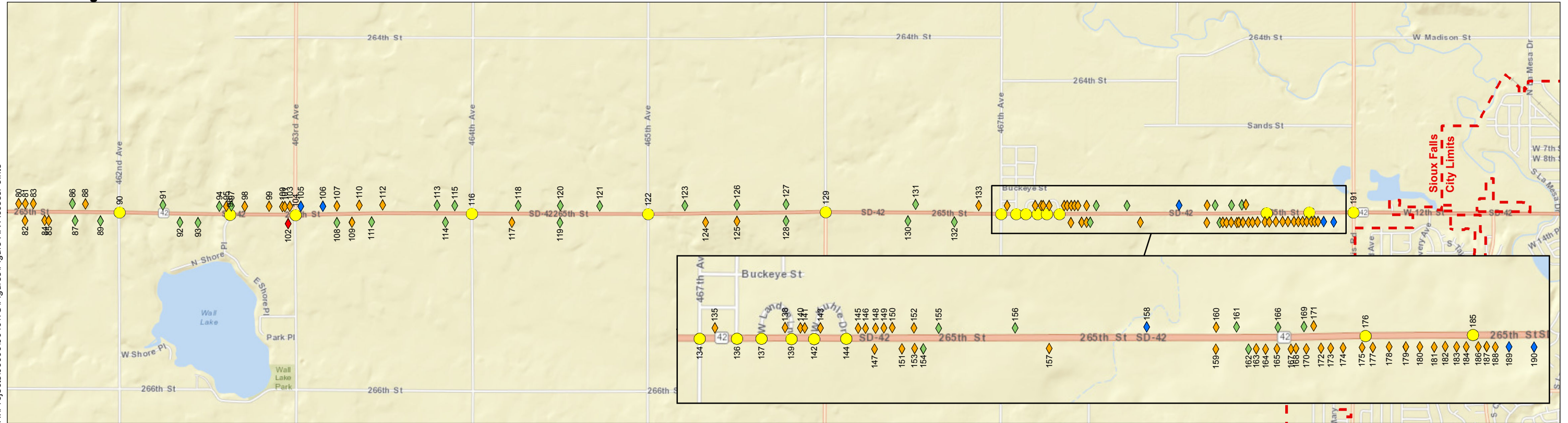
The South Dakota Access Location Criteria (see *SDAR Chapter 70:09:02 Appendix A*) classifies roadways for access management. Based on the criteria, SD 42 would have an access class of rural and urban fringe. The urban fringe would be the portion of roadway that has a TWLTL, while the rural portion would be the remainder of the corridor. Both rural and urban fringe classes have the same requirements for access spacing and density.

The unsignalized access spacing should be a minimum of 1,000 feet and the access density should be no more than five (5) accesses per side per mile. Rural minimum spacing, however, may be reduced to 660 feet by the area engineer. Therefore, as future development occurs, it is important to review existing access locations for potential closures to meet guidelines and justify that any new access allowed will not be detrimental to the existing roadway. Furthermore, as opportunities arise, existing access should be reviewed to determine if access consolidation is feasible.

**Western Segment**



**Eastern Segment**



H:\Projects\09000\040\T\Figures\Figure XX-AccessPoints



**SD 42 Western Minnehaha County Corridor Study**

South Dakota 42 Public and Private Access Points

**Figure 7**

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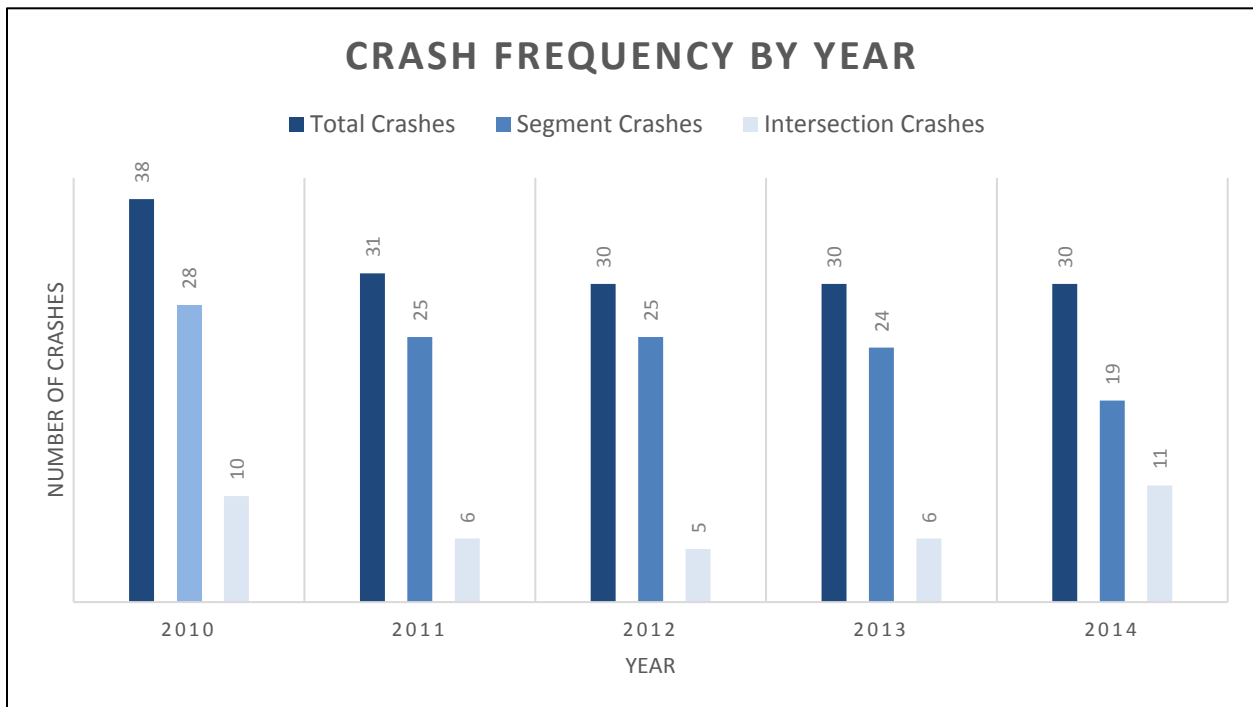
## 2.9 Crash Analysis

### 2.9.1 Current Data and Analysis

Crash data was provided by the SDDOT from January 1, 2010 through December 31, 2014, which represents the most recent five-year period available. This data was used to characterize current conditions and trends, and as critical inputs to *Highway Safety Manual (HSM) Predictive Method* model used to predict future crashes in the corridor. Field data for the SD 42 corridor was used as a basis for adjusting default values incorporated into the model. The crash frequency by year, with respect to total corridor, segment, and intersection crashes is presented in Figure 8. The crash type with the corresponding year is displayed in Figure 9.

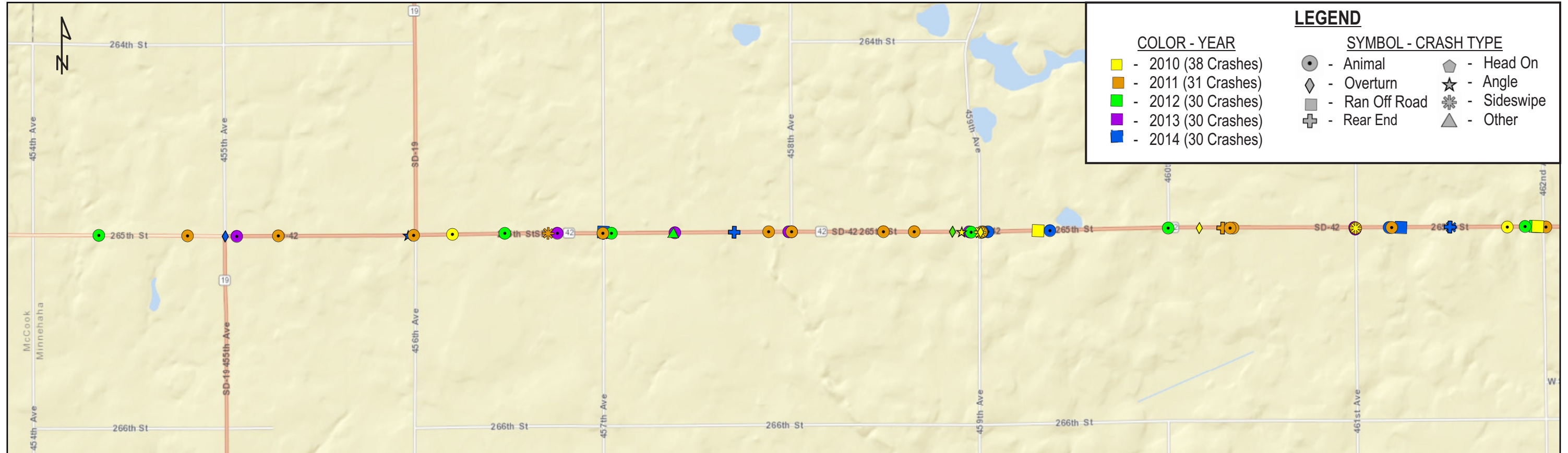
For analysis purposes, the five-year crash period was condensed to the most recent three-year period, resulting in an analysis period from January 1, 2012 through December 31, 2014. This reduction was based on guidance within the *HSM Predictive Method*. The data indicates there were a total of 90 crashes reported over the three-year analysis period within the study area (i.e., 30 crashes per year). Reported crashes occurring at study area intersections and segments over the analysis period are summarized in Table 7 and Table 8, respectively.

**Figure 8. SD 42 Crash Frequency**

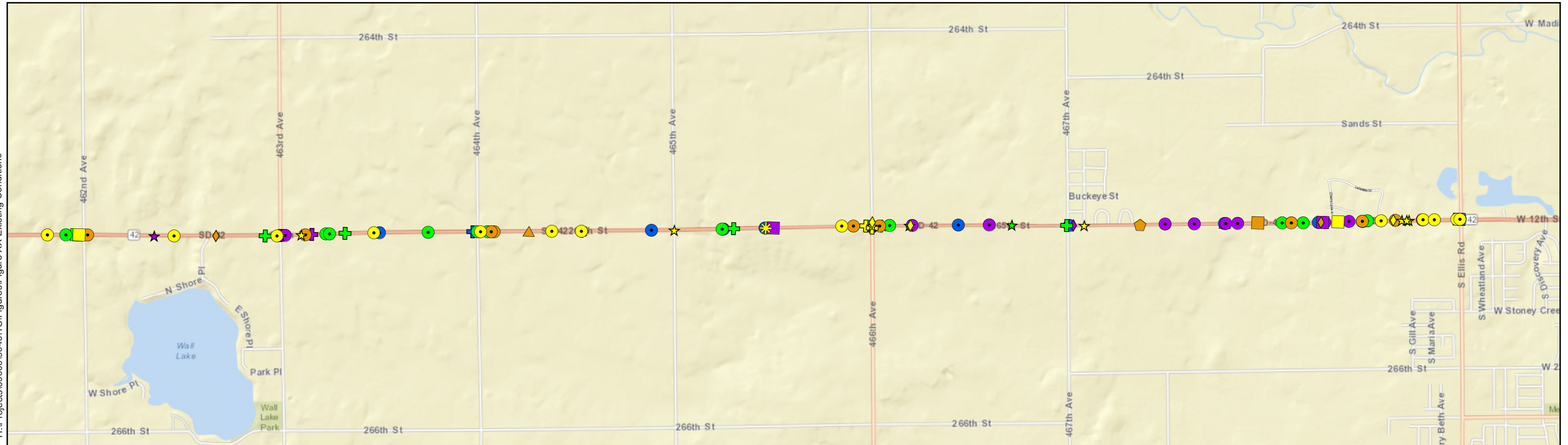


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**Western Segment**



**Eastern Segment**



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**SD 42 Western Minnehaha County Corridor Study**

South Dakota 42 Crash Data (2010-2014)

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January 2016

**Figure 9**

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**Table 7. Crash Summary by Type - Intersections**

SD 42 Intersection	Single Vehicle Crashes				Multiple Vehicle Crashes				Total
	Animal	Over turn	Ran off Road	Other	Angle	Head On	Rear End	Sides wipe	
455th Avenue (SD 19)	-	1	-	-	-	-	-	-	1
456th Avenue (SD 19)	-	-	-	-	-	-	-	-	0
457th Avenue	-	-	1	-	1	-	-	1	3
458th Avenue	1	-	-	-	-	-	-	-	1
459th Avenue (County 159)	-	-	-	-	2	-	-	-	2
460th Avenue	1	-	-	-	-	-	-	-	1
461st Avenue	2	-	-	-	-	-	-	-	2
462nd Avenue	-	-	-	-	-	-	-	-	0
North Shore Road	-	-	-	-	-	-	-	-	0
463rd Avenue (County 151)	-	-	-	-	-	-	2	-	2
464th Avenue	1	-	-	-	-	-	-	-	1
465th Avenue	-	-	-	-	-	-	-	-	0
466th Avenue (SD 17)	3	-	-	-	1	-	-	-	4
467th Avenue	1	-	-	-	-	-	1	-	2
South Cherry Lake Avenue	1	-	-	-	-	-	-	-	1
West Lakeside Drive	-	-	-	-	-	-	-	-	0
Ellis Road	-	-	1	-	-	-	1	-	2
Intersection Totals	10	1	2	0	4	0	4	1	22

**Table 8. Crash Type Summary - Segments**

SD 42 Segment <sup>(1)</sup>	Single Vehicle Crashes				Multiple Vehicle Crashes				Total
	Animal	Over turn	Ran off Road	Other	Angle	Head On	Rear End	Side Swipe	
454th Ave - 455th Ave (SD 19)	1	-	-	-	-	-	-	-	1
455th Ave (SD 19) - 456th Ave (SD 19)	1	-	-	-	1	-	-	-	2
456th Ave (SD 19) - 457th Ave	2	-	-	-	-	-	-	-	2
457th Ave - 458th Ave	3	-	-	1	-	-	1	-	5
458th Ave - 459th Ave (Co 159)	2	1	-	-	-	-	-	-	3
459th Ave (Co 159) - 460th Ave	4	-	-	-	-	-	-	-	4
460th Ave - 461st Ave	-	-	-	-	1	-	-	-	1
461st Ave - 462nd Ave	2	-	2	-	1	-	1	1	7
462nd Ave - North Shore Rd	-	-	-	-	1	-	-	-	1
North Shore Rd - 463rd Ave (Co 151)	-	-	-	-	-	-	1	-	1
463rd Ave (Co 151) - 464th Ave	5	-	-	-	-	-	3	1	9
464th Ave - 465th Ave	2	-	-	-	-	-	-	-	2
465th Ave - 466th Ave (SD 17)	3	-	1	-	-	-	1	-	5
466th Ave (SD 17) - 467th Ave	4	-	-	-	2	-	-	1	7
467th Ave - South Cherry Lake Ave	11	1	1	1	-	-	-	-	14
South Cherry Lake Ave - West Lakeside Dr	1	-	-	1	-	-	-	-	2
West Lakeside Dr - Ellis Rd	2	-	-	-	-	-	-	-	2
Segment Totals	43	2	4	3	6	0	7	3	68

(1) Segment represents South Dakota Highway 42 from west side-street to east side-street.

## 2.9.2 Findings from Current Conditions Crash Analysis

The South Dakota Strategic Highway Safety Plan (SHSP) identifies core performance measures, including the number of fatalities, fatality rate (per vehicle mile of travel), number of serious injuries, and serious injury rate (per 100 million vehicle miles traveled (MVMT)). The following information provides a summary of how reported crashes (between years 2010 to 2014) along the SD 42 study corridor relate to these performance measures:

- 1) Number of Fatalities: One (1)
- 2) Fatality Rate: 0.99 Fatalities per MVMT (the goal identified in the SHSP is 1.55 per MVMT)
- 3) Number of Serious Injuries: Six (6)
- 4) Serious Injury Rate: 5.96 Injuries per MVMT (no goal is identified)

A summary of additional crash statistics includes:

- Crash Severity:
  - 16 percent of the reported crashes were injury crashes.
  - One fatal crash was reported as a run-off-the-road crash, however there was no clear contributing conditions for the crash.
  - Two incapacitating injuries were recorded. One incapacitating injury was the result of hitting a utility pole. Icy road conditions contributed to the crash. Another incapacitating injury was a rollover, in which there were no clear contributing conditions for the crash.
- Animal Crashes:
  - 59 percent of the reported crashes were animal hits.
- Lighting Conditions:
  - 49 percent of the reported crashes occurred in the dark.
- Surface Conditions:
  - 14 percent of the reported crashes occurred in icy or snowy conditions.

## 2.9.3 SD 42 Data Incorporated in the HSM Crash Model

Crash data for the SD 42 corridor are key calibration inputs to the HSM Predictive Method along with existing roadway conditions to establish the base condition for the study area. Using the forecasted 2405 traffic and current SD 42 roadway information, a base condition for the horizon year is also established in the model. The base conditions are then used to estimate future crash frequency and severity and as the basis for evaluating the potential crash effects of different design alternatives. In addition to volume and crash data, other model inputs include lane width, shoulder type/width, grade, curves, superelevation, driveway density, rumble strips, passing lanes, two-way left-turn lanes, roadside design, lighting, an automated speed enforcement. This information is used to help calibrate the model to actual conditions. A detailed description the *HSM Predictive Method* used as part of this study is included in the Appendix.

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## 3.0 Environmental Review

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### 3.1 Overview

Since the project may require approval by the Federal Highway Administration (FHWA), the study must comply with Section 106 of the National Historic Preservation Act of 1966, as amended. Therefore, the purpose of the environmental review is to assess the potential for the project study area to contain significant archaeological sites/historic structures and determine the need for any additional investigations to aid in compliance with Section 106 and other applicable federal and state cultural resources laws. The results of the investigation will also inform an environmental overview being completed for the project in compliance with the National Environmental Policy Act (NEPA).

The potential for adverse impacts associated with the operation and condition concerns along SD 42 were addressed through identifying built and natural environmental constraints adjacent to the corridor. For the purposes of the corridor study, built and natural environmental considerations are defined below:

**Built Environment** – Includes potential cultural resources, residential properties clusters at the east end of the corridor and scattered residential properties north and south of the corridor, and businesses located adjacent to Ellis Road and 463rd Avenue (County 151). Potential impacts to these properties focus primarily on access modifications and limited relocation associated with right-of-way acquisitions at select intersections where roundabouts are recommended.

In addition, if resources identified by the South Dakota Historical Society are deemed to be on or eligible for the National Register of Historic Places and warrant preservation in place (consistent with Section 106 of the National Historic Preservation Act), then added restrictions to changes that include acquiring more right-of-way may result. As the potential for needing additional right-of-way is very limited, the potential for impacts is minor.

**Natural Environment** – Potential natural environment issues are limited to wetlands associated with:

- Cherry Creek at what would be 468th Avenue if it were present.
- Southeast of 462nd Avenue associated with Wall Lake.
- North of SD 42 between 459th Avenue and 460th Avenue.
- Long Creek as it crosses SD 42 between 455th Avenue and 456th Avenue.
- Elce Creek crossing of SD 42 west of 454th Avenue.

The vast majority of potential natural environment impacts are located in portions of the corridor, with the exception of Cherry Creek, proposed to be reconstructed as a two-lane facility. These areas would not require additional right-of-way for the roadway or ditch areas. Additionally, reconstruction and expansion of the corridor is proposed to occur along the current alignment. Thus the potential for impacts is anticipated to be minimal.

## 3.2 Environmental Review Findings

The environmental review consisted of an archeological investigation, Level I cultural resource literature review, and an architectural history assessment. The key findings of this review include:

- Three archaeological sites were previously recorded within the current study area and an additional 14 archaeological sites have been recorded within one-mile of the study area. Of the sites within the study area and one-mile radius, 13 are prehistoric sites and four are historic-period sites. Although agriculture and road construction may have disturbed some portions of the study area, the number of archaeological sites (17) located within one mile of the study area indicate that the study area may retain some archaeological sensitivity.
- A Level III archaeological survey of the project area is recommended for areas that are not currently disturbed by modern development that may fall within the final archaeology APE for this project (i.e., may be impacted by construction or other ground-disturbing impacts) to aid in complying with applicable federal and state cultural resources laws.
- Of these 113 new properties identified during the architectural history windshield survey, 36 were identified as being 40 years of age or older and 57 properties were identified as not of age. An additional 20 properties do not have known build dates. The 36 newly identified of age properties consist of residential properties and farmsteads. The remaining 57 properties were identified as not of age and, therefore, will not require future survey. If any of the 36 of-age properties fall within the final architectural history APE for this project, a Level III survey of those properties according to the South Dakota SHPO survey guidelines as well as the national guidelines is recommended in order to comply with applicable federal and state cultural resources laws.

Detailed finding associated with the cultural resources review are documented within the Appendix.

## 4.0 2045 Traffic and Operations (Existing Roadway Conditions)

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### 4.1 Traffic Forecasts

To support the alternative development and screening process, traffic forecasts for the 2045 horizon year were developed. Several sources were utilized to develop the forecasts for the a.m. and p.m. peak hours and on a daily basis. These included the Sioux Falls Regional Travel Demand Model (TDM), SDDOT 20-year traffic growth factor, Cherry Lake Reserve Traffic Impact Study (2013), and existing corridor travel patterns. Given some of the differences between these documents, such as the horizon years and growth rates, a detailed traffic forecast development process was completed. A summary of the traffic forecast methods, assumptions, and traffic volumes is included in the SD 42 Corridor Study – Traffic Forecast memo included in the Appendix. The resultant year 2045 traffic forecasts are illustrated in Figure 10.

### 4.2 Traffic Operations Analysis

Two capacity analyses were conducted to quantify year 2045 operations. Analyses focused on both a high-level planning analysis for the corridor, as well as a detailed intersection capacity analysis. The following information summarizes the capacity analysis conducted as part of the year 2045 conditions.

#### 4.2.1 Corridor Operations Analysis

Traffic volumes along the study segment of SD 42 are expected to range from approximately 4,600 to 9,900 vpd under year 2045 conditions. Comparing these ADT volumes with the planning level capacity shown (Table 3) and taking into account the level of service goals by area type, results in a general conclusion that west of 466<sup>th</sup> Avenue the existing facility should be able to accommodate forecasted traffic. East of 466<sup>th</sup> Avenue, however, forecasted volume approaches and/or exceeds thresholds for acceptable operations. It should be noted that the planning level capacity threshold approach does not account for peaking characteristics and vehicle classification.

#### 4.2.2 Intersection Capacity Analysis

To further understand how the existing roadway network can accommodate the future traffic forecasts, a year 2045 intersection capacity analysis was completed. The capacity analysis was completed for the a.m. and p.m. peak hours at the intersections using Synchro/SimTraffic software (V8.0), which incorporates the HCM 2010 methods. Results of the year 2045 intersection capacity analysis shown in Table 9 and graphically in Figure 10, indicate that the majority of the study intersections are expected to operate at overall LOS B or better during a.m. and p.m. peak hours with the existing geometric layout and traffic control. The SD 42/463rd Avenue (County 151) intersection, however, is expected to operate at LOS C during the a.m. and p.m. peak hours, while the SD 42/Ellis Road intersection is expected to operate at LOS D and LOS E during the a.m. and p.m. peak hours, respectively. Cross route delays are also expected to increase along the entire corridor. It should be

noted that city staff has indicated that the SD 42/Ellis Road intersection is expected to be reconstructed as a four-lane facility prior to 2045.

**Table 9. Year 2045 Peak Hour Capacity Analysis – Current Lanes and Intersection Control**

SD 42 Intersection	Level of Service (Delay)	
	AM Peak Hour	PM Peak Hour
455th Avenue (SD 19 South) <sup>(1)</sup>	A/C (15 sec.)	A/C (17 sec.)
456th Avenue (SD 19 North) <sup>(1)</sup>	A/B (14 sec.)	A/C (17 sec.)
459th Avenue (County 159) <sup>(1)</sup>	A/B (14 sec.)	A/B (14 sec.)
463rd Avenue (County 151) <sup>(2)</sup>	C (16 sec.)	C (21 sec.)
466th Avenue (SD 17) <sup>(1)</sup>	A/D (25 sec.)	B/F (72 sec.)
467th Avenue <sup>(1)</sup>	A/C (23 sec.)	A/D (32 sec.)
North Holland Avenue <sup>(1)</sup>	A/C (19 sec.)	A/C (24 sec.)
South Cherry Lake Avenue <sup>(1)</sup>	A/D (32 sec.)	A/F (54 sec.)
West Lakeside Drive <sup>(1)</sup>	A/C (18 sec.)	A/D (27 sec.)
Ellis Road	D (44 sec.)	E (69 sec.)

(1) Indicates an unsignalized intersection with cross-street stop control where the overall LOS is shown followed by the worst approach LOS.

(2) Indicates an unsignalized intersection with all-way stop control.

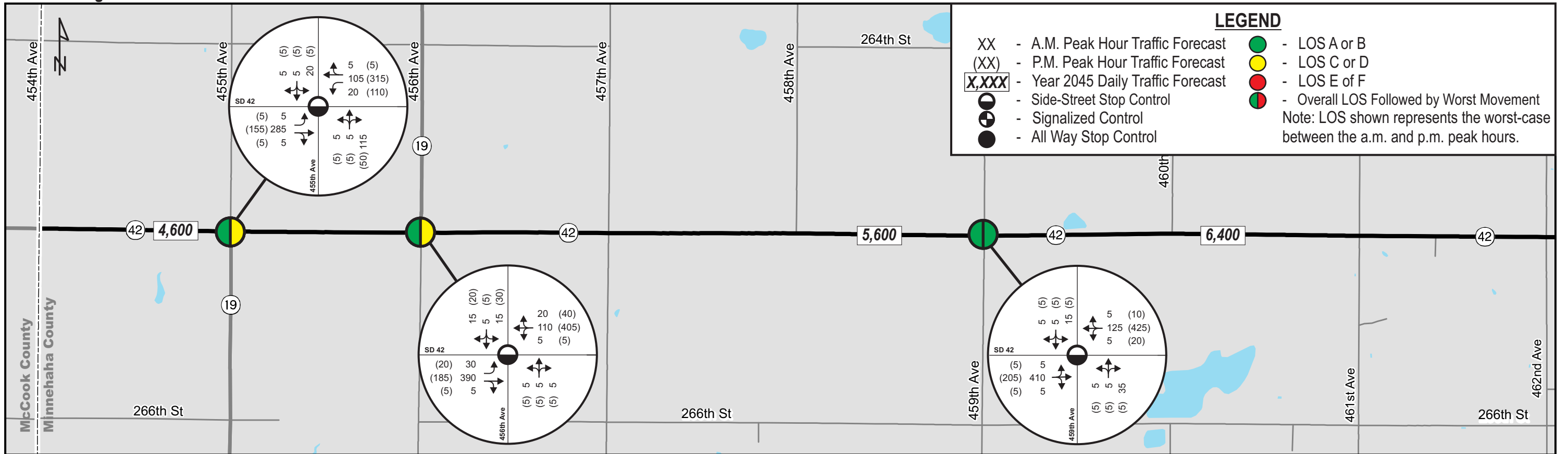
### 4.3 Crash Prediction – 2045 Current Road Conditions

As previously noted for the 15 mile SD 42 study corridor there has been an average of approximately 30 crashes per year over the latest three year period. The general roadway characteristic of the corridor and information regarding the type and intensity of the reported crashes were used to develop a SD 42 corridor calibrated *HSM Predictive Method* model. With the model an estimate of future crashes associated with a specific combination of traffic and road design can be developed and the impacts associated with implementing improvements such as adding turn lanes or through lanes can be quantified. The first step in application of the calibrated crash prediction model was to develop the 2045 Baseline condition, which assumes no change in the number of lanes or the intersection control along the corridor. Thus, the primary factor contributing to changes in crashes would be the anticipated change in traffic. Along SD 42, traffic volume is forecasted to increase by approximately 2.1 to 2.4 percent per year through 2045, which results in approximately a doubling of traffic.

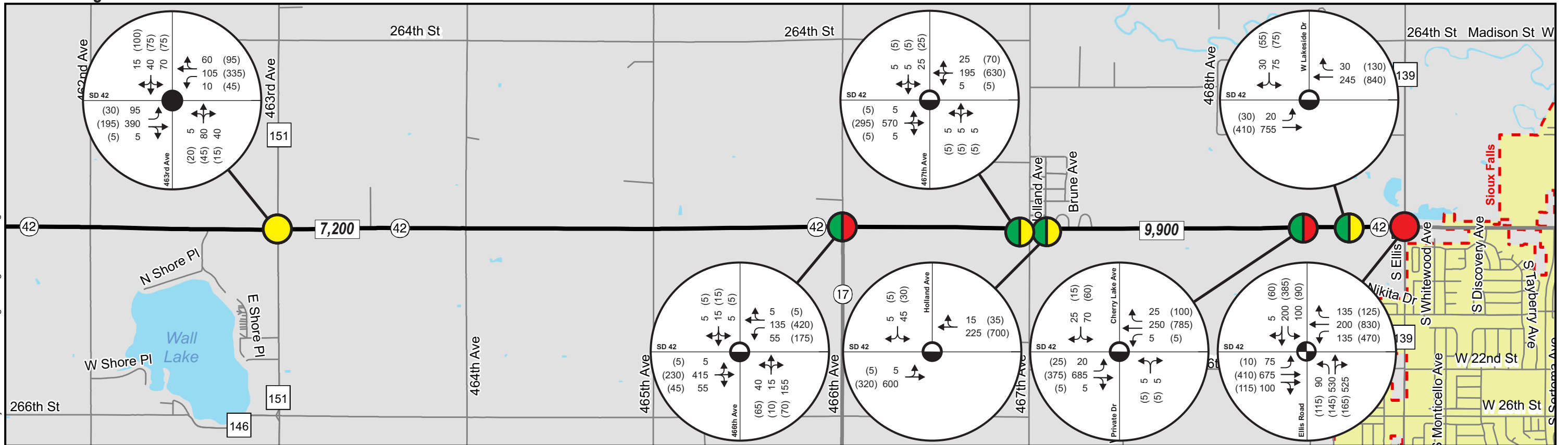
In the crash modeling approach there is a direct relationship between the change in volume and change in crashes. As corridor traffic volume is anticipated to double over the 30 year planning horizon, without any roadway improvements crashes would likely increase by a similar magnitude. The 2045 Baseline model is the basis for comparison of the crash/safety impacts of alternate roadway improvements within the corridor.



**Western Segment**



**Eastern Segment**



H:\Projects\090000\9040\TSP\Figures\Figure 4-Existing Conditions



**Year 2045 Forecasts - Existing Roadway Conditions**

South Dakota Highway 42 Corridor Study  
Sioux Falls, SD

00009040  
August 2016

Figure 10

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## 5.0 Alternatives Development and Screening

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This chapter describes the steps followed in preparing a range of concepts for the SD 42 corridor and the screening process used to develop the corridor study recommendations provided in Chapter 6. The first section describes the process of developing and screening potential transportation improvement alternatives. The second section describes the alternatives and technical assessment of each alternative relative to the evaluation criteria. Each alternative was evaluated with respect to the ability to address travel demand through the 2045 horizon, potential to enhance safety, impacts to adjacent developed/undeveloped property, environmental impacts, and cost. Through the applied screening process, a composite improvement concept for the corridor that is anticipated to include both rural and urban areas was prepared. The concept was then presented for public comment and minor revisions to the concept were incorporated to establish a feasible alternative for the corridor.

### 5.1 Alternatives Development and Screening Process

A range of preliminary geometric improvement alternatives were developed to address safety and operational deficiencies identified along the SD 42 corridor and key cross-streets. The alternatives developed reflect the rural and urban area types that are anticipated to be present in the 2045 horizon. The character of the area influences the alternatives in two ways:

- Rural area sections include development of ditches for stormwater conveyance, while areas within the urban limits of Sioux Falls were assumed to include in curb-and-gutter. An urban cross-section would also be considered in locations where four-lane expansion is needed to provide adequate capacity through 2045.
- SDDOT policy for acceptable peak hour traffic operations reflect LOS B operations in rural areas and LOS C operations in urban areas. For the SD 42 corridor, these criteria were applied as follows:
  - All-Way Stop Control Intersections: the area specific criteria were applied to the overall intersection level-of-service.
  - Minor Street Stop Control Intersections: the area specific criteria were applied to operations on the SD 42 mainline. Cross street operations (i.e., the stop approach) with LOS C and LOS D were considered acceptable as long as the SD 42 mainline maintained a LOS B or better. For cross route approaches that reflected LOS E or LOS F, mitigation alternatives were proposed even if the SD 42 mainline operations were within the acceptable range.

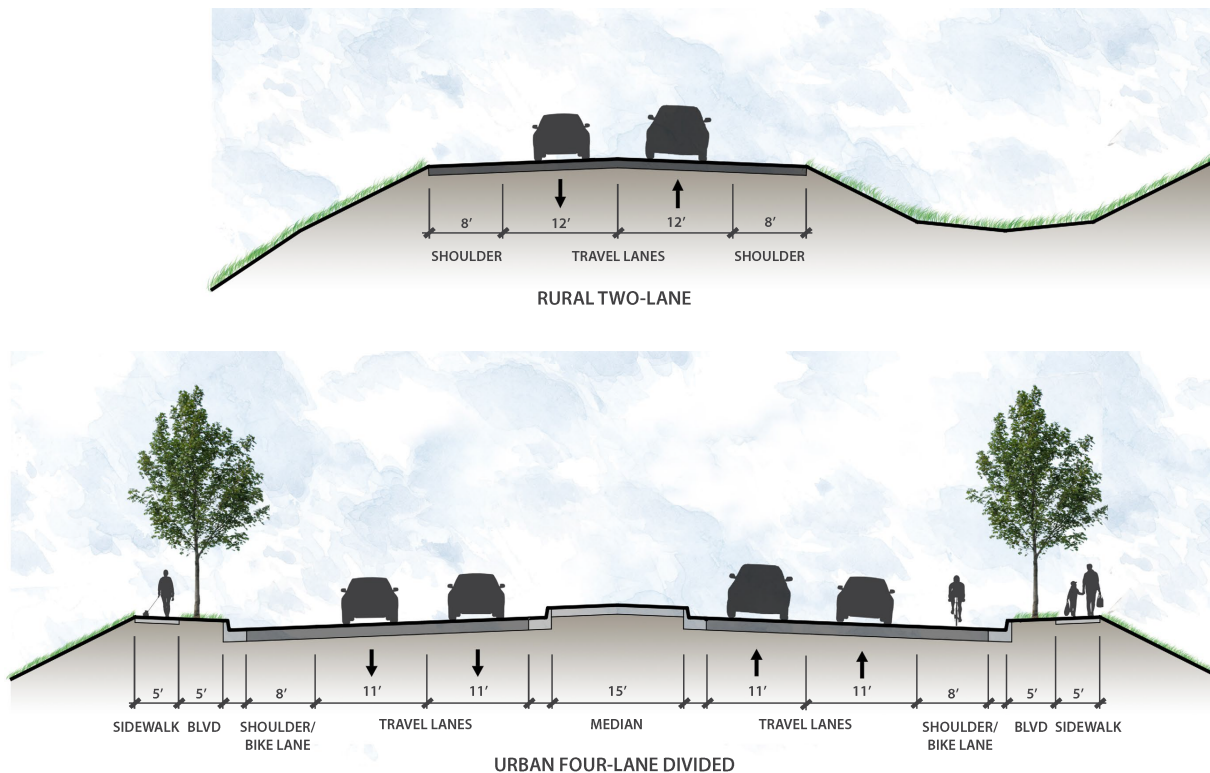
Proposed cross sections for both two- and four-lane divided roadways were established and reviewed with SDDOT and City staff. For each section type, addressing multimodal travel was important to the overall corridor concept. As such, a method of accommodating pedestrians and/or bicycle travel was included.

Accommodation assumptions by section type are as follows:

- Two-Lane Rural: Bicycle and pedestrian modes would be accommodated on the shoulder. The cross section developed for rural areas provides an eight-foot outside shoulder, which meets the minimum four-foot outside the rumble strip requirement (Source: SDDOT Road Design Manual)
- Four-Lane Urban: A eight-foot bicycle lane was incorporated into the proposed section. Pedestrian accommodation was identified throughout and included five foot sidewalks on both sides of the road, set back five feet from the curb.

Figure 11 displays the proposed two-lane and four-lane typical sections.

**Figure 11. Proposed Typical Cross Sections – Two-lane Rural and Four-Lane Urban**



Proposed cross sections in both the urban and rural conditions support accommodation of SL 2015, Chapter 173, Section 1 regarding minimum separation afforded to bicycles as they are overtaken by motor vehicles traveling the same direction (South Dakota Statutes 32-2-26.1).

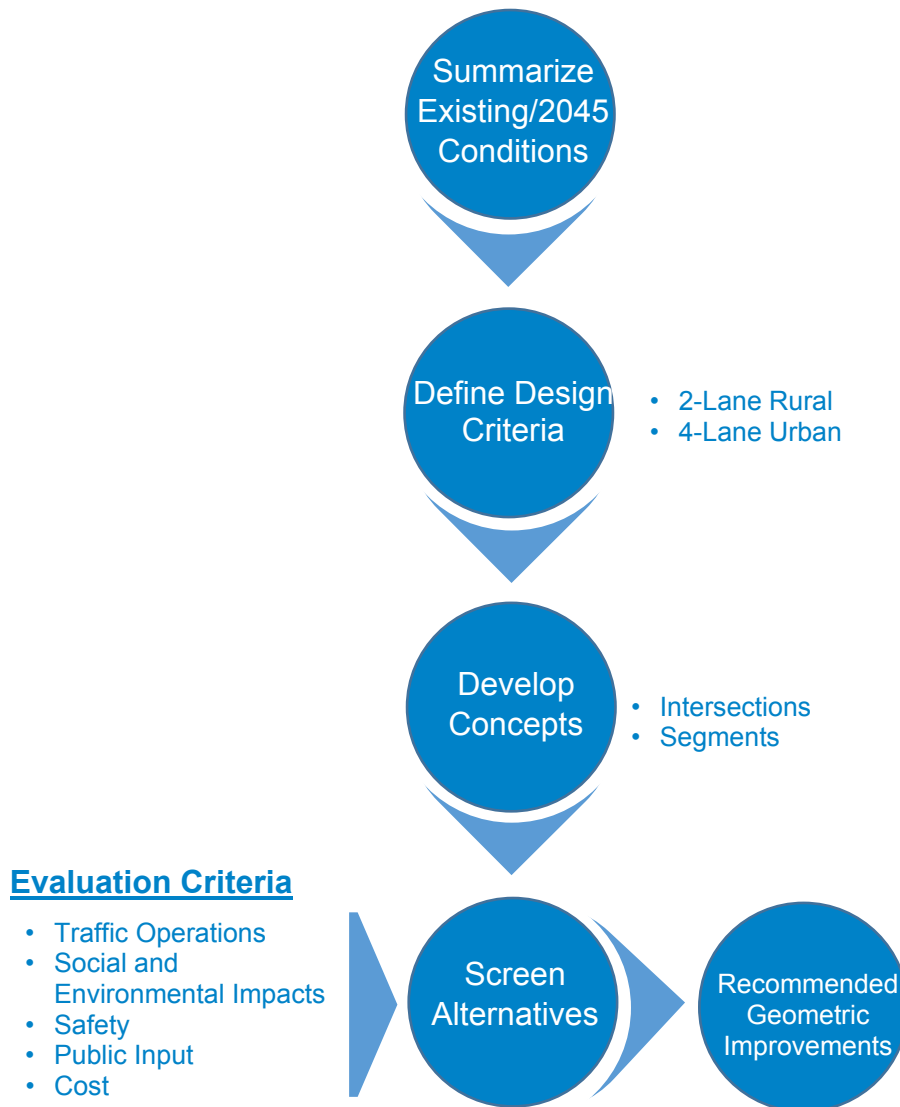
Alternatives developed for key intersections and segments of the corridor were compared relative to the No Build alternative, which is defined as retaining the current segment and intersection geometry, traffic control, and access. For the portion of the corridor from 467th Avenue through approximately what would be 468th Avenue (i.e., one mile east of 467th Avenue), the combination of current residential development and anticipated areas of future development led to development of a range

of segment and intersection alternatives. Thus, through this segment the range of alternatives were also compared against each other.

In support of a consistent comparison between different segments of the corridor and across the range of alternatives, a set of evaluation criteria were defined and applied in the screening. Figure 12 diagrams the alternatives development and screening process. Each of the criteria employed in the screening is defined below:

- **Traffic Operations:** Encompasses a range of assessments of the ability of the intersection and segment improvements to provide acceptable traffic flow during the peak periods. Subcategories of this criteria are:
  - **Provides Adequate Capacity:** SDDOT and City traffic operations goals reflect a system that provides intersection operations representative to LOS B operations in rural areas and LOS C operations in urban areas. The potential for an alternative to achieve these goals was a critical determinant during development and screening.
  - **Level-of-Service:** Provides the results of the Highway Capacity Manual methods analysis of intersection operations using a.m. and p.m. peak hour traffic for 2045.
  - **Signal Warrant Met:** The combination of mainline and cross-street volume in 2045 results in less than the acceptable threshold for traffic operations with two-way or all-way stop control. Thus, operations with a signal were evaluated, which generally provides a higher level of intersection capacity than stop controlled intersections. A signal would not be recommended at a location unless the appropriate warrants were satisfied.
- **Potential for Social and Environmental Impacts:** This category of evaluation criteria is primarily footprint-based impacts associated with each of the segment and intersection alternatives. With very few exceptions, road segments between two intersections can be located within the currently estimated right-of-way. Thus, the primary focus of these criteria are the higher volume intersections.
- **Driver Expectation:** Represents a qualitative measure of how common each of the proposed configurations would be for drivers in the region. Concepts that are new configurations/applications in the region would not be very common. Thus, would be rated as Low in driver expectation. Common intersection control or configuration alternatives (stop signs) would be provided a High driver expectancy rating.
- **Additional Right-of-Way Required:** This criterion is displayed in two parts. First whether additional right-of-way is needed (Yes or No); with a second part of the estimated acres of new right-of-way.
- **Building Impacts:** This criterion is also a two part analysis. The first part is whether buildings are likely to be impacted by implementing the alternative (Yes or No) and the second part is a measure of the severity (Impacted or Acquired).
- **Wetland Impacts:** A two-part review of, first, whether there is the potential for affecting wetlands. The second part is an estimate of the number of acres within the identified roadway footprint.

**Figure 12. Corridor Alternatives Screening Process**



- **Farmland Impacts:** This criterion is separated into two elements. First, whether there is the potential for the footprint to extend outside the current right-of-way and cover areas presently in crop production or used for hay. The second part of the review provides an estimate of the potentially impacted acres.
- **Cultural Resource Impacts:** Reflect the results of the literature and windshield review of the corridor and whether areas with an expanded footprint are adjacent to buildings or properties with a potential for historical significance.
- **Safety Impacts:** Each of the alternative intersection and/or segment treatments were incorporated into the Crash Prediction Model along with traffic volume for 2045 conditions. These were evaluated relative to crashes associated with the 2045 traffic volumes and the

current geometrics and traffic control. Results of the predicted change in crash rate and severity were then monetized to establish annual cost/benefit associated with the action.

- **Property Access Impacts:** Proposed portions of the corridor where a four-lane divided cross section is warranted would likely result in restricting left turn access into and out of individual private drives and minor cross streets. Additionally, intersections where improvements are being proposed may also include recommendations for relocating driveways that are within the influence area of an intersection. The influence area is defined as the distance back from the junction where traffic going through the intersection impacts traffic using the driveway. This criterion provides a Yes or No response to whether property access is impacted.
- **Public Meeting Input:** The August 10, 2016 SD 42 Corridor Study public information meeting included the opportunity for people to rate the alternative when more than one intersection or segment concept was being evaluated. The information incorporated into the screening was a summary of the votes received.
- Estimated construction cost in 2016 dollars.

Each of the screening criteria into the consultant's review of each intersection and segment alternative, with the end product being a recommendation for action in the corridor. As the criteria are not all expressed using a similar scale, the recommendation blended a combination of quantitative and qualitative results. The consultant's recommendation was presented to the Study Advisory Team (SAT) for input and then the composite result was presented at the final corridor study public meeting. Based on comments received at the meeting and direction by the SAT, changes to the initial consultant's recommendation were incorporated into the locally preferred alternative.

## **5.2 Range of Alternatives**

### **5.2.1 Segment Alternatives**

Identification of alternatives for the corridor were divided into two phases, with the first phase addressing the number of through lanes on SD 42. The second phase focused on intersection treatments necessary to provide acceptable operations under current and future conditions. Based on the forecast traffic volumes, a two-lane section would accommodate peak hour traffic through 2045 from the west terminus at 454th Avenue to east of 465th Avenue. The segment from 466th Avenue to 467th Avenue represents a transition area where the forecast traffic approaches the four-lane threshold. From 467th Avenue to the east, a four-lane section is necessary to provide sufficient capacity to meet the desired thresholds. As intersections are often the controlling points relative to traffic operations, 466th Avenue becomes a key intersection relative to transitioning between two and four lanes along SD 42. Alternatives for the intersection geometrics were developed for both two lane and four lane cross sections.

### **5.2.2 Intersection Alternatives**

Intersection geometrics necessary to provide acceptable operations through 2045 were developed through reviewing a.m. and p.m. peak hour traffic operations relative to the respective rural and urban

LOS thresholds (i.e., rural LOS B; urban LOS C). The following sections describe the intersection geometric improvements reviewed for each intersection.

#### **454th Avenue**

Current intersection geometrics are adequate to accommodate forecasted traffic through 2045.

#### **455th Avenue (SD 19 South)**

Current intersection geometrics are adequate to accommodate forecasted traffic through 2045.

#### **456th Avenue (SD 19 North)**

Adding a right turn lane and a left turn lane to the westbound approach allows westbound vehicles turning north to exit the through lane and balances the eastbound left turn lane presently in place.

#### **457th Avenue**

Current intersection geometrics are adequate to accommodate forecasted traffic through 2045.

#### **458th Avenue**

Current intersection geometrics are adequate to accommodate forecasted traffic through 2045.

#### **459th Avenue**

By adding left turn lanes to eastbound and westbound SD 42 approaches, adequate capacity would be provided through 2045.

#### **460th Avenue**

Current intersection geometrics are adequate to accommodate forecasted traffic through 2045.

#### **461st Avenue**

Current intersection geometrics are adequate to accommodate forecasted traffic through 2045.

#### **462nd Avenue**

Current intersection geometrics are adequate to accommodate forecasted traffic through 2045.

#### **463rd Avenue (County 151)**

Forecasted traffic at this intersection exceeds the level that can be reasonably accommodated by adding turn lanes and retaining the current cross-street stop control or installing all-way stop control. The 2045 volumes do not meet warrants for installing a traffic signal. In addition, the area around the intersection is expected to remain relatively rural and thus adding a traffic signal at this location would result in an unexpected condition for drivers, which could result in more crashes on SD 42.

Given that the purpose of the alternatives analysis is to identify and evaluate mitigation to provide adequate traffic capacity through the 2045 horizon year, the following additional alternatives were reviewed:



- Add right turn lane to the westbound approach and signalize the intersection. These improvements would result in LOS B operations in the a.m. and p.m. peaks, however, forecasted volume would not meet minimum thresholds for justifying a signal.
- Reconstruct the intersection with a single lane roundabout as the intersection control. The roundabout concept would provide LOS B operations through 2045 in both peak periods.

These two 463rd Avenue alternatives are illustrated in Figure 13.

#### **464th Avenue**

Current intersection geometrics are adequate to accommodate forecasted traffic through 2045.

#### **465th Avenue**

Current intersection geometrics are adequate to accommodate forecasted traffic through 2045.

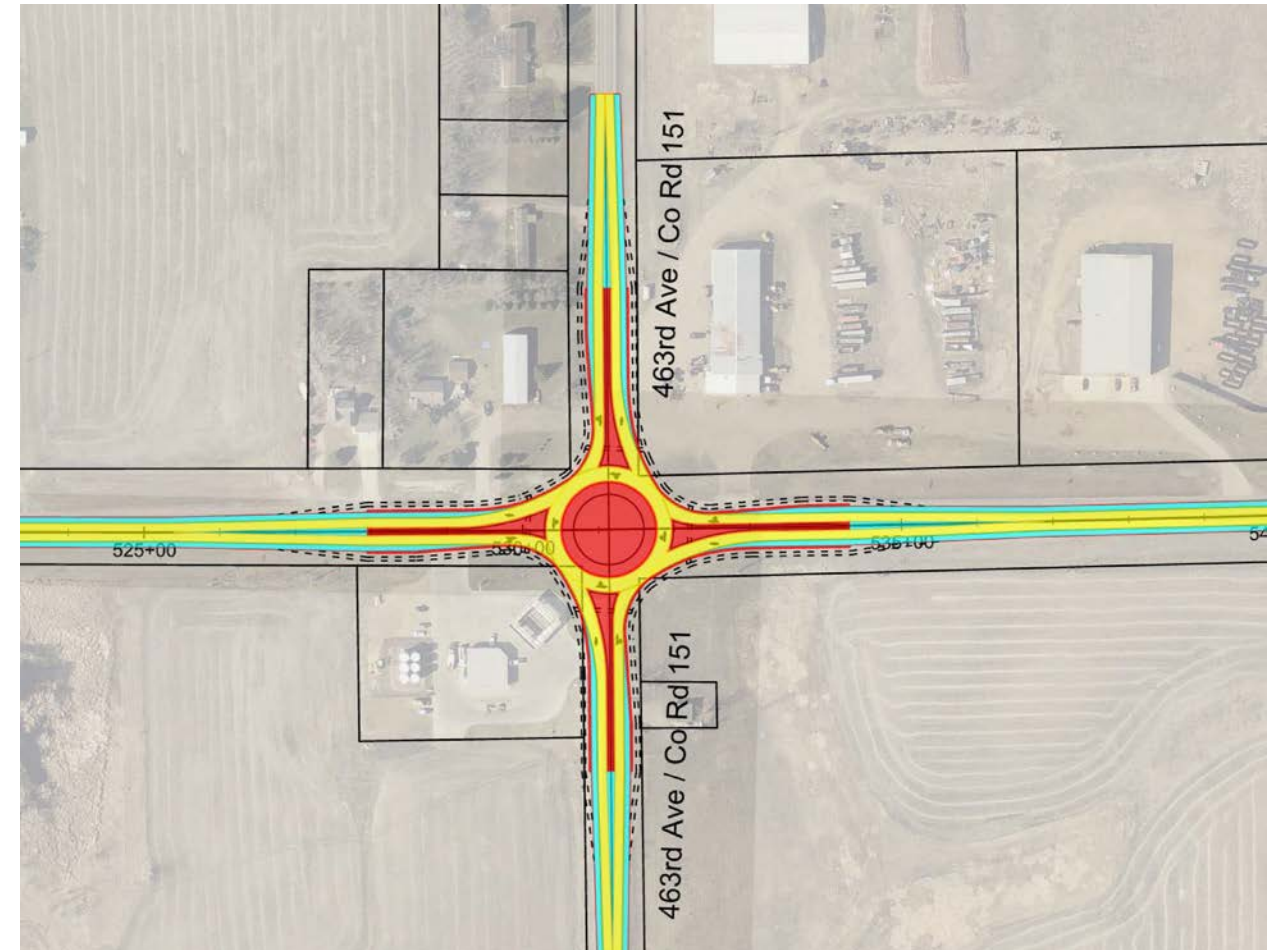
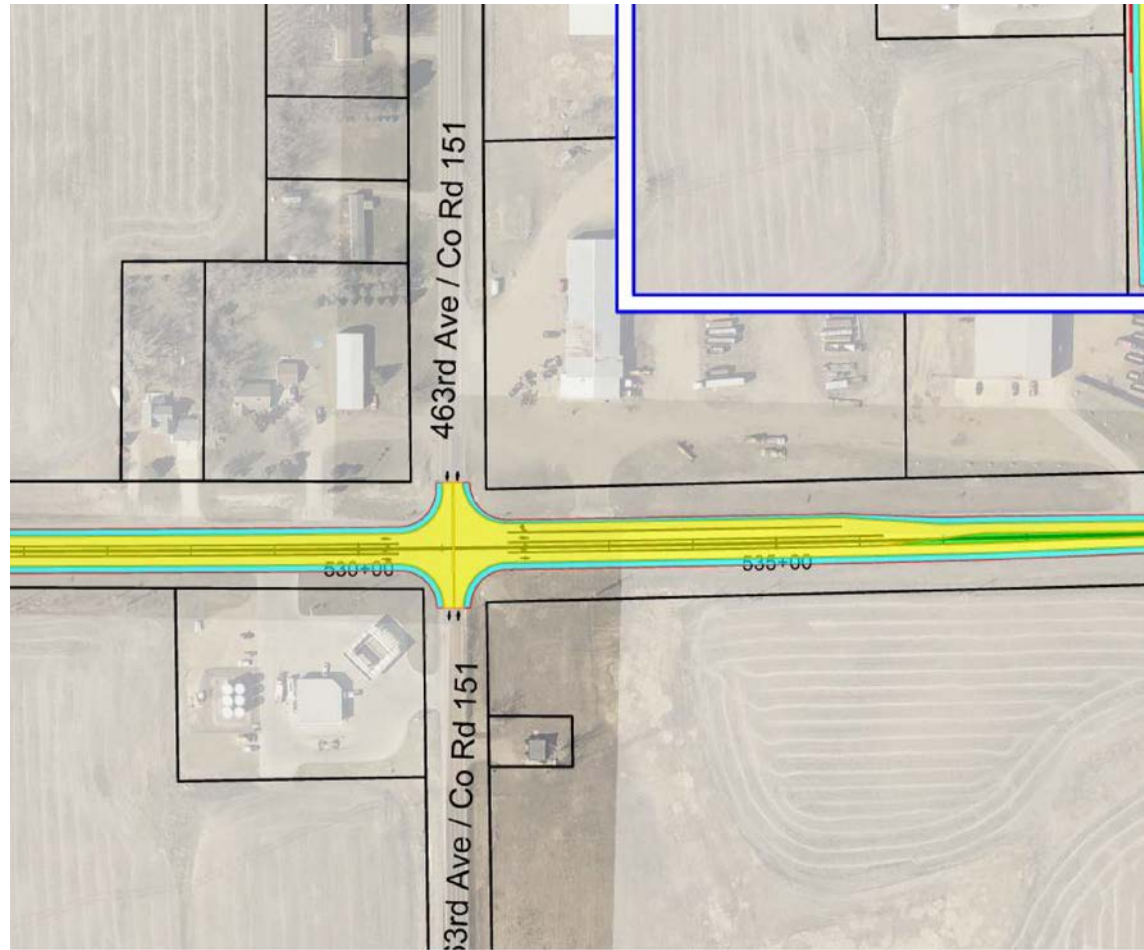
#### **466th Avenue (SD 17)**

466th Avenue (SD 17) represents the westerly extent of where a four-lane corridor would be necessary to meet the LOS guidelines under 2045 conditions. The need for four lanes is more a function of the traffic forecasted to travel through on SD 42, than the forecasted traffic on either the north or south approaches of 466th Avenue. The range of alternatives for the intersection included a four-lane SD 42 and the following traffic control and cross-street alternatives.

- Retain the stop control on 466th Avenue and add a northbound right turn lane to remove those vehicles from the critical movements included in the traffic operations analysis. This alternative would provide for adequate operations on SD 42, but would result in LOS C and LOS E for 466th Avenue motorists during the a.m. and p.m. peak hours, respectively.
- Replace the side street stop control with a traffic signal. No additional turn lanes would be required to provide adequate traffic operations, however, forecasted traffic at the intersection would not satisfy signal warrant thresholds.
- Transition the four-lane section to two lanes east of 466th Avenue and convert the intersection control to a single lane roundabout. With the alternative in place, LOS B would be provided in the a.m. and p.m. periods through 2045.
- Continue the four-lane section west to the 466th Avenue intersection and convert the control to a hybrid roundabout that would facilitate the four-to-two lane transition on SD 42. The hybrid reflects the integration of elements of two-lane and a multi-lane roundabouts. The concept supports the traffic operation needs at the intersection and creates a transition between two and four lanes on SD 42. The alternative provides LOS B through 2045 in the peak periods.

The 466th Avenue (SD 17) alternatives are illustrated in Figure 14.

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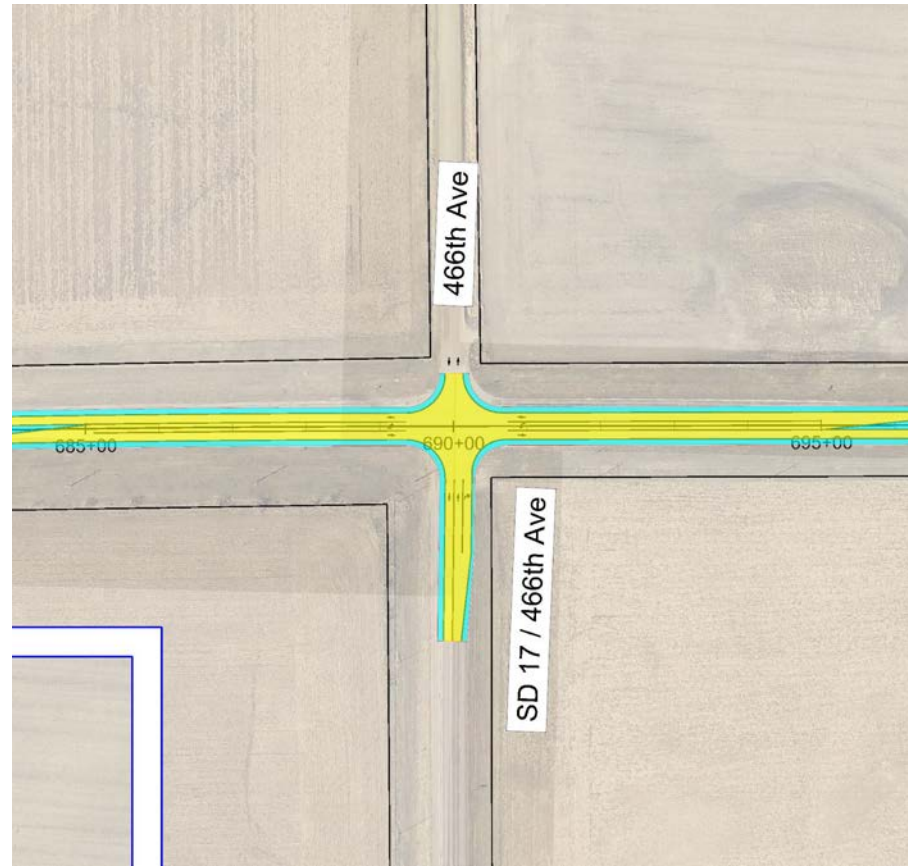
**Add Turn Lanes and Signalize – Option A**

- Provides Adequate Capacity through 2045 – LOS B
- 2045 Traffic does not Meet Signal Warrant
- Rural Signal – Advanced Warning Needed
- Wall Lake Oil – Driveways Within Influence Area of Intersection
- Crash Rate Lower than Roundabout Alternative – Average Crash Severity Greater

**Single Lane Roundabout – Option B**

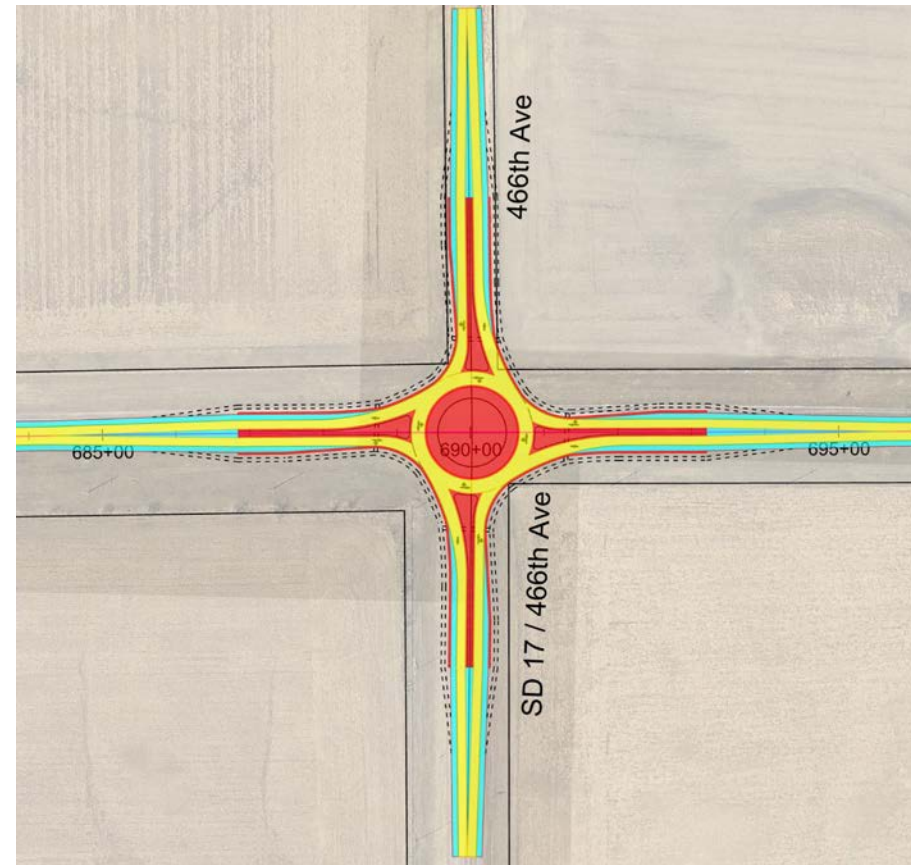
- Provides Adequate Capacity through 2045
- Minor Right-of-Way Impacts:
  - SW quadrant
  - SE quadrant
  - NE quadrant
- Requires Driveways/Accesses Change:
  - Wall Lake Oil on both SD 42 and 463<sup>rd</sup> Avenue:
    - Right-in-right-out Only
    - Shorten Roundabout Medians
    - Relocate Driveways Farther from Intersection
  - Commercial in NE quadrant
    - Close and Relocate to North End of Parcel
- Reduced Crashes Severity Relative to Conventional Intersection – Crash Rate Higher than Conventional Intersection





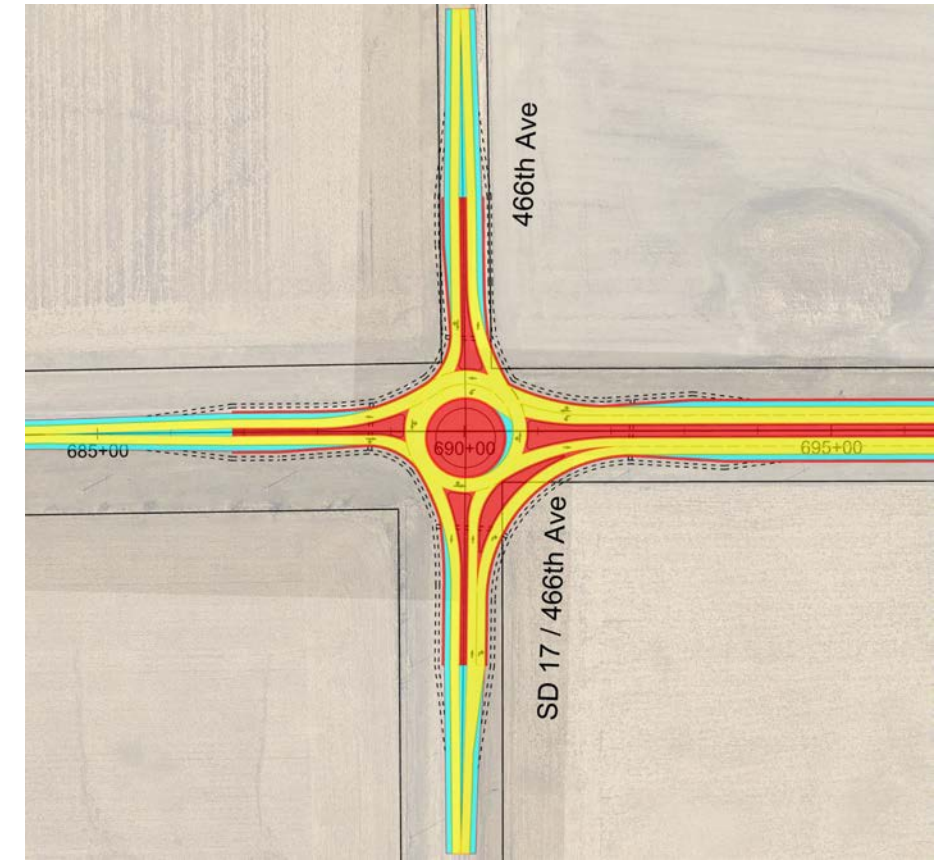
**Conventional – Option A**

- Add Northbound Right Turn Lane on SD 17 (466<sup>th</sup> Avenue)
- Existing Control - Provides Adequate Capacity through 2045
- Accommodated within Current Right-of-Way
- If SD 42 Volume Increases to Require 4-Lane through SD 17, Conventional and Current Control does not Provide Adequate Capacity



**Roundabout – Option B**

- Provides Adequate Capacity through 2045
- Minor Right-of-way Impacts NE, NW, and SE Quadrants (No Buildings)
- Assumes 4-Lane Urban to 2-Lane Rural Transition occurs just west of 467<sup>th</sup> Avenue



**Hybrid Roundabout – Option C**

- Provides Adequate Capacity through 2045
- Minor Right-of-way Impacts in NE, NW and SE Quadrants (No Buildings)
- Creates Transition from 4-Lane Urban to 2-Lane Rural
- Limited Number of Similar Hybrid Roundabouts in Existence in US
- First in South Dakota



## 467th Avenue

467th Avenue represents the westerly extent of the area defined as urban through 2045 and the urban area designation influences the alternative development in two ways:

- The acceptable congestion for a signal, all-way stop or roundabout threshold reflects LOS C operations (LOS B in rural areas).
- A signal, if warranted, is an acceptable traffic control device.

In addition to expanding SD 42 to four-lanes through the intersection, the range of alternatives considered at the intersection included:

- Retain the cross-street stop control and add an eastbound left turn lane, a westbound left turn lane, and a westbound right turn lane. The result in LOS A on SD 42 and LOS C and D on 467<sup>th</sup> Avenue for the a.m. and p.m. peak periods, respectively.
- Replace the cross-street stop control with a traffic signal and add eastbound and westbound left turn lanes to SD 42. The signal provides LOS A operations in both peak periods through 2045.
- Replace the cross-street stop signs with a multi-lane roundabout. The multi-lane roundabout provides LOS A operations through 2045 in both a.m. and p.m. peak periods.
- Replace the cross-street stop signs with a hybrid roundabout that would provide for both the traffic operation needed to accommodate 2045 traffic and a transition from four lanes to two lanes. Initially, the options at this intersection were evaluated independently of the upstream and downstream intersections, however, the recommended concept was coordinated with 466th Avenue, primarily relative to the transition from four lanes to two lanes on SD 42. The roundabout provides LOS B and C operations in the a.m. and p.m. peak periods through 2045, respectively.

## 467th Avenue to 468th Avenue – Segment

The SD 42 segment from 467th Avenue to 468th Avenue is unique in the corridor due to the density of local streets and private driveways on the north side. Traffic volume in this segment of the corridor warrants four-lanes on SD 42 and a four-lane median divided section has been included in the alternatives. Access across the median would be restricted to quarter-mile spacing, which will impact access to and from the adjacent properties and local streets. Figure 15 and Figure 16 display the range of alternatives developed for review along this section, which include:

- Option A – Provide limited access at the west access to Kuhle Drive as well as a full access at the half mile location east of 467th Avenue. Spacing between these access points and also between Kuhle Drive and 467th Avenue would be consistent with the City of Sioux Falls access management policy. Partial access at Kuhle Drive would provide for all movements except left turns to and from Kuhle Drive (three-quarters access). The Kuhle Drive access would provide opportunity for U-turns on SD 42 to support access across the median.

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# Option A



## 467<sup>th</sup> Avenue to 468<sup>th</sup> Avenue – Option A

- SD 42 – 4 Through Lanes
- Holland Avenue:
  - Close
- Landon Lane:
  - Right-in-Right-out Only
- Kuhle Avenue - ¾ Access :
  - EB/WB Left Permitted (No Signal)
  - NB/SB – Right-in-Right-Out Only
- All Others:
  - Right-in-Right-Out Only

# Option B

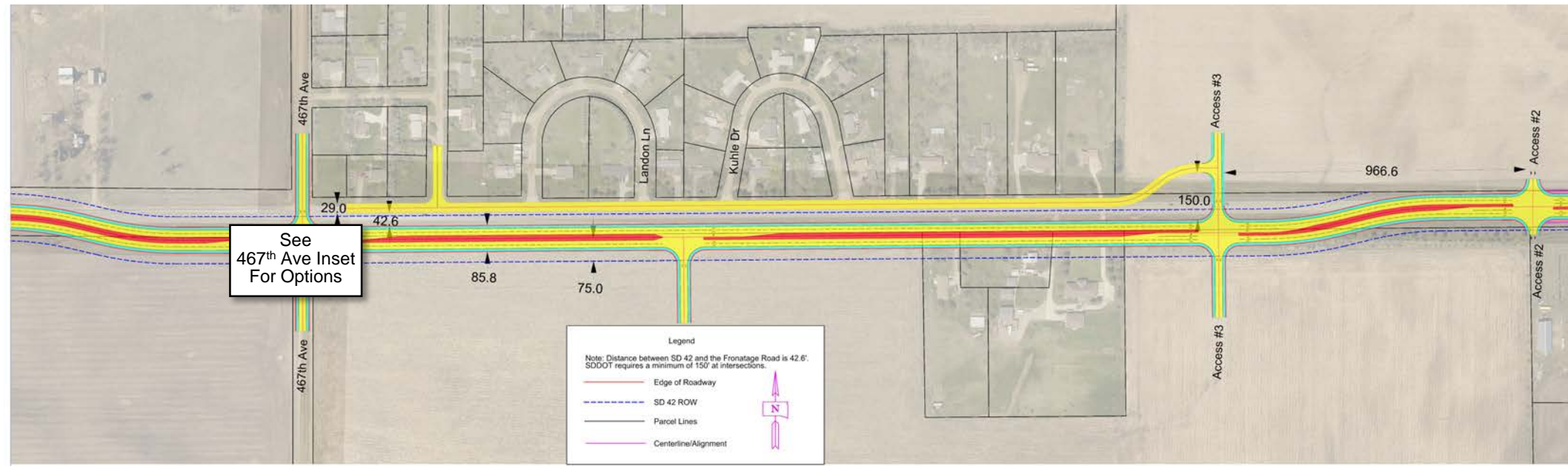


## 467<sup>th</sup> Avenue to 468<sup>th</sup> Avenue – Option B

- SD 42 – 4 Through Lanes
- Holland Avenue:
  - Close
- Landon Drive:
  - Full Access: East Leg
  - Right-in-Right-Out: West Leg
- Kuhle Lane:
  - Full Access: East Leg
  - Right-in-Right-Out: West Leg
- All Others:
  - Right-in-Right-Out Only



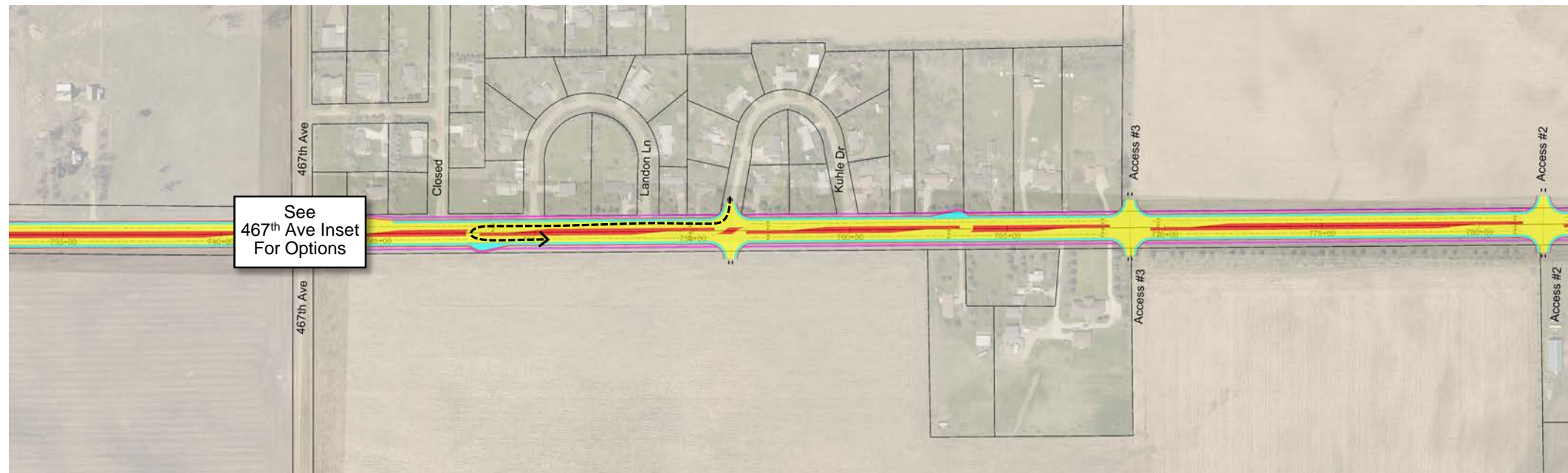
## Option C



### **467<sup>th</sup> Avenue to 468<sup>th</sup> Avenue – Option C**

- SD 42 – 4 Through Lanes
- Service Road:
  - Shift SD 42 to South
- New Full Access at Access #3:
  - WB Right Turn Lane
- All North Side Streets and Driveways:
  - Full Access (Through Service Road)
- Existing South Side:
  - Right-in-Right-Out

## Option D



### **467<sup>th</sup> Avenue to 468<sup>th</sup> Avenue – Option D**

- SD 42 – 4 Through Lanes
- J-Turn Provided between Landon Lane (west) and Holland Drive – Allow westbound to eastbound U-turns
- J-Turn Provided between Kuhle Drive (east) and Access #3 – Allow eastbound to westbound U-turns
- Holland Avenue:
  - Close
- Landon Lane:
  - Right-in-Right-out Only
- Kuhle Avenue West Leg - ¾ Access :
- All Others:
  - Right-in-Right-Out Only



- Option B – Provide full access at Landon Lane and Kuhle Drive and a full access at the half-mile location east of 467th Avenue. The full access intersections at Landon Lane and Kuhle Drive enhance accessibility to the adjacent properties, but the Landon Lane access and the resulting spacing between Landon Lane and Kuhle Drive would not comply with the City of Sioux Falls access management policy.
- Option C – The intent of this option is to retain full access to and from all of the properties on the north side of SD 42 and comply with City of Sioux Falls access management policy. The service road would be located along the current SD 42 alignment and SD 42, as a four-lane divided roadway, would be relocated to the south. Transitions to the current alignment would be established west of 467th Avenue and east of the half mile access between 467th Avenue and 468th Avenue.
- Option D – Similar to Option A, this alternative provides a three-quarter (no left turns into or out of the cross street) access at the west end of the Kuhle Drive loop road and a full access at the half-mile location. Limiting corridor access to the Option A level results in motorists traveling to the east from homes along the north side of SD 42 to make a U-turn at either Kuhle Drive or 467th Avenue. Requiring this U-turn adds traffic to the 467th Avenue intersection and concentrates potential conflicts that could result in crashes at the 467th Avenue intersection. In this alternative additional opportunities for U-turns are provided at a point approximately halfway between Kuhle Drive and 467th Avenue and halfway between Kuhle and the half-mile access (labeled as Access #2). Adding the opportunity for U-turns at these locations increases the level of access convenience to properties on the north and south side of SD 42 and distributes the potential crash conflicts across a greater distance, which has the potential to reduce crashes relative to Option A.

### **468th Avenue (New One-Mile Arterial)**

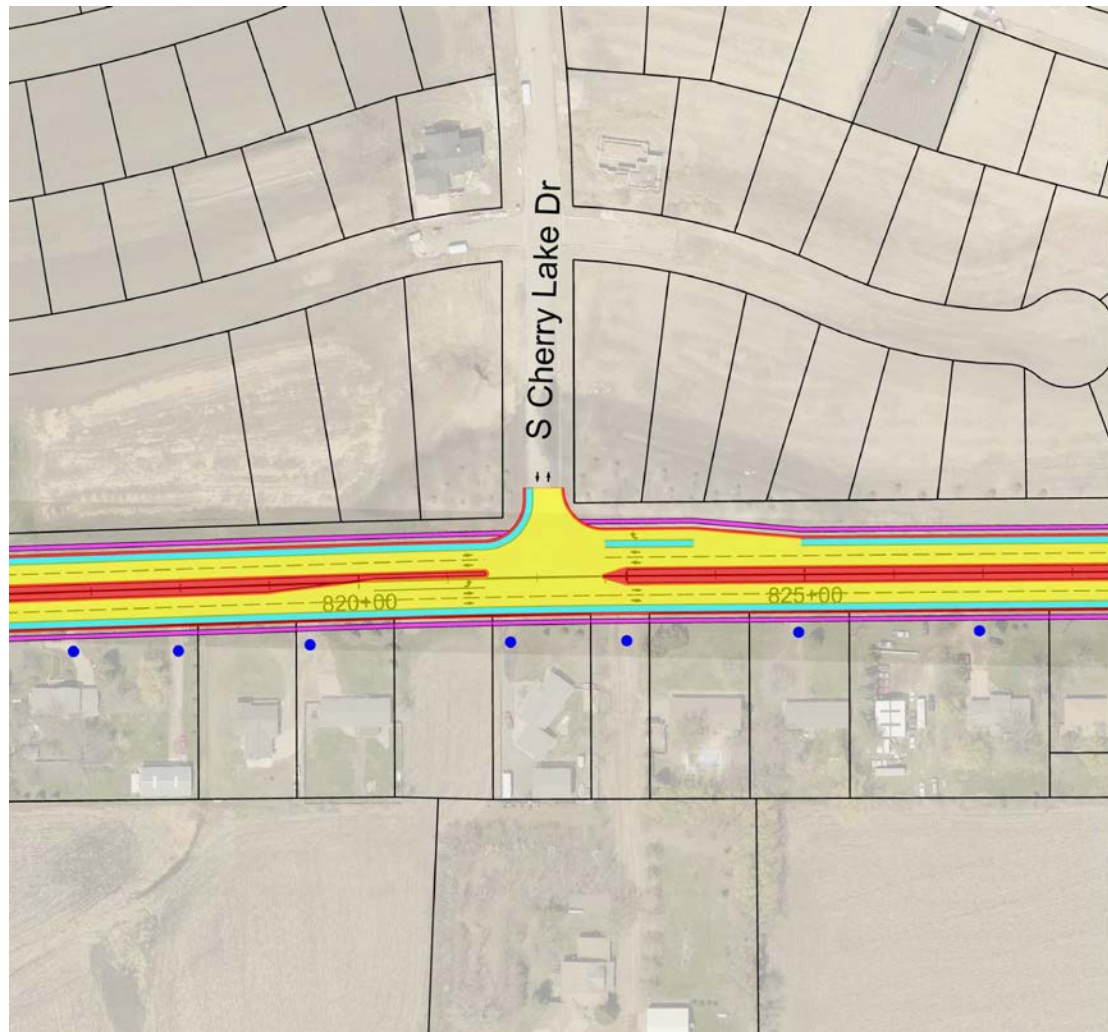
Adding a new north-south roadway at 468th Avenue is consistent with the City of Sioux Falls road plan to support managed growth in the city. The expectation at this point is for a two-lane 468th Avenue and adding left turn lanes to the east and west approaches along SD 42 to accommodate U-turns for adjacent property access in the median divided section.

### **Cherry Lake Drive**

Alternatives for Cherry Lake Drive address conditions necessary to accommodate traffic under the current access to the residential subdivision to the north and potential for future development to the south that would include adding a south approach to the intersection. The range of control and geometric alternatives, which are illustrated in Figure 17, include:

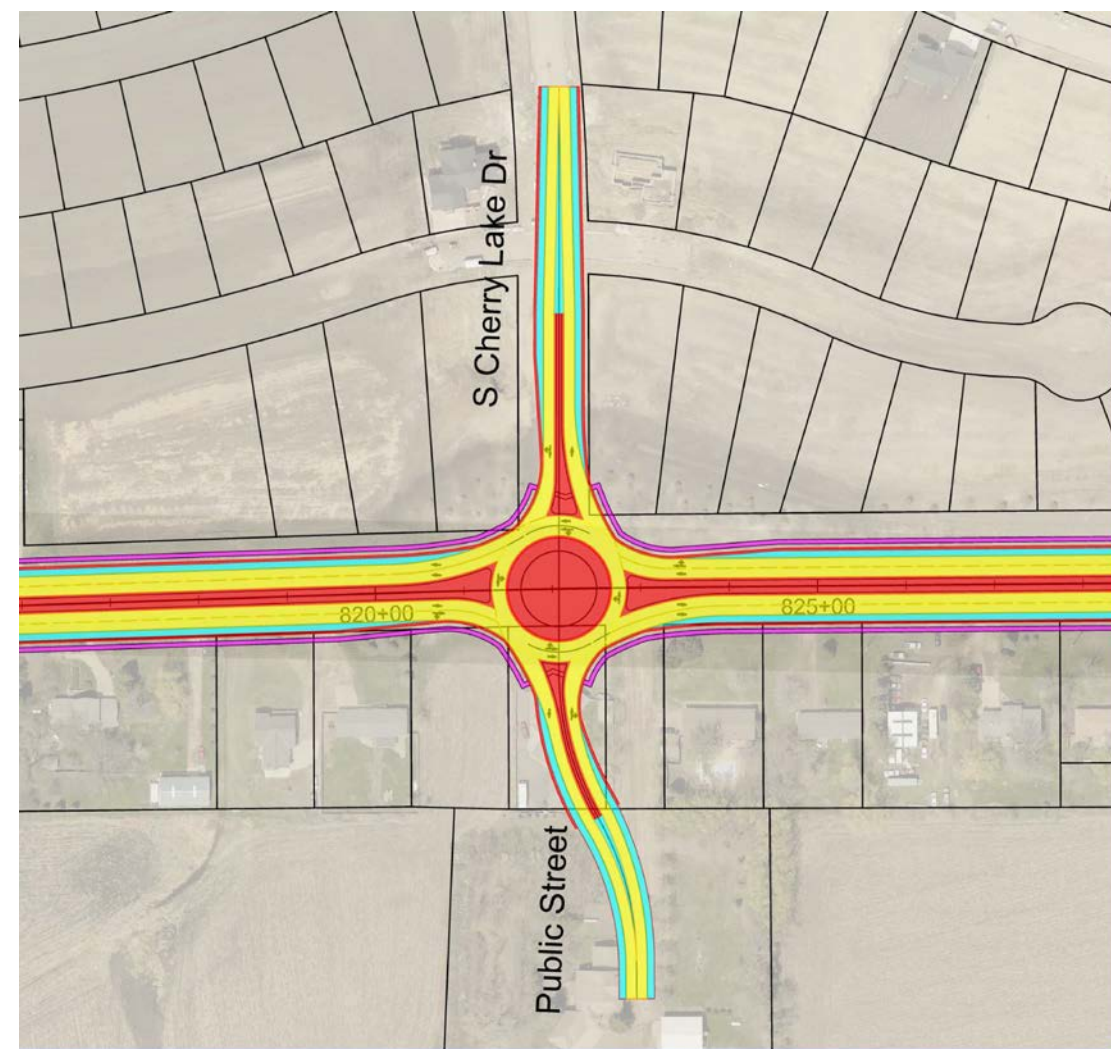
- Cherry Lake North Only – In this alternative a right turn lane is included on the westbound approach and a left turn lane to the eastbound approach. Additionally, accommodation for the westbound left turn lane is included for a possible future south leg and to support U-turns from Lake Shore Drive. In this alternative, the current stop control on Cherry Lake Drive would be retained.

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**Conventional Intersection Alternative**

- Add EB Left Turn Lane
- Add WB Right Turn Lane
- Provides Capacity Needed
- Signal Warrant Not Likely Met
- Reduces Property Impacts to South



**Multi-lane Roundabout (4 Leg)**

- Provides Adequate Capacity through 2045
- Minimal Right-of-Way Impacts on North Side
- Significant Right-of-Way Impacts on South Side (Property Acquisition)
- Most Traffic is through on SD 42 – Reduces Efficiency of Roundabout
- “New” Control Concept (Multi-lane Roundabout) for State/Community
- Reduced Crashes Relative to Conventional Intersection



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- Adding the South Approach to the Intersection – Should development on the south side of SD 42 adjacent to Cherry Lake Drive be proposed and access to the route requested as part of that development, the following access alternatives would be incorporated:
  - Conventional Intersection- The south approach providing a single lane in the north and southbound directions. 2045 forecast volumes are borderline on satisfying signal warrants.
  - Multi-Lane Roundabout – A multi-lane roundabout providing the capacity required to accommodate traffic through the 2045 horizon, but would require additional right-of-way.

### **Lakeside Drive**

The current full access would be retained with an eastbound left turn lane and an eastbound right turn lane added to SD 42. A westbound left turn lane to support U-turns to provide access from the east to south side residents is also included.

### **Ellis Road**

Forecasted traffic associated with the SD 42 Corridor Study at Ellis Road are relatively consistent with the forecasts completed for the West Corridor which was proposed along Ellis Road in this portion of the metro area. As forecasted traffic was similar, the recommended concept for the intersection was carried into this alternatives review. For the intersection, the following turn lanes would be included, in addition to both SD 42 and Ellis Road being expanded to four-lane urban routes:

- Add a second westbound left turn lane to the current single left turn lane.
- Add right turn lanes to each of the four approaches.

## **5.3 Alternatives Screening Summary**

Table 10 provides a summary of the range of alternatives evaluated along each segment and at each intersection of the SD 42 corridor from the Minnehaha County/McCook County line to Ellis Road in Sioux Falls. Information presented in the summary matrix was used to assist the SAT in evaluating the alternatives relative to the desired performance measures and, where there are multiple alternatives, the summary provides a side-by-side comparison. The proposed Build concept presented in the next chapter was prepared by combining the preferred segment and intersection elements presented in the table and from input received through the public outreach process.

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**Table 10. SD 42 Corridor Alternatives Comparison Summary**

Segment-Intersection/Alternative Segments in Gray Intersections in White	Traffic Operations			Social and Environmental Impacts						Safety Impact			Input from Public Meeting <sup>5</sup> (Preference Votes - 1st / 2nd / 3rd / 4th)	Estimated Construction Cost (2016 \$)
	Provides Adequate Capacity (2045) <sup>1</sup> (Y/N)	LOS (A.M. Peak, P.M. Peak)	If Signal - Meets Warrant? (Y/N)	Driver Expectancy/ Familiarity (L / M / H)	Additional ROW Required (Y/N) If Y (Acres)	Buildings Impacted (I) - Impacted (A) - Acquired	Wetland Impacts (Acres)	Farmland Impacts (Acres)	Cultural Resource Impacts (Properties)	2045 Crash Reduction % <sup>3</sup>	Annual Cost Savings Impact <sup>4</sup> (\$)	Property Access Impact		
454th Avenue to 455th Avenue (SD 19 South) - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
455th Avenue (SD 19 South) - Add EB Left Turn Lane	Yes	A/C, A/C	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$65,000.00
455th Avenue to 456th Avenue (SD 19 North) - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
456th Avenue (SD 19 North) - Add WB Left and Right Turn Lanes	Yes	A/B, A/C	N/A	H	No	No	No	No	No	38%	\$48,000	No	N/A	\$345,000.00
456th Avenue (SD 19 North) to 457th Avenue - 2 Lane	Yes	N/A	N/A	H	No	No	Yes (0.31)	No	No	0%	\$0	No	N/A	\$3,700,000.00
457th Avenue - No Change	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$65,000.00
457th Avenue to 458th Avenue - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
458th Avenue - No Change	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$40,000.00
458th Avenue to 459th Avenue - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
459th Avenue - Add EB and WB Left Turn Lanes	Yes	A/B, A/B	N/A	H	No	No	No	No	No	48%	\$60,000	No	N/A	\$252,000.00
459th Avenue to 460th Avenue - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
460th Avenue - No Change	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$65,000.00
460th Avenue to 461st Avenue - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
461st Avenue - No Change	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$65,000.00
461st Avenue to 462nd Avenue - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
462nd Avenue - No Change	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$65,000.00
462nd Avenue to 463rd Avenue (Co Rd 151) - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
<b>463rd Avenue - 2 Intersection Improvement Alternates</b>														
463rd Avenue (Co Rd 151) Signalized Intersection Option	Yes	B/B	No	M	No	No	No	No	No	(-29%)	(\$-3,500)	No	5 / 13 / 0 / 0	\$545,000.00
463rd Avenue (Co Rd 151) Single Lane RAB Option	Yes	B/B	N/A	L	Yes (0.89)	Yes (I)	No	Yes (0.18)	No	(-3%)	\$65,000	Yes	13 / 5 / 0 / 0	\$1,300,000.00
463rd Avenue (Co Rd 151) to 464th Avenue - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
464th Avenue - No Change	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$65,000.00
464th Avenue to 465th Avenue - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
465th Avenue - No Change	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$65,000.00
465th Avenue to 466th Avenue (SD 17) - 2 Lane	Yes	N/A	N/A	H	No	No	No	No	No	0%	\$0	No	N/A	\$3,700,000.00
<b>466th Avenue - 4 Intersection Improvement Alternates</b>														
466th Avenue (SD 17) Add NB Right Turn	Yes	A/C, A/E	N/A	H	No	No	No	No	No	NA	NA	No	Not Included	\$50,000.00
466th Avenue (SD 17) Signalized Intersection Option	Yes	B/A	No	H	No	No	No	No	No	70%	\$160,000	No	0 / 3 / 10 / 0	\$700,000.00
466th Avenue (SD 17) Single Lane RAB Option	Yes	B/B	N/A	L	Yes (0.88)	No	No	Yes (0.88)	No	44%	\$160,000	No	0 / 11 / 3 / 0	\$130,000.00
466th Avenue (SD 17) Hybrid RAB Option	Yes	B/B	N/A	L	Yes (1.02)	No	No	Yes (1.02)	No	44%	\$160,000	No	19/0/0/0	\$1,500,000.00
<b>466th Avenue to 467th Avenue - 2 Segment Alternatives</b>														
466th Avenue (SD 17) to 467th Avenue - 4-Lane/2-Lane Transition	Yes	N/A	N/A	H	No	No	No	No	No	16%	\$55,000	Yes	N/A	\$4,000,000.00
466th Avenue (SD 17) to 467th Avenue - All 4-Lane	Yes	N/A	N/A	H	No	No	No	No	No	31%	\$100,000	Yes	N/A	\$7,200,000.00

Segment-Intersection/Alternative Segments in Gray Intersections in White	Traffic Operations			Social and Environmental Impacts						Safety Impact			Input from Public Meeting <sup>5</sup> - 1st / 2nd / 3rd / 4th	Estimated Construction Cost (2016 \$)
	Provides Adequate Capacity (2045) <sup>1</sup> (Y/N)	LOS (A.M. Peak, P.M. Peak)	If Signal - Meets Warrant? (Y/N)	Driver Expectancy/Familiarity (L / M / H)	Additional ROW Required (Y/N) If Y (Acres)	Buildings Impacted (I) - Impacted (A) - Acquired	Wetland Impacts (Acres)	Farmland Impacts (Acres)	Cultural Resource Impacts (Properties)	Safety Impact		Property Access Impact		
										2045 Crash Reduction % <sup>3</sup>	Annual Cost Savings Impact <sup>4</sup> (\$)			
<b>467th Avenue - 4 Intersection Improvement Alternates</b>														
467th Avenue EB Left, WB Right and WB Left Turn Lane	Yes	A/C, A/D	N/A	H	No	No	No	No	No	77%	\$215,000	Yes	Not Included	\$550,000.00
467th Avenue Signalized Intersection Option	Yes	A/A	No	H	No	No	No	No	No	62%	\$190,000	Yes	0 / 3 / 4 / 2	\$700,000.00
467th Avenue Hybrid RAB Option	Yes	B/C	N/A	L	Yes (1.63)	No	No	Yes (0.89)	No	87%	\$260,000	Yes	0 / 7 / 3 / 0	\$1,700,000.00
467th Avenue Multilane RAB Option	Yes	A/A	N/A	L	Yes (1.69)	No	No	Yes (0.89)	No	87%	\$260,000	Yes	12 / 2 / 0 / 0	\$1,900,000.00
<b>467th Avenue to 468th Avenue - 4 Segment Alternatives</b>														
Option A - 3/4 Access at Kuhle Drive	Yes	N/A	N/A	H	No	No	Yes (0.78)	No	No	0%	\$15,000	Yes	0 / 3 / 0 / 1	\$7,286,000.00
Option B - Access #3 Landon/Kuhle Intersection	Yes	N/A	N/A	H	No	No	Yes (0.78)	No	No	(-16%)	(\$-38,500)	Yes	3 / 2 / 4 / 0	\$7,386,000.00
Option C - Service Road/Relocate SD 42	Yes	N/A	N/A	H	Yes (10.30)	Yes (I)	Yes (0.78)	Yes (9.04)	No	5%	\$30,000	Yes	9 / 2 / 1 / 2	\$7,998,000.00
Option D - Access #3 J-Turn	Yes	N/A	N/A	M	Yes (0.11)	No	Yes (0.78)	Yes (0.04)	No	0%	\$15,000	Yes	2 / 2 / 0 / 1	\$7,386,000.00
468th Avenue to Cherry Lake Drive	Yes	N/A	N/A	H	No	No	Yes (0.73)	No	No	40%	\$30,000	No	N/A	\$3,600,000.00
<b>Cherry Lake Drive - 7 Intersection Improvement Alternates</b>														
Option 1 - Cherry Lake Dr 3 Legged Side Street Stop Control	No	A/C, A/E	N/A	H	No	No	No	No	No	69%	\$85,000	Yes	Not Included	\$550,000.00
Option 2 - Cherry Lake Dr 3 Legged Signalized Intersection Option	Yes	A/A	No	H	No	Yes (A)	No	No	No	32%	\$40,000	Yes	12 / 0 / 0 / 1	\$650,000.00
Option 3 - Cherry Lake Dr 4 Legged Signalized Intersection Option	Yes	B/A	Yes	H	No	Yes (A)	No	No	No	(-7%)	\$17,500	Yes		\$700,000.00
Option 4 A - Cherry Lake Dr Multilane RAB Option - 3 Legged	Yes	B/A	N/A	L	Yes (0.42)	Yes (A)	No	No	No	83%	\$110,000	Yes	0 / 1 / 2 / 3	\$1,600,000.00
Option 4B - Cherry Lake Dr Curve South Leg RAB Option	Yes	B/A	N/A	L	Yes (1.41)	Yes (A)	No	No	No	66%	\$100,000	Yes	0 / 0 / 3 / 2	\$1,900,000.00
Option 4C - Cherry Lake Dr Rotate South Leg RAB Option	Yes	B/A	N/A	L	Yes (1.29)	Yes (A)	No	No	No	66%	\$100,000	Yes	0 / 0 / 0 / 2	\$680,000.00
Option 4D - Cherry Lake Dr Split South Leg RAB Option	Yes	B/A	N/A	L	Yes (1.29)	Yes (A)	No	No	No	66%	\$100,000	Yes	1 / 2 / 0 / 5	\$680,000.00
Cherry Lake Dr to Ellis Road	Yes	N/A	N/A	H	No	No	No	No	No	16%	\$45,000	No	N/A	\$3,600,000.00
Ellis Road	Yes	C/C	Yes	H	Yes (0.26)	No	No	No	No	29%	\$32,500	No	N/A	\$1,480,000.00
Ellis Road to End of Project	Yes	N/A	N/A	H	No	No	No	No	No			No	N/A	\$1,000,000.00

Notes:

1 - List includes only improvements evaluated for the corridor. All provide adequate capacity to support minimum acceptable peak hour operations.

2 - Change is relative to the rate associated with the current segment and/or intersection cross section and intersection control.

3 - Change in Crash Rate Relative to Rate for Current Intersection Geometry and Control.

4 - Estimated dollar value of crash reductions associated with implementing the improvement relative to the current. General annual cost savings per reduced crash by severity. Based on 2016 Dollars:

Property Damage Only - \$17,600      Fatality/Injury - \$374,800

5 - Persons attending the August 10, 2106 public information meeting were provided the opportunity to vote their preference of which alternative they preferred.



## 6.0 Corridor Improvement Plan

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The proposed Build concept for the SD 42 corridor reflects a combination of retaining the current two-lane section and, where traffic volume warrants, expansion of the corridor to an urban four-lane divided section. For each of the cross section alternatives left and right turn lanes are proposed for locations where traffic volume warrants are met. In addition, a limited number of access modifications have been incorporated into the Build concept, which is illustrated in Figure 18 and Figure 19.

### 6.1 Two-Lane Section

The current two-lane cross section is proposed to be maintained from the McCook/Minnehaha County line through 466th Avenue. Forecasted traffic volume along this section can be accommodated at an acceptable level of service with the following intersection improvements:

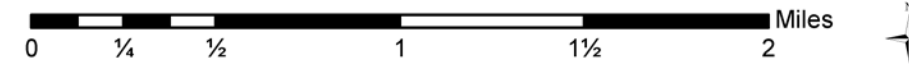
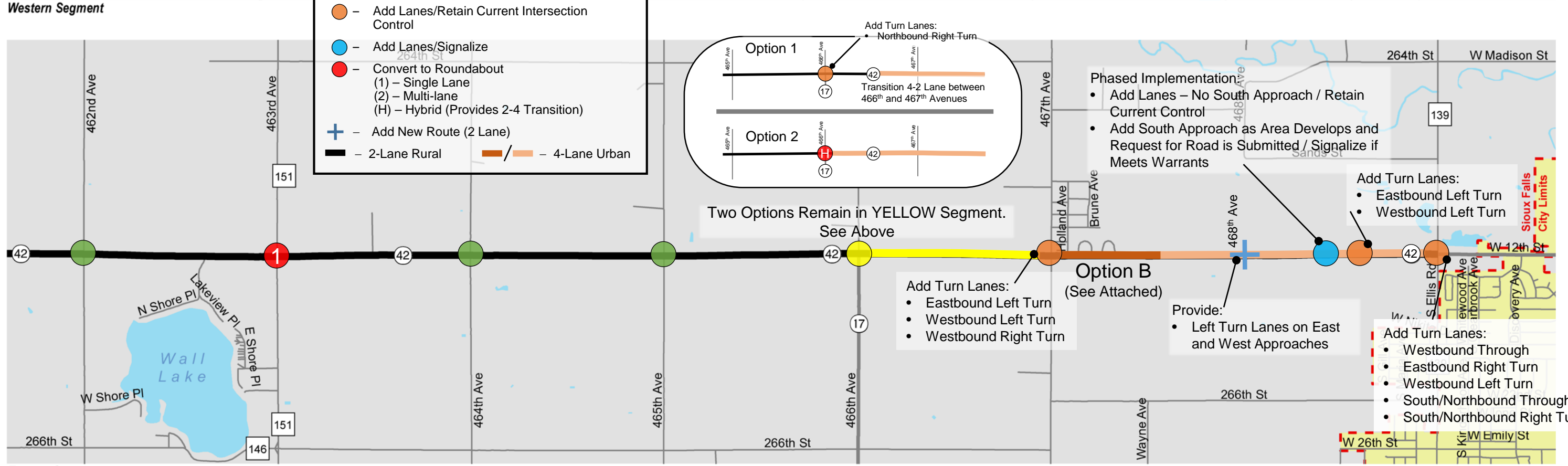
- SD 19 (456th Avenue): Along SD 42 add a westbound left turn lane and a westbound right turn lane.
- 459th Avenue: Add an eastbound left turn lane and a westbound left turn lane to SD 42.
- County 151 (463rd Avenue): Reconstruct the intersection as a roundabout.
- SD 17 (466th Avenue): Two Build alternatives have been maintained in the improvement plan as the segment east of the intersection represents the areas where traffic volumes suggest the transition from two lanes to four lanes is necessary to provide adequate capacity through the horizon year. The two alternatives are:
  - Two-lane – Retain the two lane section on SD 42 and the current configuration of turn lanes and add a northbound right turn lane on SD 17 (466th Avenue).
  - Four-lane – Reconstruct the intersection as a roundabout configured to provide the transition from two to four lanes within the intersection. This concept is referred to as a hybrid roundabout.

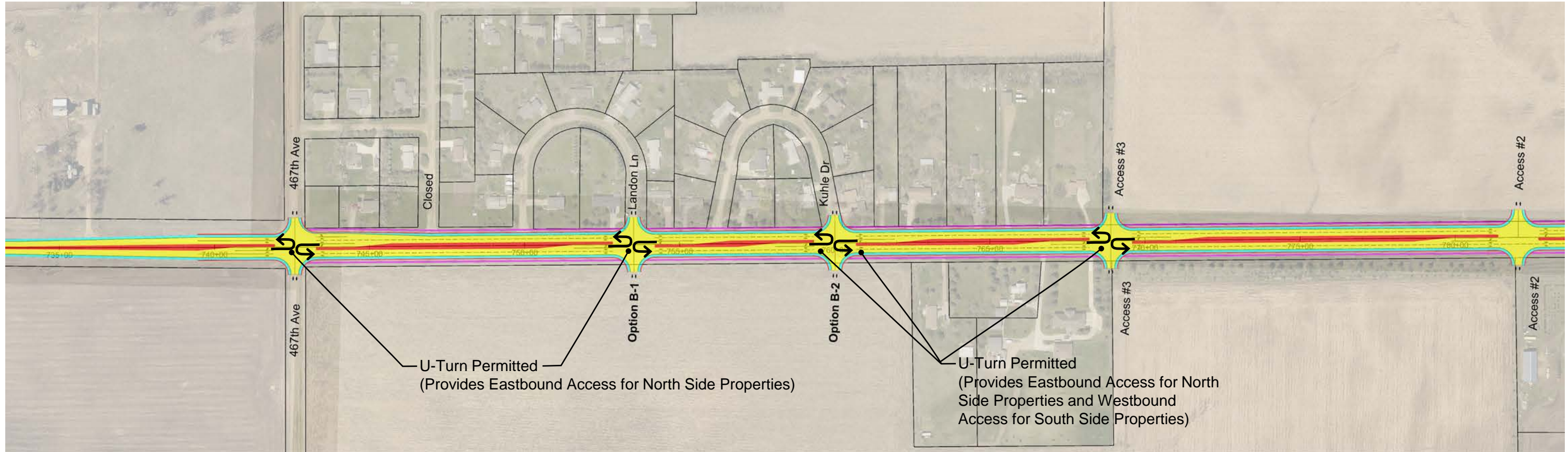
Roundabouts in rural areas of the state are a relatively new concept and construction costs are higher than for conventional intersections. Thus, the SDDOT will continue to review during future project development both a conventional intersection and a roundabout configuration and base final decisions on observed and forecasted conditions reflective of the construction period. A side-by-side comparison of conventional and roundabout alternatives with information to aid discussion is provided in the Appendix.

### 6.2 Four-Lane Section

Widening the corridor from two-lanes to four-lanes is proposed east of 467th Avenue, with the potential to extend the expansion to SD 17 (466th Avenue). The four-lane Build concept reflects an

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urban cross section with curb and gutter and a median to separate eastbound and westbound traffic. Proposed elements of the Build alternative are:

- 467th Avenue: Add an eastbound left turn lane and left and right turn lanes in the westbound direction to SD 42. The current stop control on 467th Avenue would be maintained.
- 467th to Future 468th Avenue: Provide full access median openings at the east access to Landon Lane and Kuhle Dive and allow a full access opening at the half-mile and three-quarters of a mile point between 467th Avenue and future 468th Avenue.
- 468th Avenue: The City of Sioux Falls road improvement plans includes adding a new north-south roadway at 468th Avenue as development extends to the west. The corridor would extend south from SD 42 to at least 41<sup>st</sup> Street and north to Maple Street.
- Cherry Lake Drive: Retain the stop control on Cherry Lake Drive. No additional turn lanes would be included with the four-lane concept as the current two-way left turn lane would be converted to left turn lanes in the proposed median.
- Ellis Road: The intersection configuration concept developed for the West Corridor has been incorporated into the Build concept for SD 42. Intersection improvements include:
  - Widening Ellis Road to a four-lane divided section with a left and right turn lane on both the north and south approaches.
  - Add a second westbound left turn lane to SD 42 (12th Street).
  - Add an eastbound right turn lane on SD 42 (12th Street).

### **6.3 Predicted Crash Impacts of Build Concept**

The *Highway Safety Manual (HSM) Predictive Method* was used to predict crash frequency and severity along the corridor based on future traffic volumes and roadway characteristics. The predictive method was evaluated for both existing conditions and with recommended improvements identified in this document. The recommended improvements were classified into categories based on the following two alternatives between 467th Avenue and 466th Avenue (SD 17):

- 1) Alternative 1 – A four-lane urban divided segment that extends to the SD 42/466th Avenue intersection and includes a roundabout at the SD 42/466th Avenue intersection.
- 2) Alternative 2 – A four-lane urban divided segment that transitions to a two-lane rural undivided roadway east of the SD 42/466th Avenue intersection. The SD 42/466th Avenue intersection remains as side-street stop control and includes a new northbound right turn lane.

The recommended improvement alternatives were compared to existing conditions to develop a future crash reduction percentage, which represents the safety impact to the corridor based on the recommended improvement. A summary of the corridor crash frequency is shown in Table 11, which indicate that the recommended improvements are expected to reduce the crash frequency by approximately 15 percent.

The crash severity was also evaluated using the HSM default distribution percentages. These default distributions are used to determine the number of fatal and injury crashes versus property damage only. A summary of the total corridor crashes by severity for Alternatives 1 and 2 are shown in Table 12, which indicates that both alternatives are expected to reduce fatal/injury crashes between 19 and 24 percent and property damage only by approximately 11 to 12 percent.

**Table 11. Corridor Crash Frequency Summary**

Location	Existing Crashes (2012-2014)	Future Crashes Existing Conditions (2045-2047)	Future Crashes With Recommended Improvements (2045-2047) <sup>(2)</sup>	Future Crash Reduction Due to Recommended Improvements <sup>(2)</sup>
Intersections	22	87.08	69.12 - 72.80	-16 % to -21 %
Segments	68	129.04	112.14 - 114.10	-12 % to -13 %
<b>Total</b>	<b>90</b>	<b>216.12</b>	<b>181.27 - 186.91</b>	<b>-14 % to -16 %</b>

(1) Detailed intersection and segment crash prediction is included in the Appendix.

(2) The range represents the difference between Alternatives 1 and 2. Alternative 1 represents the lower end of the range while alternative 2 represents the higher end.

**Table 12. Corridor Crash Severity Summary**

Location	Existing Crashes (2012-2014)		Future Crashes Existing Conditions (2045-2047) <sup>(1)</sup>		Future Crashes With Recommended Improvements (2045-2047) <sup>(1)</sup>		Future Crash Reduction Due to Recommended Improvements	
	FI	PDO	FI	PDO	FI	PDO	FI	PDO
<b>Alternative 1</b>								
Intersections	1	21	36.21	50.88	25.46	43.67	-30 %	-14 %
Segments	13	55	41.51	87.53	33.78	78.37	-19 %	-10 %
<b>Alternative 1 Total</b>	<b>14</b>	<b>76</b>	<b>77.71</b>	<b>138.41</b>	<b>59.23</b>	<b>122.03</b>	<b>-24 %</b>	<b>-12 %</b>
<b>Alternative 2</b>								
Intersections	1	21	36.21	50.88	28.33	44.47	-22 %	-13 %
Segments	13	55	41.51	87.53	34.74	79.37	-16 %	-9 %
<b>Alternative 2 Total</b>	<b>14</b>	<b>76</b>	<b>77.71</b>	<b>138.41</b>	<b>63.07</b>	<b>123.84</b>	<b>-19 %</b>	<b>-11 %</b>

(1) HSM Default Crash Severity Distributions used for future crash predictions.

It should be noted that detailed intersection and segment crash prediction data is provided in the appendix.

Centerline rumble strips are a longitudinal safety feature that are installed continuously or intermittently at or near the centerline of an undivided highway. The purpose of rumble strips are to alert drivers, through vibration and sound, who unintentionally stray over the roadway centerline. Rumble strips are often installed as a countermeasure for driver error, rather than roadway deficiencies. Centerline rumble strips are a proven countermeasure to reduce crash frequency and severity on rural two-lane roadways, specifically head-on and opposite direction sideswipe collisions.

A summary of the HSM crash modification factors for centerline rumble strips are shown in Table 13. The crash modification factors for shoulder rumble strips on rural multi-lane divided roadways is also provided for reference. Crash modification factors for shoulder rumble strips have not been developed for rural two-lane highways.

**Table 13. Potential Crash Effects of Installing Rumble Strips**

Treatment	Setting	CMF (All Crashes)	CMF (Injury)
Install Centerline Rumble Strips	Rural (Two-Lane)	0.86 <sup>(1)</sup>	0.85
Install Shoulder Rumble Strips	Rural (Multi-Lane Divided) <sup>(2)</sup>	0.84	0.83

(1) When using the Predictive Method, the CMF for centerline rumble strips is 0.94. This value was derived using crash type percentages found in HSM Chapter 10.

(2) For reference only, CMF's have not been developed for shoulder rumble strips on rural two-lane highways.

The SDDOT Roadway Design Manual states rumble strips have been proven to enhance visibility of pavement markings not only during night time conditions, but also during wet weather. Use of rumble strips in rural sections posted at 55 mph or more should be considered as part of the road design and should be coordinated with the Region Traffic Engineer.

Land use and anticipated bicycle use along individual segments of corridor should be considerations factored into where to place rumble strips if they are included in the implemented concept. As they not only produce inside the vehicle vibration and noise, there is also the external noise that can be considered a nuisance to people living nearby. There are several techniques for reducing the occurrence of noise that should be considered during the design process, including locating the strips on the outside of the shoulder where they would not be encountered very often. Additionally, the vibration experienced by bicyclists riding over rumble strips is considered a safety concern for bicyclists.

## 6.4 Access Management

As each access point along the corridor, whether a public street or a private driveway, creates conflict points for vehicle traveling through and into/out of the corridor, the number of points should be limited. For the proposed Build alternative an access control and management concept was developed that included recommendations for actions at each access point along the corridor. For the vast

majority of the current public and private access points the current location was acceptable. East of 467<sup>th</sup> Avenue the combination of private driveways and public streets results in an access density of 29 per mile, which exceeds the guideline threshold. During the more detailed design and environmental evaluation steps of evaluating improvements in the corridor, the SDDOT and the City of Sioux Falls will conduct reviews of each access permit along the corridor to determine whether there are locations where access can be relocated, consolidated or eliminated.

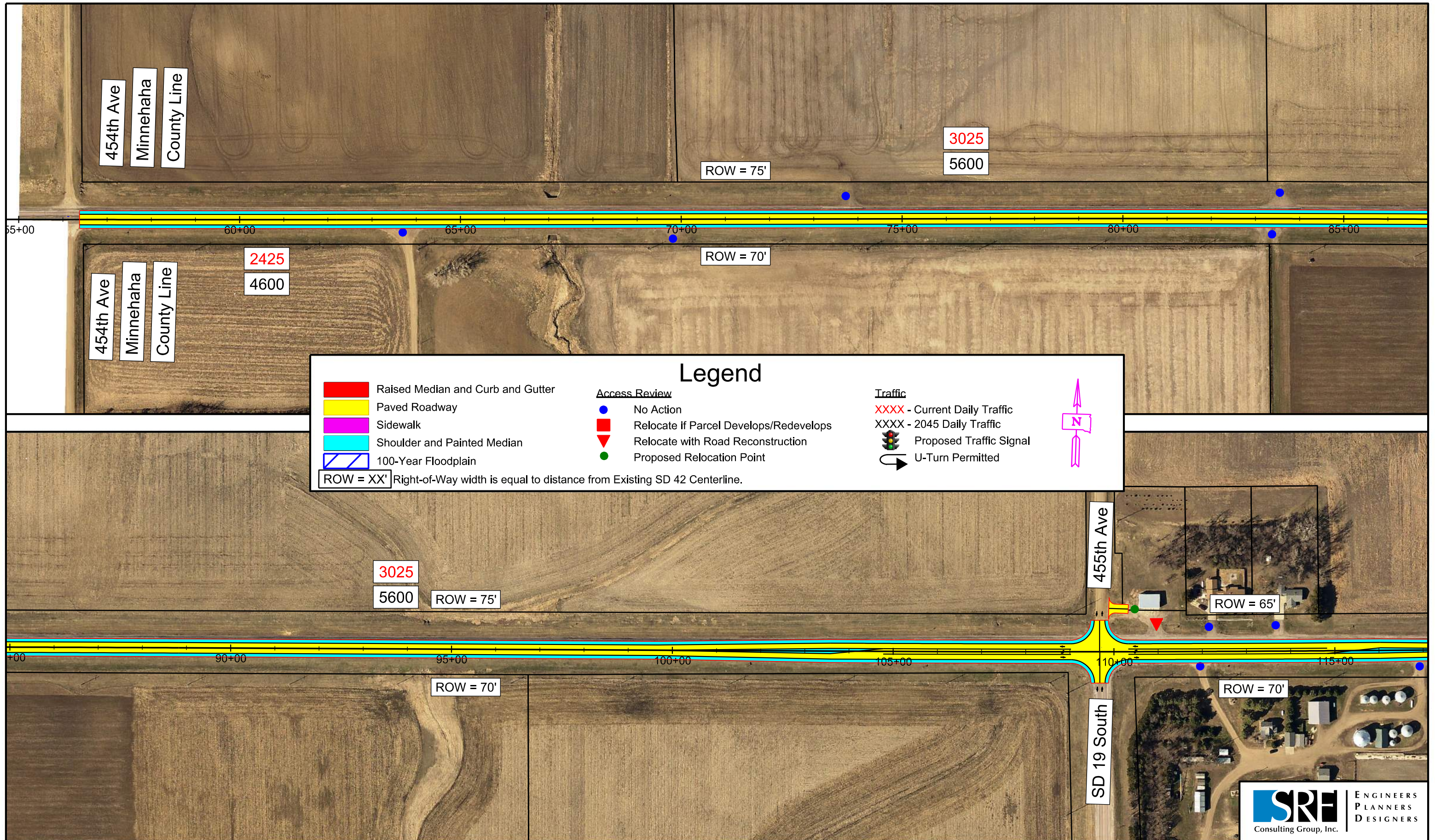
Recommendations for action at this stage of project development are to relocate the following accesses as part of the Build concept:

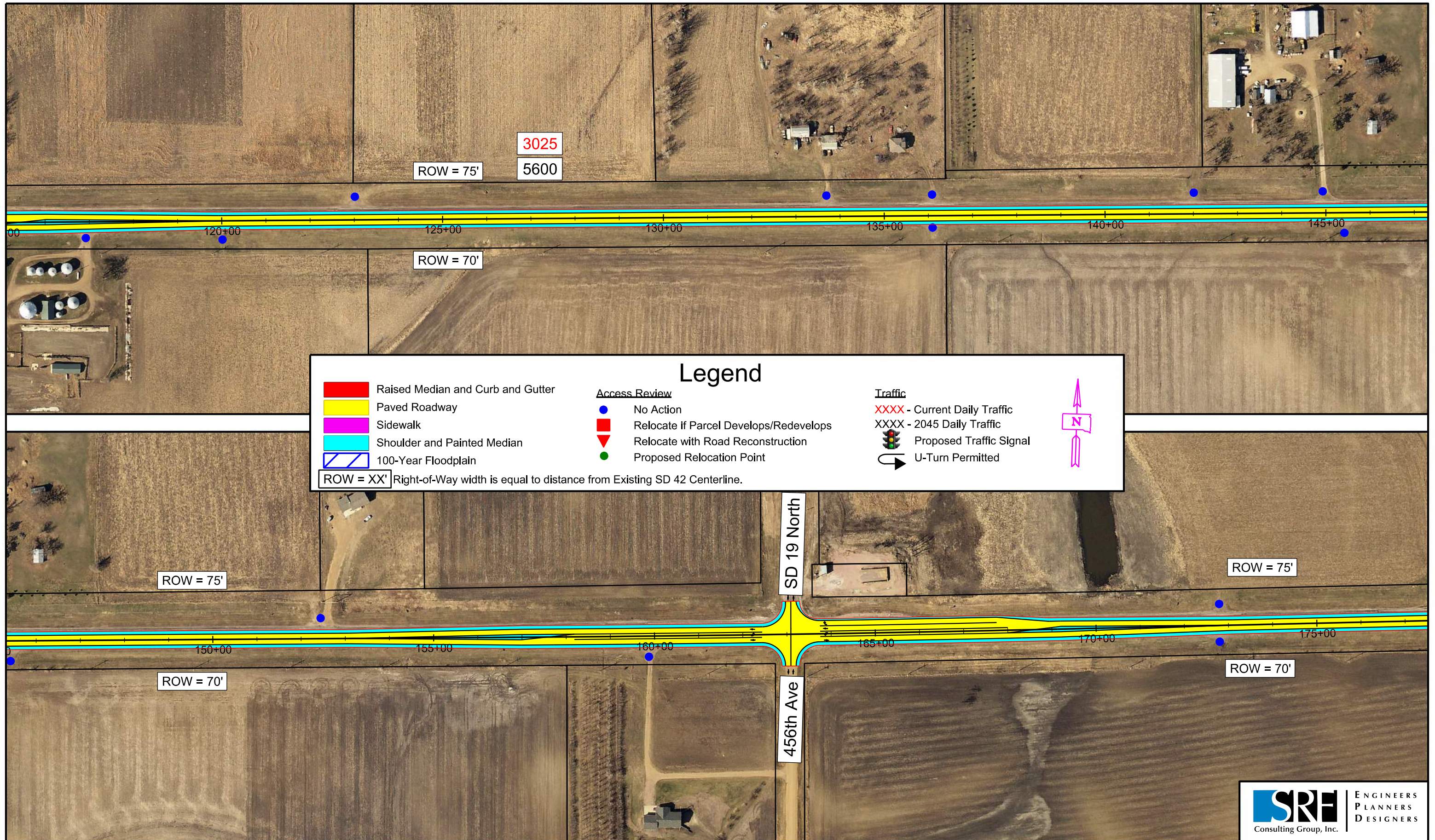
- SD 19 (455th Avenue): Relocate the northeast quadrant drive closest to the intersection from SD 42 to SD 19 (455th Avenue).
- County 151 (463rd Avenue): Relocate the SD 42 driveway and the 463rd Avenue driveway to the parcel in the northeast quadrant to a point on 463rd Avenue north of the proposed median for the roundabout.
- 467th Avenue: Relocate the drive in the northeast quadrant closest to the intersection to 467th Avenue.
- Holland Drive: Close the access point on SD 42.
- Landon Lane East Leg: Relocate the closest drive in the northwest quadrant from SD 42 to Landon Lane.
- Kuhle Drive West Leg: Relocate the driveway in the northeast quadrant from SD 42 to Kuhle Drive.
- Access #3: Close the driveway in the southwest quadrant that is closest to intersection. The property has a second driveway located approximately 150 feet west of the driveway recommended to be closed. Additionally, the current field access that would be located directly east of Access #3 is proposed to be relocated to Access #3.
- Access #2 (one-quarter mile west of 468th Avenue): the field access on the north side of SD 42 and the driveway on the south side are recommended to be relocated to Access #2.
- Access #1: Relocate the field access directly west of the proposed intersection to a point farther south on Access #1 route when the roadway is constructed.

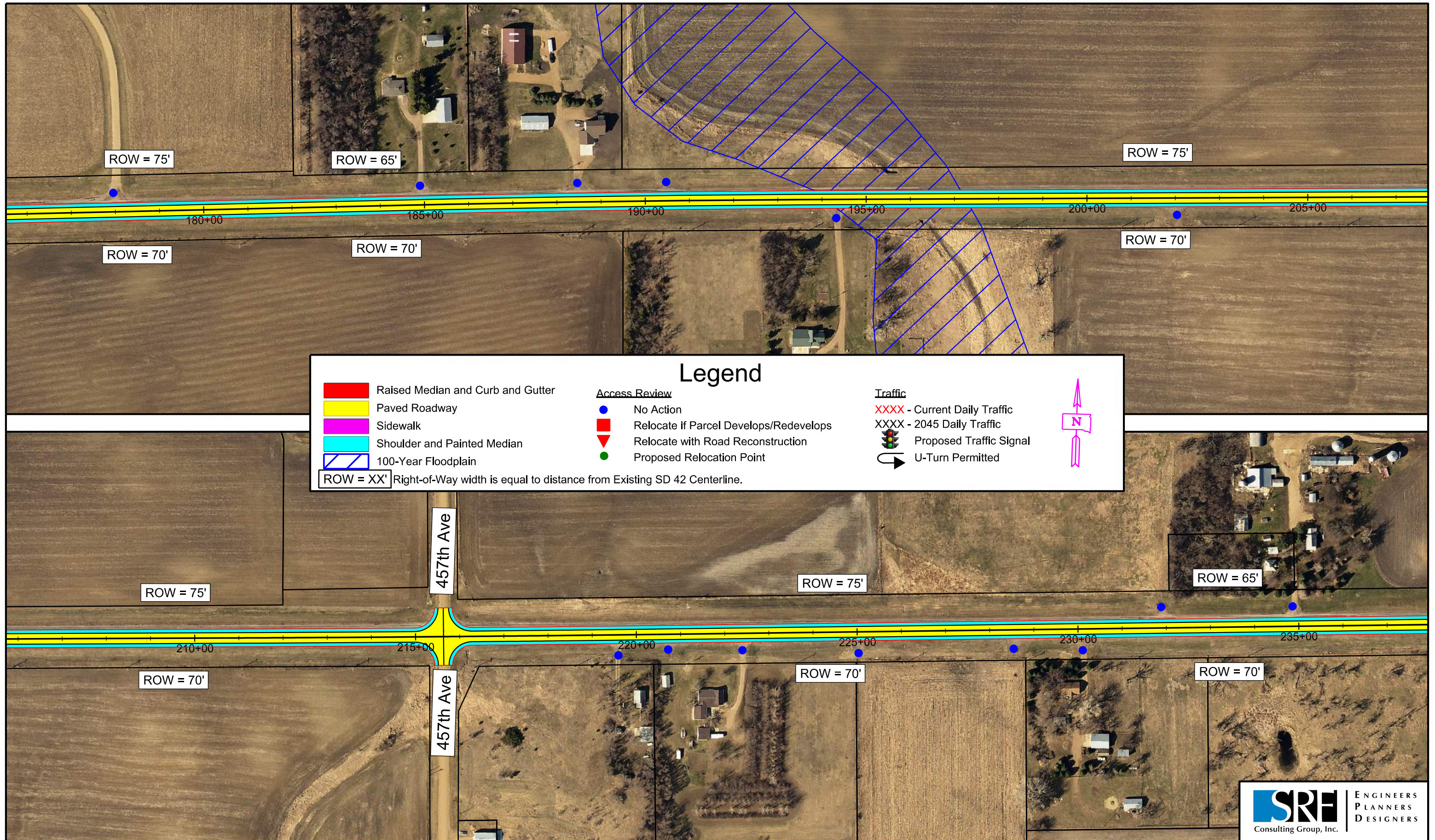
With the exception of the full access intersections displayed in the proposed Build concept along the four-lane section, current private driveways would be restricted to right-in-right-out access. To accommodate travel to the east for north side properties and to the west for south side properties, U-turns would be permitted at each of the proposed full access locations along SD 42.

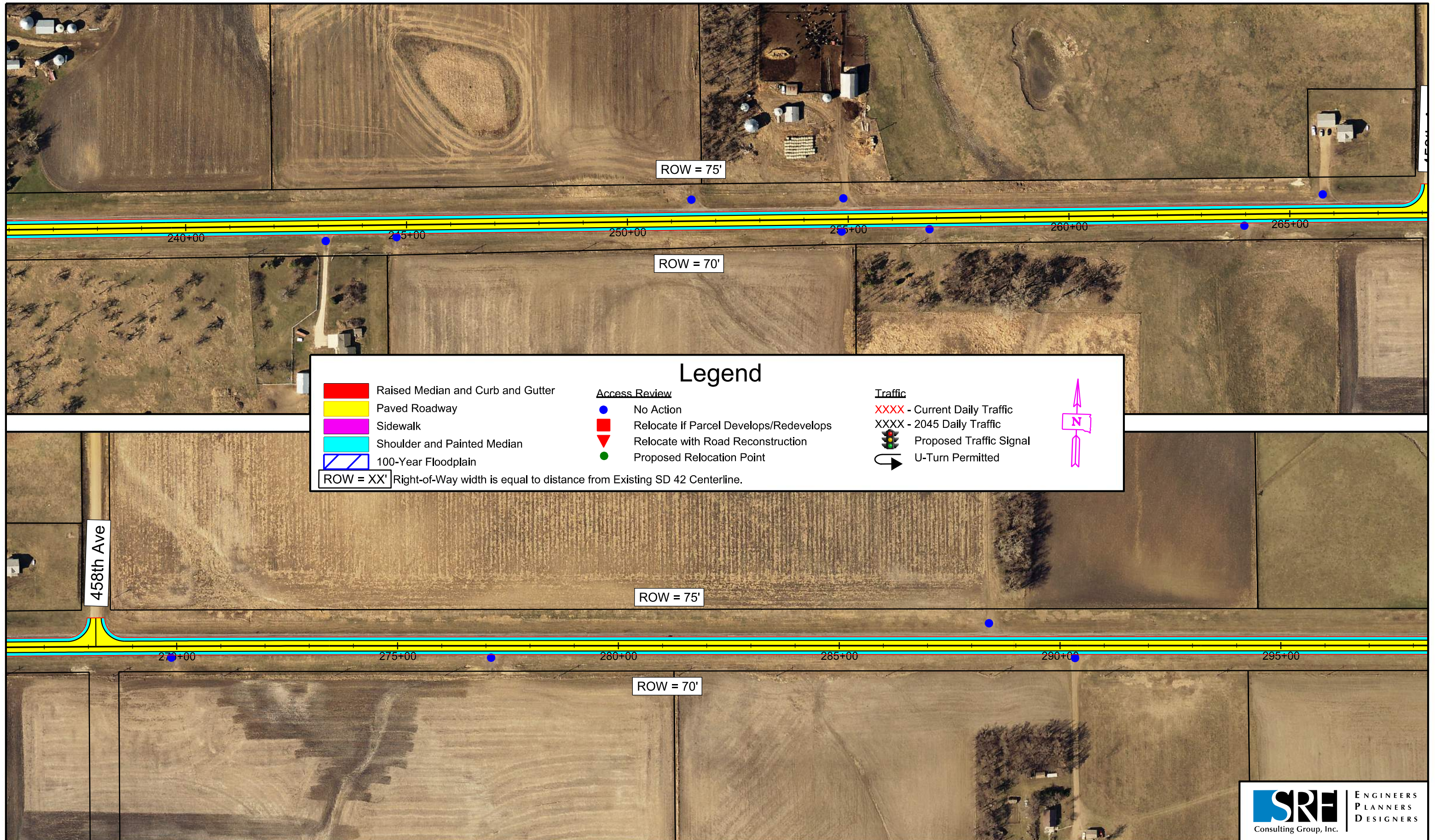
The Build concept alternative overlaid on a corridor aerial photo, to show context, is displayed in Figure 20 through 34.

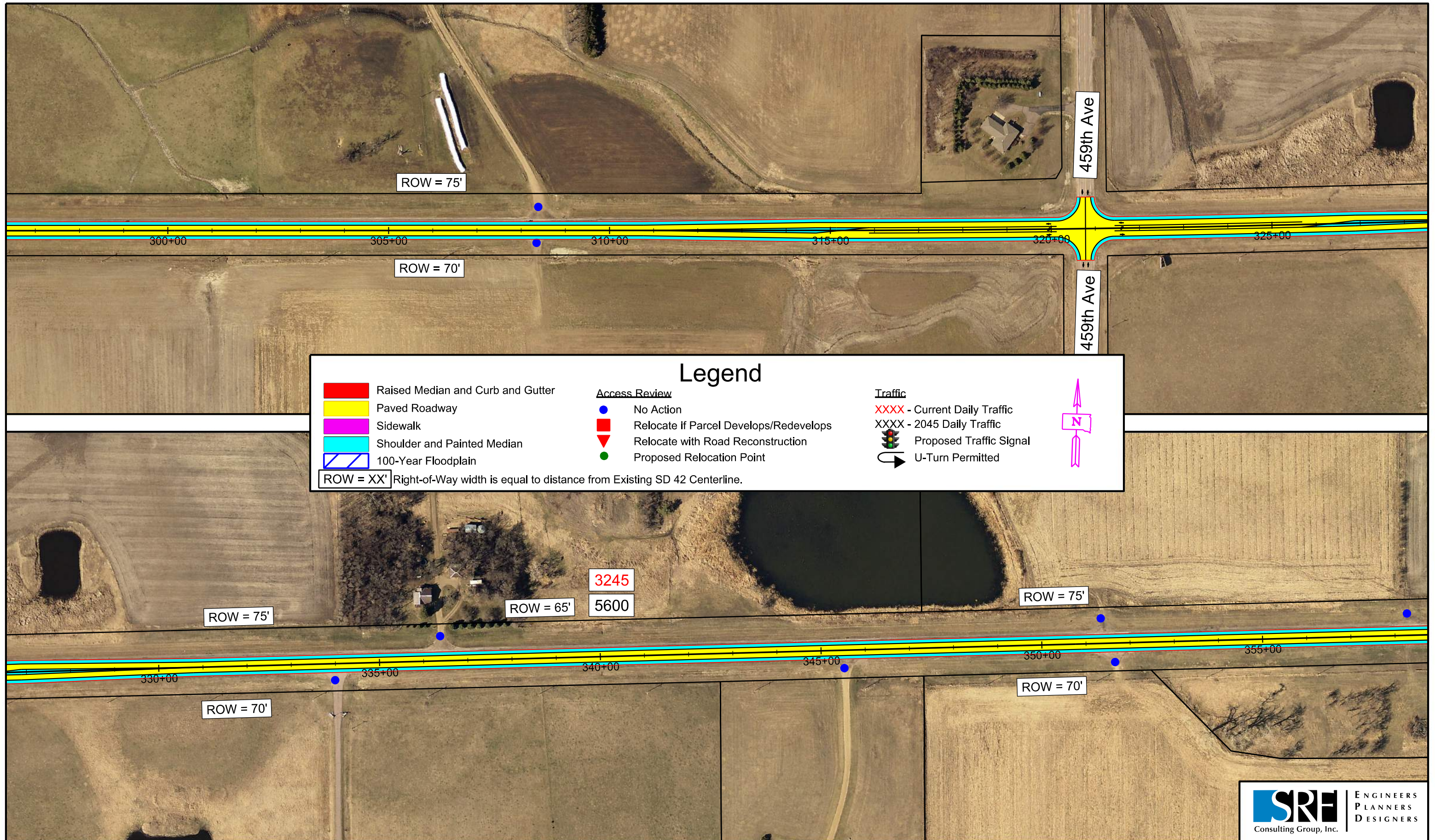


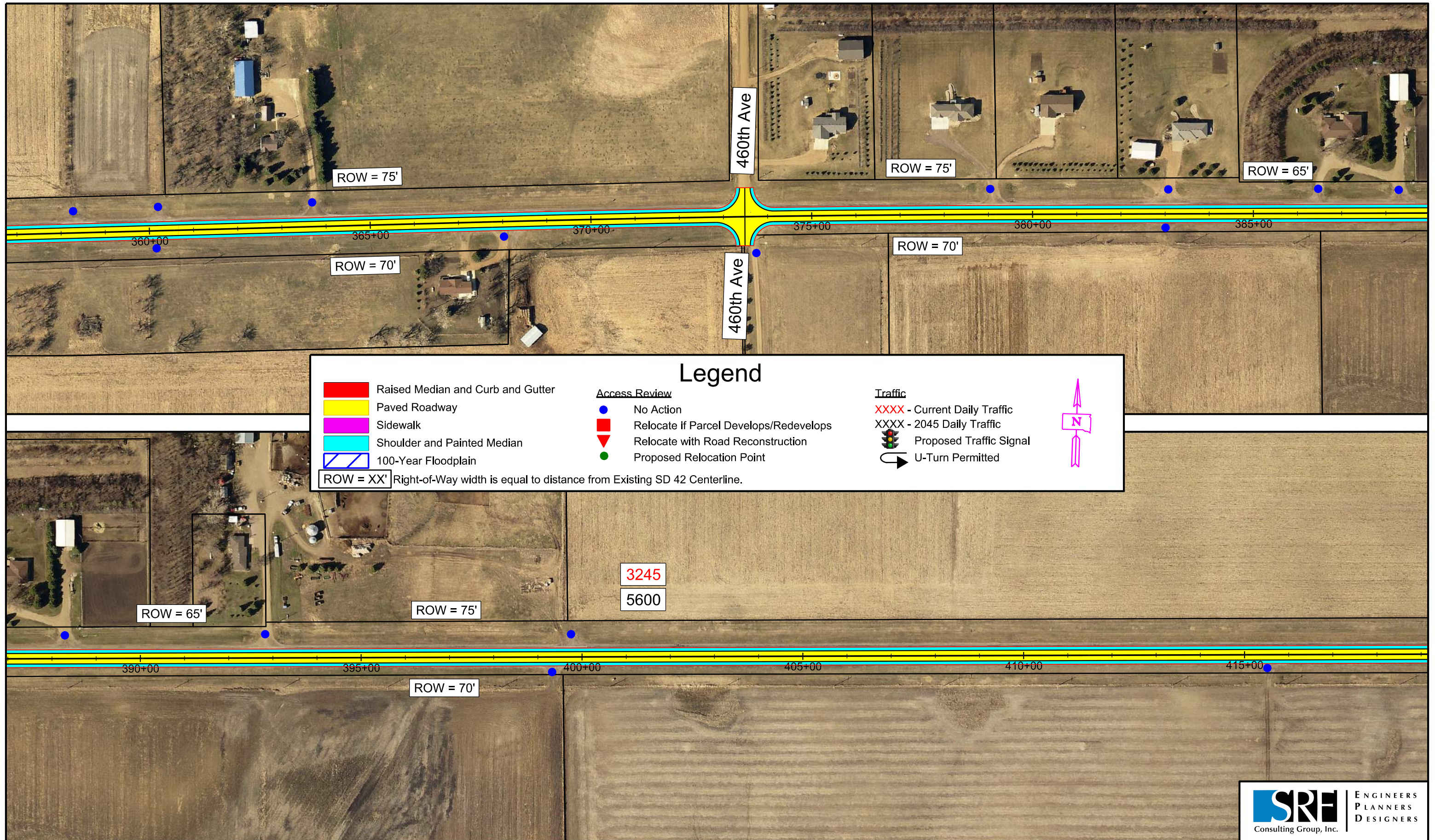


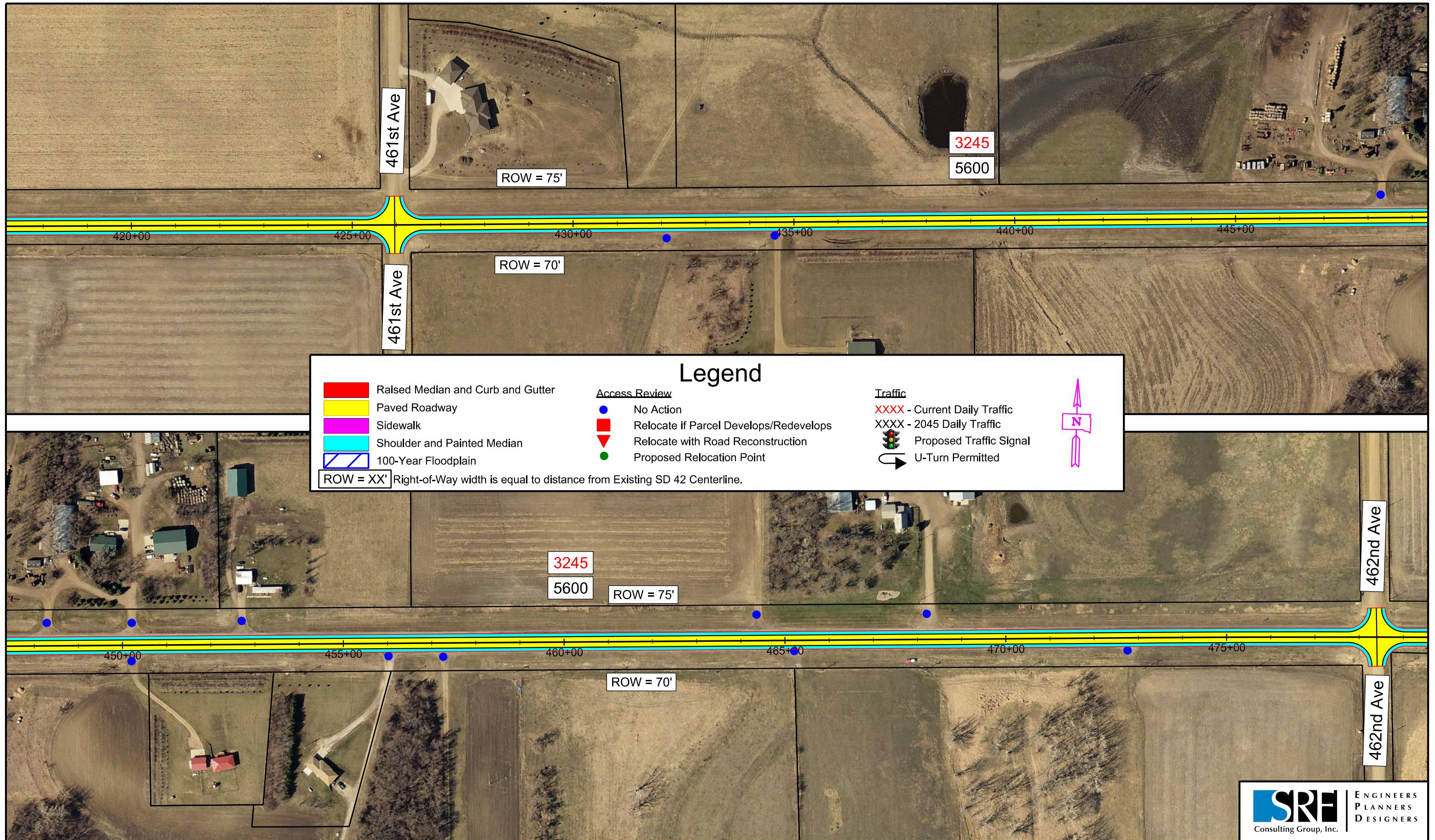


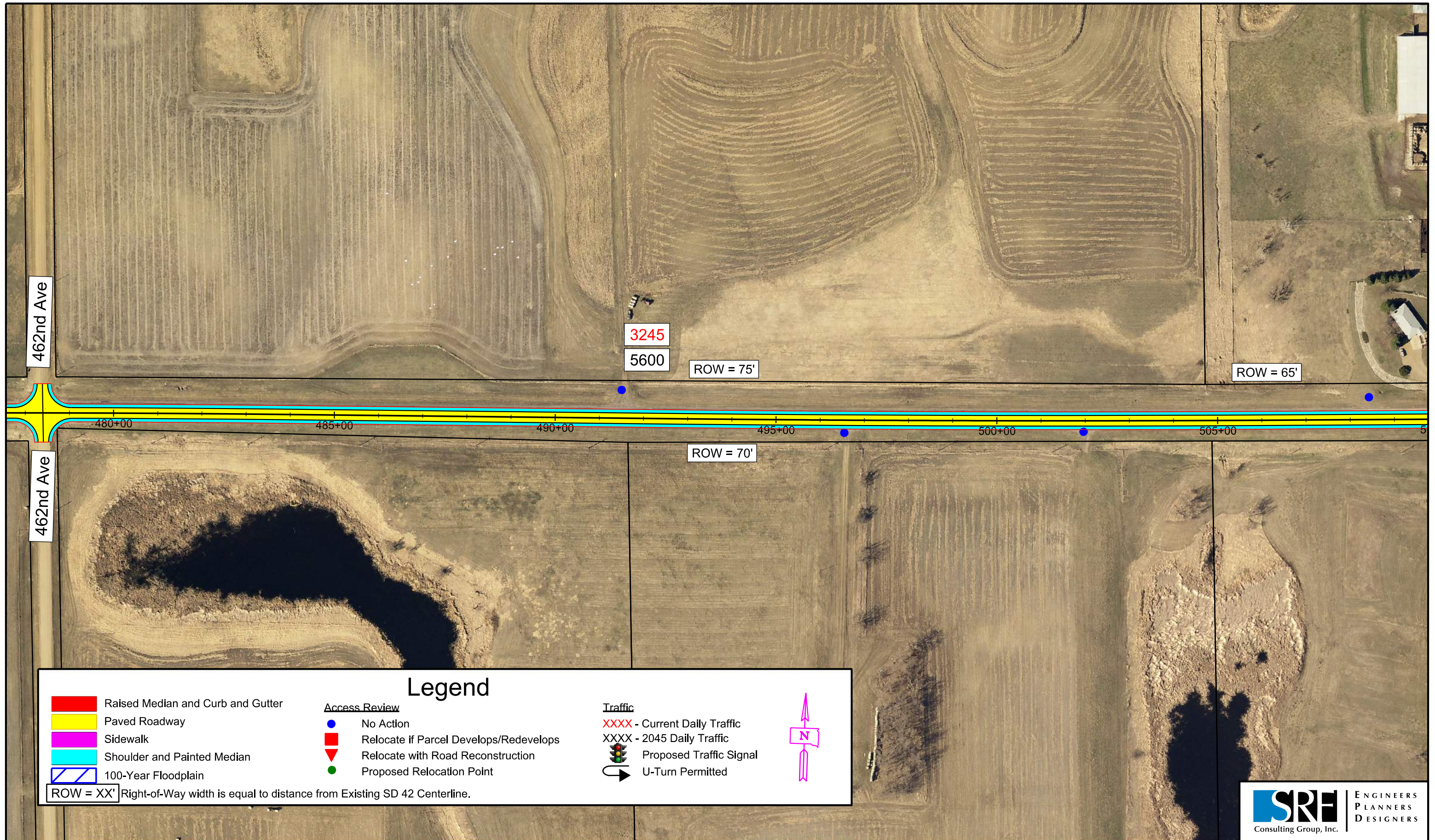




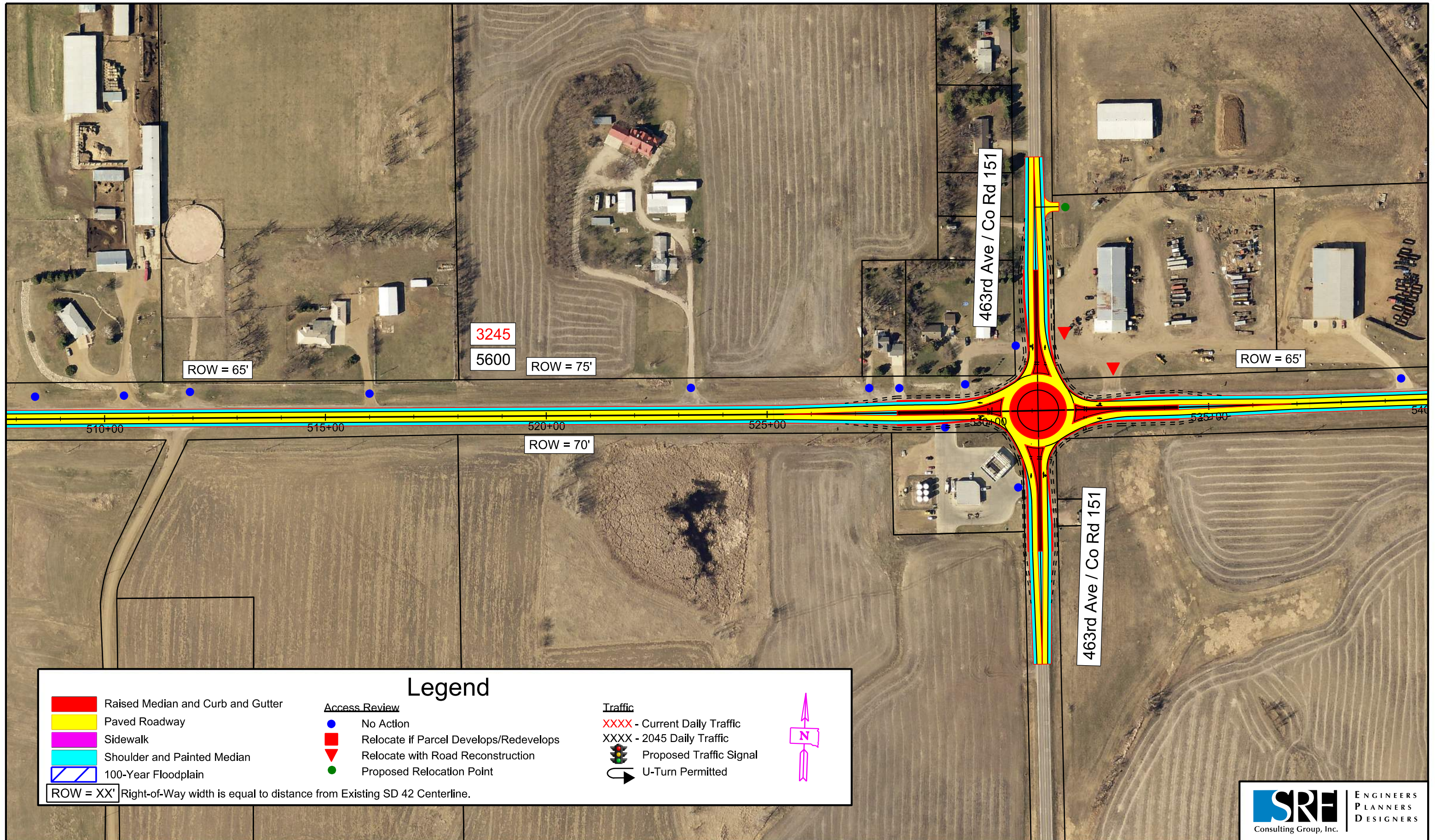












### Legend

<ul style="list-style-type: none"> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: red; margin-right: 5px;"></span> Raised Median and Curb and Gutter</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: yellow; margin-right: 5px;"></span> Paved Roadway</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: magenta; margin-right: 5px;"></span> Sidewalk</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: cyan; margin-right: 5px;"></span> Shoulder and Painted Median</li> <li><span style="display: inline-block; width: 15px; height: 10px; border: 1px solid blue; margin-right: 5px;"></span> 100-Year Floodplain</li> </ul>	<p><u>Access Review</u></p> <ul style="list-style-type: none"> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: blue; border-radius: 50%; margin-right: 5px;"></span> No Action</li> <li><span style="display: inline-block; width: 15px; height: 10px; background-color: red; margin-right: 5px;"></span> Relocate if Parcel Develops/Redevelops</li> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: red; transform: rotate(45deg); margin-right: 5px;"></span> Relocate with Road Reconstruction</li> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: green; border-radius: 50%; margin-right: 5px;"></span> Proposed Relocation Point</li> </ul>	<p><u>Traffic</u></p> <ul style="list-style-type: none"> <li>XXXX - Current Daily Traffic</li> <li>XXXX - 2045 Daily Traffic</li> <li><span style="display: inline-block; width: 10px; height: 10px; background-color: green; border: 1px solid black; margin-right: 5px;"></span> Proposed Traffic Signal</li> <li><span style="display: inline-block; width: 10px; height: 10px; border: 1px solid black; margin-right: 5px;"></span> U-Turn Permitted</li> </ul>
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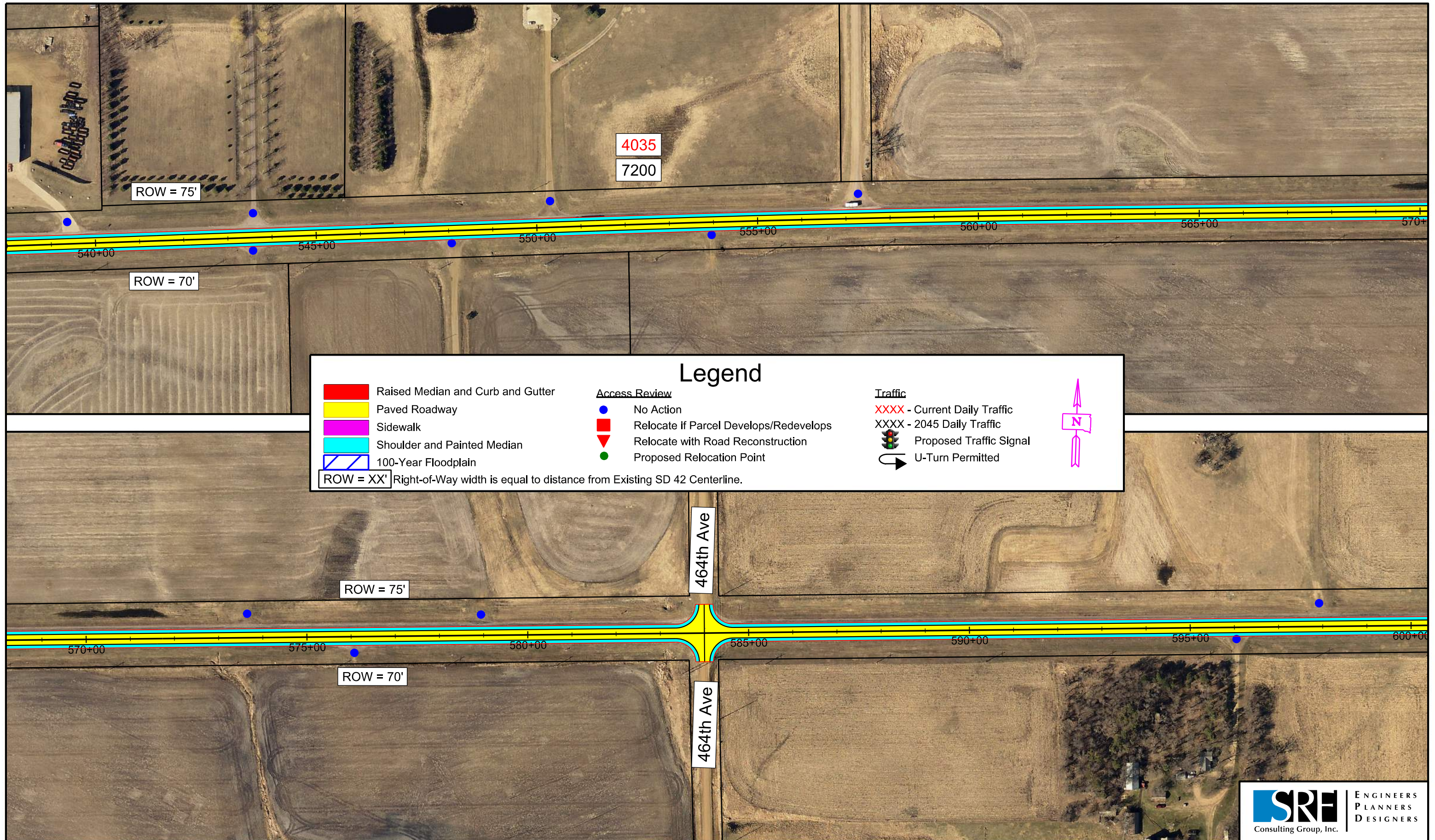
ROW = XX' Right-of-Way width is equal to distance from Existing SD 22 Centerline.

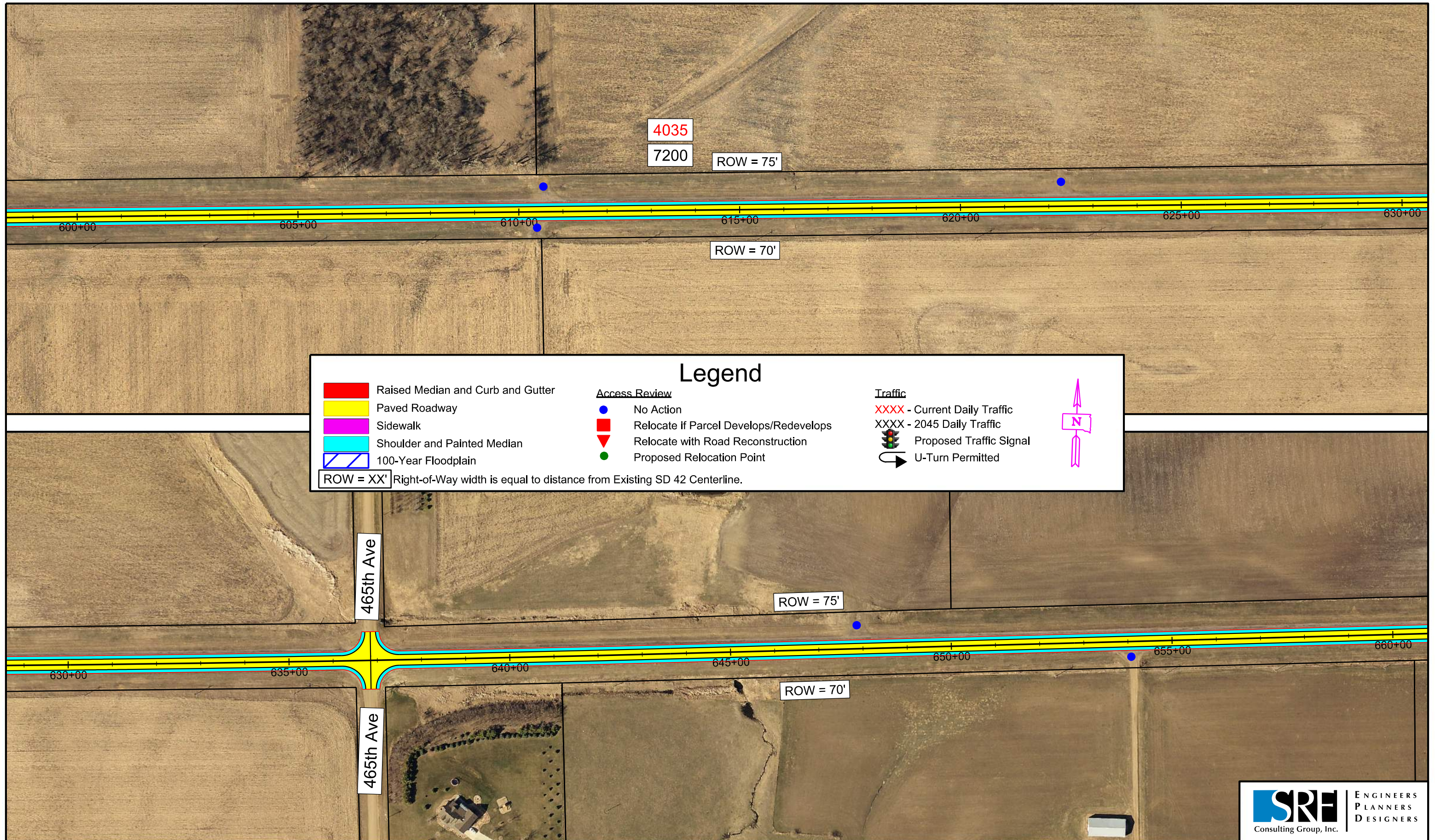


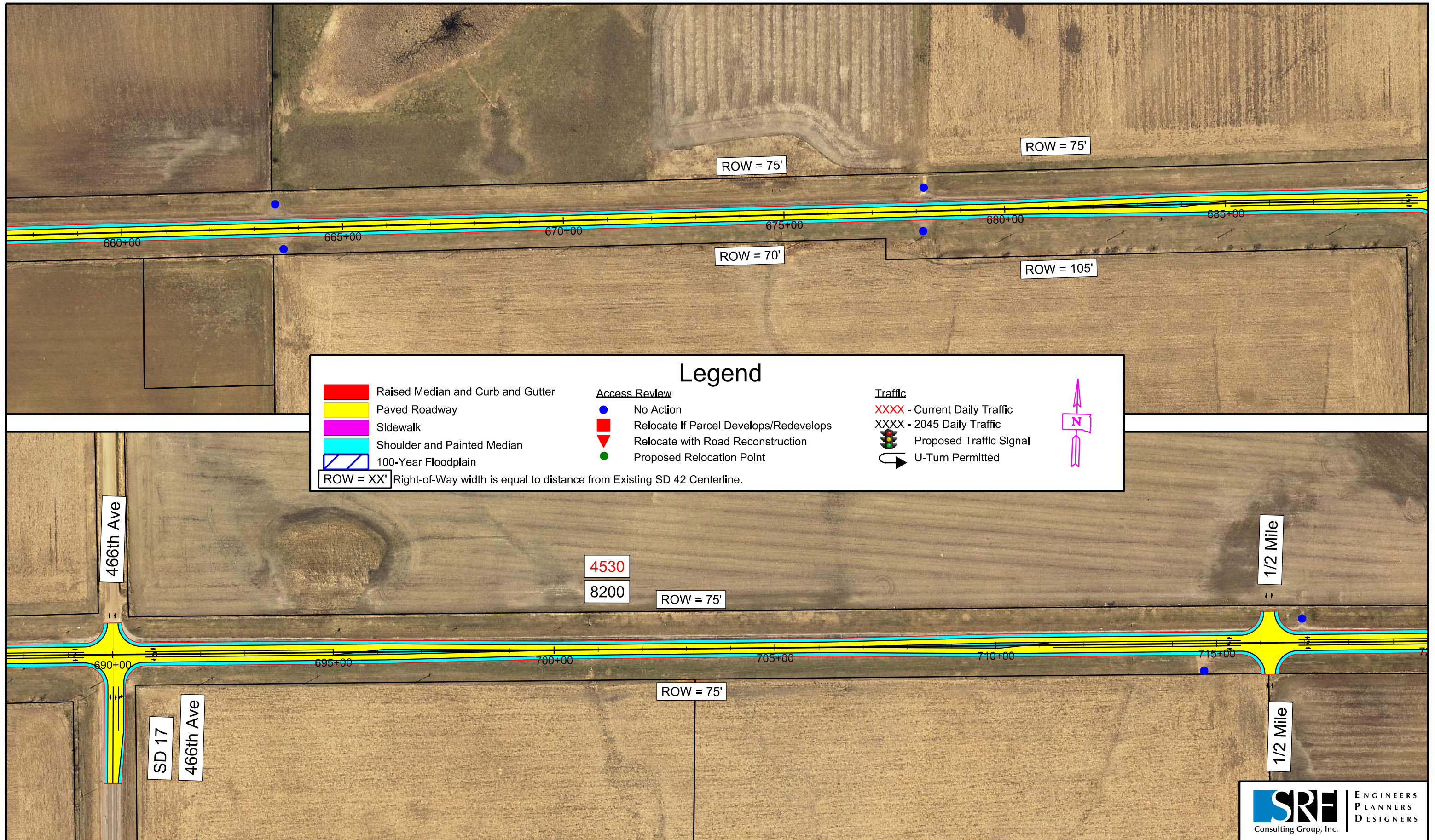
**SD 22 Western Minnehaha County Corridor Study**

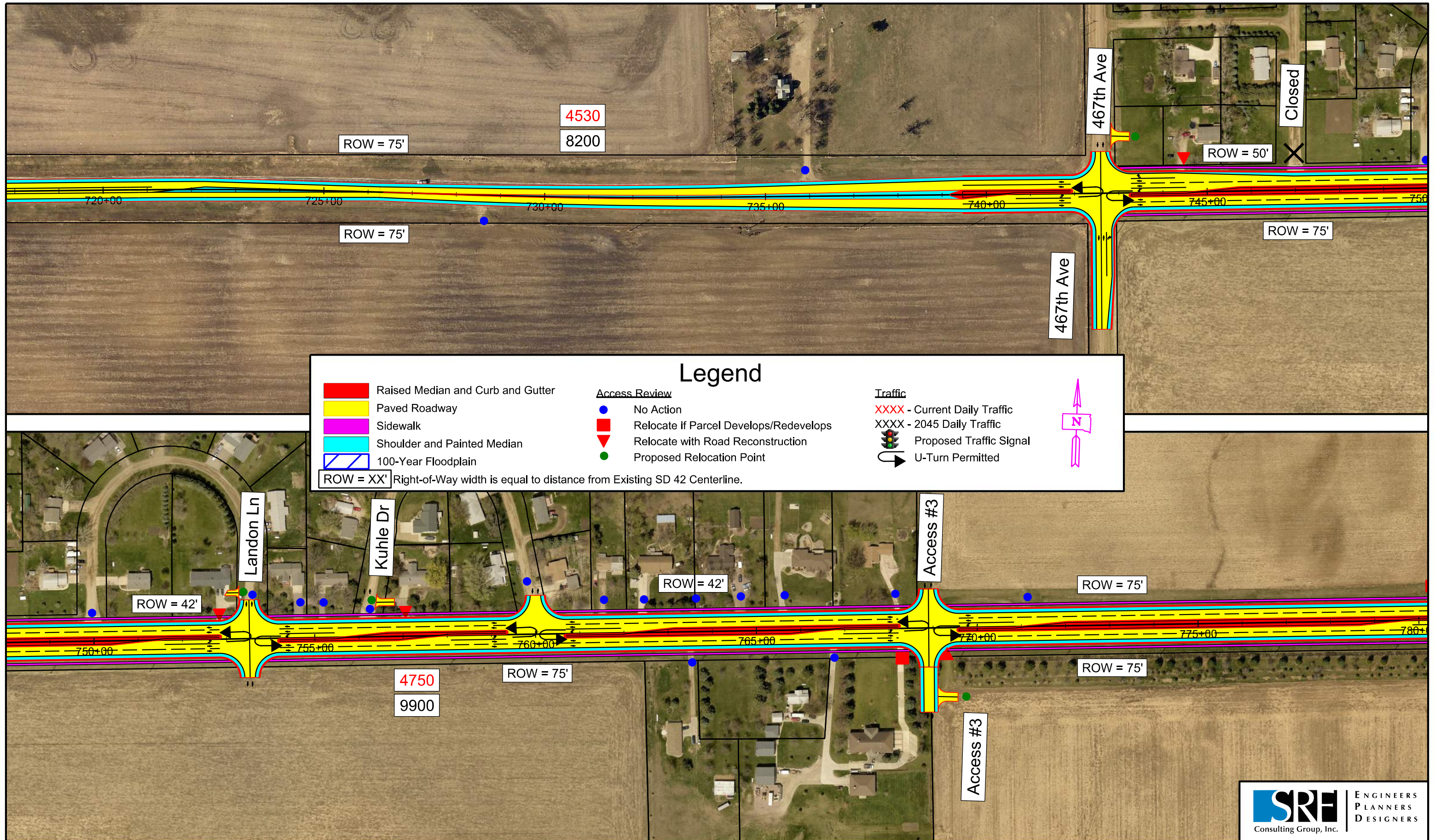
**Mainline Build Alternative Segment 9**

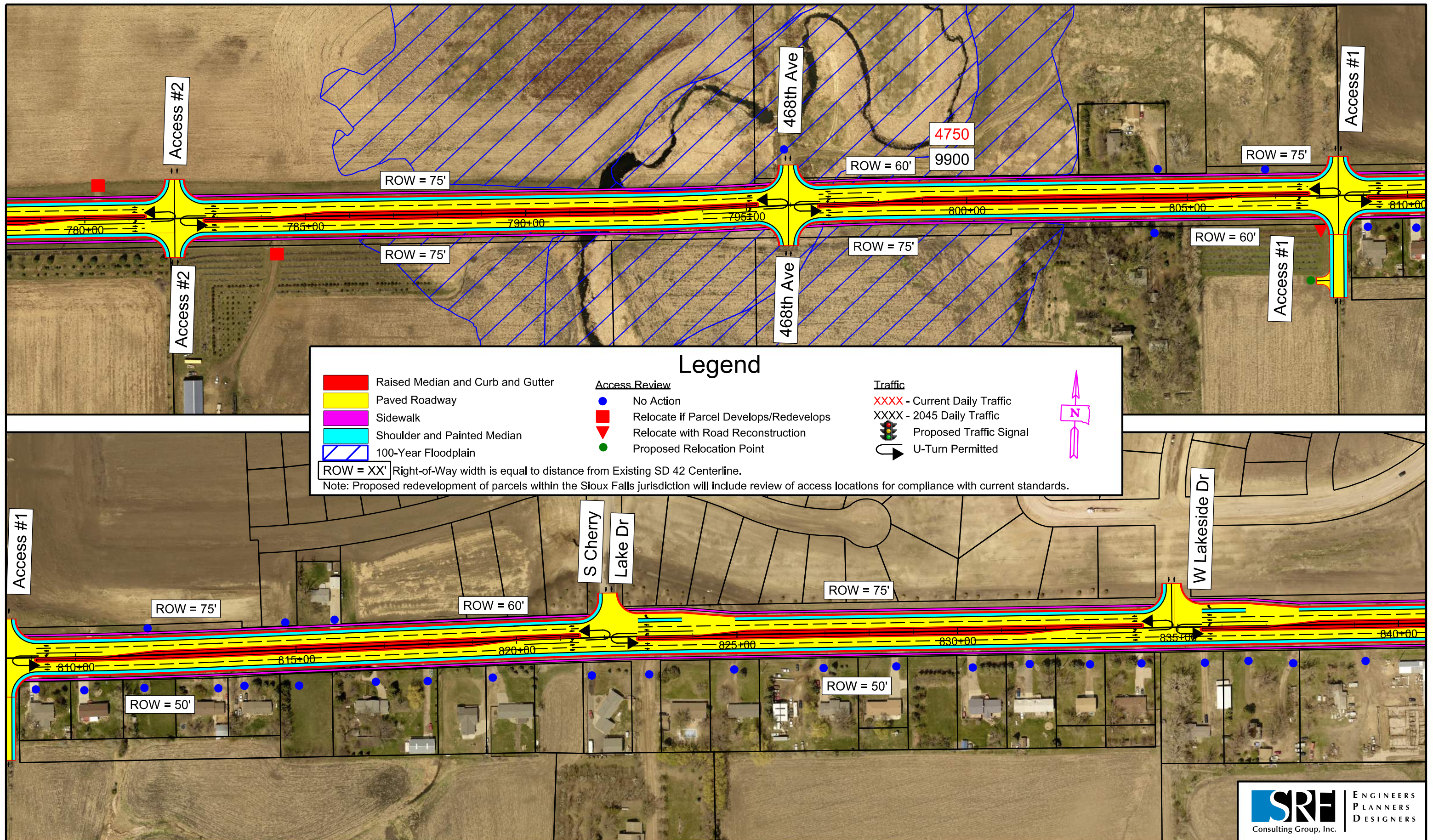
Figure 28

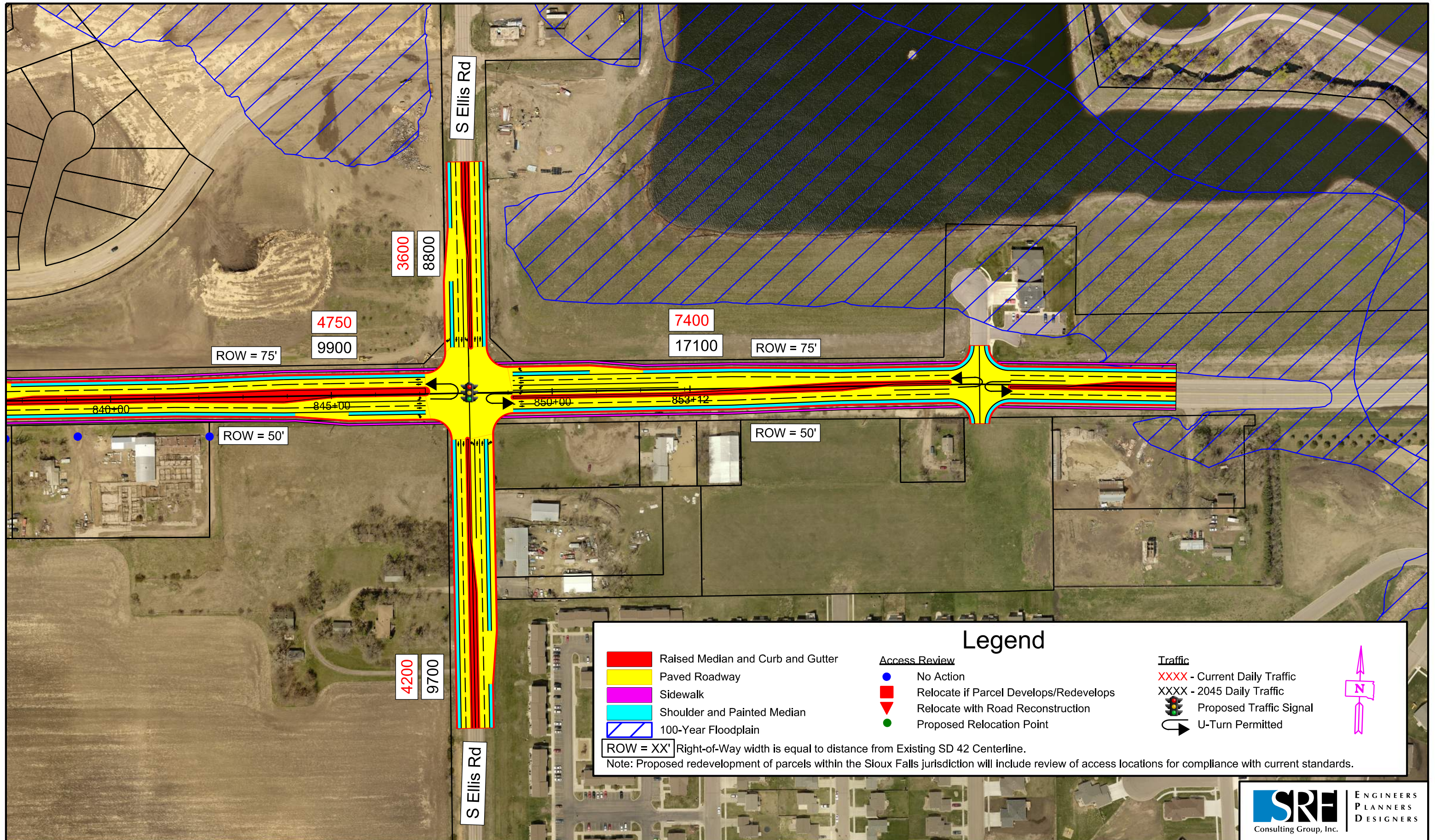












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