South Dakota Highway 42 Corridor Study February 2004

South Dakota DOT

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South Dakota Highway 42 Corridor Study

Prepared by:

SD Highway 42 Corridor Steering Committee

Rick Laughlin, Craig Smith, Tom Week – South Dakota Department of Transportation
Mark Hoines – Federal Highway Administration
Shannon Ausen – City of Sioux Falls
Dave Queal – Minnehaha County
Tim Nicolai – Split Rock Township
Austin Eich – Southeastern Council of Governments
Kevin Gallo – Sioux Falls Metropolitan Planning Organization- Citizen's Advisory Committee
Mark Rodvold – MidAmerican Energy

Assisted by SEH, Inc.

February 2004

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1.0 Project Overview

The South Dakota Department of Transportation (SDDOT) conducted a corridor preservation study for SD Highway 42, from approximately Mile Marker 373 eastward to the Iowa border. The study area and its approximate limits are identified in the following **Figure 1**. The study began in July 2003 and was completed in February 2004. Among study products are a preservation plan that will describe opportunities and constraints, potential design concepts and right-of-way needs to accommodate forecasted traffic, access management strategies, and an implementation plan, including a corridor "footprint" to illustrate the future SD 42.

SDDOT has a standing Corridor Preservation Committee comprised of representatives from SDDOT and local governments. The Corridor Preservation Committee has formed a Corridor Steering Committee comprised of SDDOT staff, and representatives of cities, counties, Metropolitan Planning Organizations, and other local stakeholders. The Corridor Steering Committee is responsible for coordinating public input and serving as a community liaison.

The Corridor Steering Committee has also identified a number of special concerns within the SD 42 Corridor, as follows:

- Need to consider the existing Rowena community;
- Need to consider the planned parks in the west portion of the corridor; and,
- Need to consider the planned aesthetics of the corridor, including a possible border entry feature.

2.0 Issue Identification and Confirmation

2.1 Data Collection Summary

To begin the study, existing data were inventoried from a variety of sources and aggregated according to type of issue to determine interrelatedness and begin to examine the corridor's opportunities and constraints. The following list illustrates a summary of the types of data that were collected and examined in July, August, and September, 2003, for the project:

- Project Statement
- SD Corridor Process Preservation Chart
- Access planning/permitting administrative rules (SD)
- 2000, 2001, 2002 Average Daily Traffic in project area
- SD 42 Geometric data and existing right-of-way
- Hourly Automated Traffic Recorder data for Jan.-Dec. 2002 for corridor
- East Sioux Falls and Arboretum Master Plan
- Arrowhead Park Master Plan and Costs
- "Assessment of Techniques for Corridor Preservation in South Dakota" – SDDOT Publication, March 2002
- SD42 Public Involvement Plan
- Intersection Geometry
- ARC Map with speed limits
- SD42 Traffic Forecasts
- Historic AADT for SD42 (last 20-30 years)
- 24 hour average hourly traffic counts outside city limits for state highways and county roads near corridor
- 24 hour average hourly counts on major roadways within city limits
- Intersection directional turning movement counts
- Crash data over last 3 years in study area
- Current transportation planning studies in the area
- Minnehaha County Comprehensive Plan
- Minnehaha County Zoning and Subdivision Ordinances
- Transit service in the study
- Demographic/census data for area
- Road File (Base map)
- Minnehaha County CIP
- Draft copy of Years 2004-2008 Transportation Improvements Plan
- Shape files of Historical Landmarks
- Wetlands, floodplains, slopes, and parcels
- Minnehaha County Zoning map
- 10th Street Travel Time Study
- Threatened and endangered species
- Contacts with Iowa and Minnesota transportation agencies

2.2 Existing Conditions

2.2.1 Transportation System and Land Development Features

SD Highway 42 has been identified as a "commuter" corridor for persons living in Southeastern Minnehaha County, Rock County, Minnesota, and Lyon County, Iowa that commute to Sioux Falls for business, shopping, and recreation trips. SD 42 is classified as an Arterial highway in South Dakota and besides I-90, is the only major east-west state highway connection on the rapidly developing east side of Sioux Falls.

The six-mile SD 42 Corridor is characterized by three distinct landscapes:

1) Rural Agricultural (eastern half)
2) River Valley/Natural Environment (middle quarter)
3) Suburban and Urbanizing Development (western quarter)

The Rural Agricultural area in Valley Springs Township comprises the eastern half of the project corridor. Significant features include large farming operations, the unincorporated community of Rowena, a manufactured home park, a quarrying operation, and a large telecommunications tower. Besides SD 42, county and local roads in the project area include County Highways 109, 111, and 146; 267th and 268th Streets; and 482nd and 485th Avenues.

The River Valley/Natural Environment area in Valley Springs and Split Rock Townships comprises the middle quarter of the project corridor. Significant features include farming operations, the Big Sioux River and its tributaries and floodplains, and greenbelt areas (Arrowhead Park, Sioux Falls Arboretum, and East Sioux Falls Nature Area). In addition to SD 42, county and local roads in the project area include County Highway 115, East 41st Street, East 26th Street, and Riverview Avenue.

The Suburban and Urbanizing Development area in the western one-quarter of the study corridor is located in Split Rock Township and approaches the eastern Sioux Falls city limits. Significant features include rural residential developments and the Willow Run 18-hole golf course. In addition to SD 42, county and local roads in the project area include River Bluff Avenue, Six-Mile Road, and East 26th Street.

2.2.2 SD 42 Geometric and Right of Way Analysis

SD 42 is configured as a two lane rural highway throughout the length of the study area. Variations in the width of the traveled lanes, shoulders, and right of way for each segment of the corridor are shown in **Table 1**.

Table 1 also indicates the desirable future roadway cross-section and right of way width needed to serve long-term transportation demands.

Highway performance and safety are influenced by lane width and shoulder width. Review of **Table 1** indicates that existing lane widths of at least 12 feet exist throughout the corridor. Shoulder width is sub-standard on Segments 2, 5, 6 and 7 that have shoulder widths of four feet or less. Eight-foot wide shoulders are desirable to allow stalled vehicles to be parked outside of the traffic lane, to allow room for emergency maneuvers, and to relieve right and left turning vehicle conflicts. In

Table 1
SD 42 Cross Sections

SEGMENT	LOCATION		MILE POINT		LENGTH	EXISTING GEOMETRY				SDDOT / Higway Capacity Manual Standards[1]			
	From	To	From	To	Miles	Urban or Rural Section	Parking Allowed?	Street Section (ft)	ROW Width (feet)	Urban or Rural Section	Parking Allowed?	Highway Section[3] (ft)	ROW Width (feet)
1	Six Mile Road	26th Street	371.31	371.94	0.63	Rural	No	8-12-12-8 40	150	Rural	No	8-12-12-4-16-4-12-12-8 88	200
2	26th Street	Riverview Ave	371.94	373.05	1.10	Rural	No	3-14-14-3 34	66	Rural	No	8-12-12-4-16-4-12-12-8 88	200
3	Riverview Ave	SD 11 North	373.05	373.56	0.51	Rural	No	8-14-14-8 44[6]	150	Rural	No	8-12-12-4-16-4-12-12-8 88	200
4	SD 11 North	Ledge Rock Avenue (Appx. Rowena West Side City Limits)	373.56	375.10	1.54	Rural	No	8-14-14-8[4] 44	150	Rural	No	10-12-12-10 44	150[5]
5	Ledge Rock Avenue (Appx. Rowena West Side City Limits)	CR 111 (Appx. Rowena East Side City Limits)	375.10	375.62	0.52	Rural	Yes	4-14-14-4 36	66	Rural[2]	No	10-12-12-10 44	120
6	CR 111 (Appx. Rowena East Side City Limits)	CR 109	375.62	376.62	1.00	Rural	No	4-14-14-4 36	66	Rural	No	10-12-12-10 44	120
7	CR 109	Iowa Border	376.62	378.17	1.55	Rural	No	4-14-14-4 36	66	Rural	No	10-12-12-10 44	120
					6.86								6.10

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Notes:

1 Future geometry based upon 2025 traffic forecast. Assumes four lane roadway when ADT exceeds 10,000.

2 Bypass of Rowena assumed

3 8-12-12-4-16-4-12-12-8 infers - 8' reaction area (shoulder), 12' lane, 12' lane, 4' inside shoulder, 16' median, 4' inside shoulder, 12' lane, 12' lane, 8' reaction area (shoulder)
88 infers - 88 feet curb to curb width

4 The 44' roadway section runs from CR 115 to appx .5 mile east of CR 115. Then the roadway transitions to a 36' section as stated

addition, the Highway Capacity Manual indicates that shoulders less than six feet wide may inhibit vehicle speed and roadway capacity.

Vertical and horizontal alignment may limit sight distance for drivers and impede traffic flow or contribute to safety problems. Anecdotal evidence indicates that sight distance may be an issue along some segments of the corridor. An assessment of operational effects of horizontal and vertical alignment issues can be performed based upon the percentage of the overall length of the corridor that is signed and striped as no passing zone. **Table 2** indicates the percentage of No-Passing-Zone for each segment of eastbound and westbound SD 42 based upon DOT records. Overall 48% of the Eastbound SD 42 corridor is signed and striped as a no passing zone. Westbound SD 42 is controlled as a no passing zone over 53% of its length. Corridor segments 1, 2 and 3 (Six mile Road to SD 11 North) are controlled by no-passing zones over 70% of its length in both directions while 41% segments 4 through 7 are controlled as no-passing-zones.

Preliminary discussion with project stakeholders has identified two geometric issues related to intersection operation. **Figure 2** and **Figure 3** depict intersection issues and illustrate potential solutions to those issues. Further study will be done to confirm the issue to be real (or not) and to assess the appropriateness of the proposed solution.

2.2.3 Access Inventory

Access density influences corridor performance in terms of safety and travel speed. The location and type of existing accesses is depicted in **Figure 4**. Shown are locations for four different access types including field approaches, residential accesses, commercial accesses, and public street intersections. Access density for each segment is computed in **Table 3**.

For comparison purposes, Access Location Criteria from the SDDOT's Access Management Administrative Rules are included in the **Appendix A**. SDDOT access guidelines for highways in Urban Fringe and Rural areas allow five access points per mile per side. Access density along the corridor ranges from 2.9 to 6.0 accesses per mile per side. Within the City of Rowena, an area classified as Urban Developed, there are about 12 accesses per mile on each side of the highway compared to 2 accesses per block face prescribed in the guidelines. Rowena's access density is lower than that which would be allowed in a typical urban setting with 660 foot (1/8 mile) blocks, which would equate to 16 accesses per mile per side.

Table 2
SD 42 No Passing Zones

SEGMENT	LOCATION		MILE POINT		LENGTH	NO PASSING ZONES		
	From	To	From	To	Miles	Westbound % NPZ's	Eastbound % NPZ's	Average % NPZ's
1	Six Mile Road	26th Street	371.31	371.94	0.63	77%	67%	72%
2	26th Street	Riverview Ave	371.94	373.05	1.10	74%	59%	67%
3	Riverview Ave	SD 11 North	373.05	373.56	0.51	90%	59%	74%
4	SD 11 North	Ledge Rock Avenue (Appx. Rowena West Side City Limits)	373.56	375.10	1.54	39%	40%	40%
5	Ledge Rock Avenue (Appx. Rowena West Side City Limits)	CR 111 (Appx. Rowena East Side City Limits)	375.10	375.62	0.52	60%	38%	49%
6	CR 111 (Appx. Rowena East Side City Limits)	CR 109	375.62	376.62	1.00	39%	56%	47%
7	CR 109	Iowa Border	376.62	378.17	1.55	35%	37%	36%
1-7	Six Mile Road	Iowa Border	371.31	378.17	6.86	53%	48%	51%

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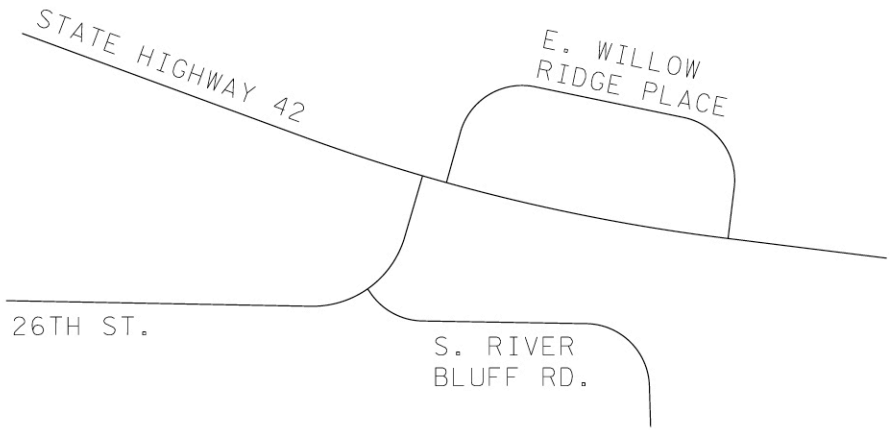
09/22/03

EXISTING INTERSECTION CONFIGURATION

ISSUES:

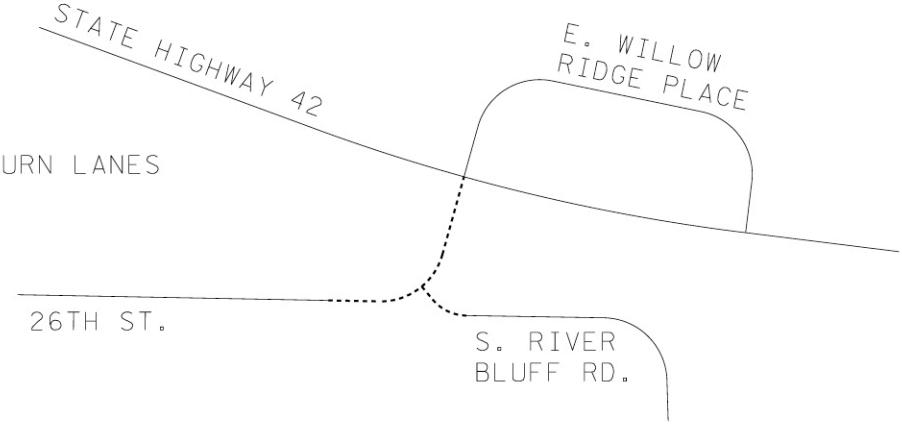
- MISALIGNED CROSS ROADS
- DRIVER CONFUSION
- LEFT TURN CONFLICTS
- POTENTIAL CRASHES



POTENTIAL SOLUTION

POTENTIAL SOLUTION:

- ALIGN CROSS ROADS
- PROVIDE OPPOSING LEFT TURN LANES



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No Scale

SEH	DOT	SOUTH DAKOTA HIGHWAY 42 CORRIDOR STUDY	Geometric Issues	**FIGURE 2**

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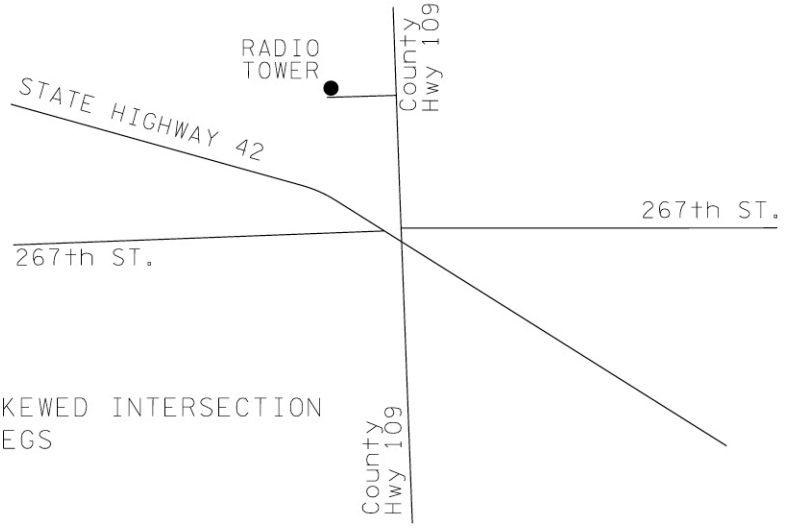
09/22/03

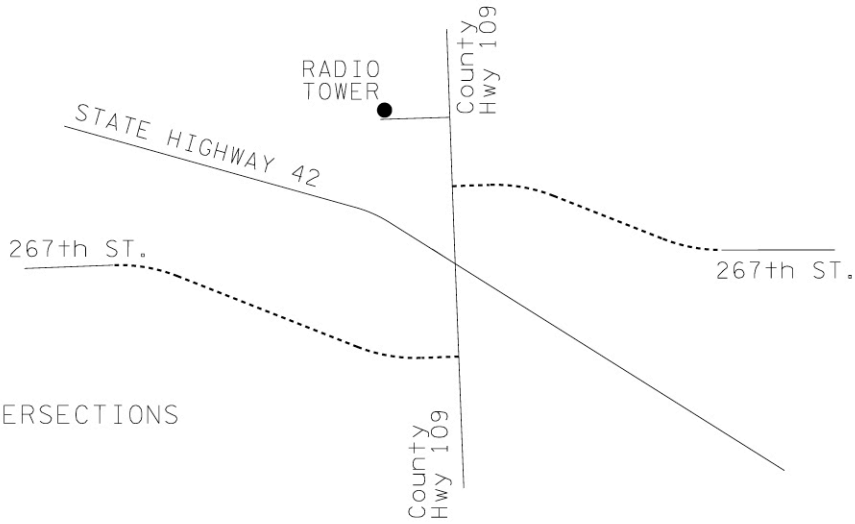
EXISTING INTERSECTION CONFIGURATION



ISSUES:

- SD 42/COUNTY HWY 109 SKEWED INTERSECTION
- SIX ENTERING/EXITING LEGS
- DRIVER CONFUSION
- POTENTIAL CRASHES

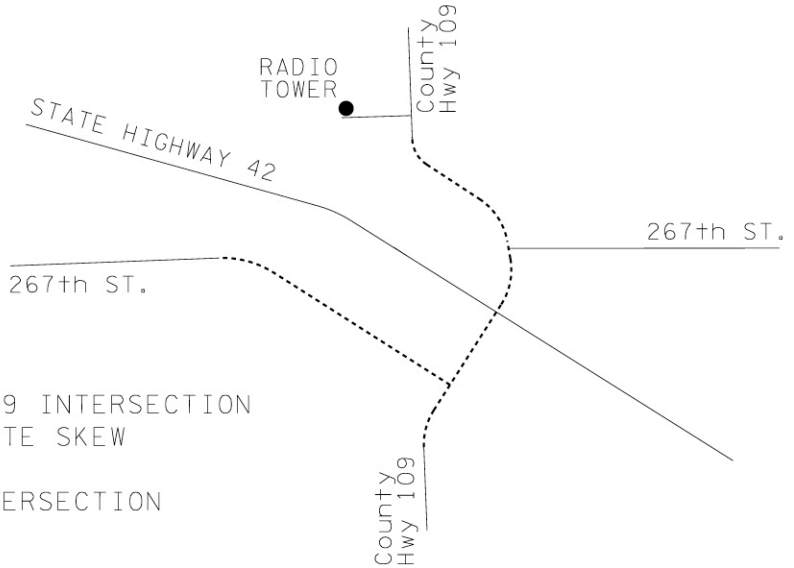
POTENTIAL SOLUTION A



POTENTIAL SOLUTION A:

- RE-ALIGN 267TH ST. INTERSECTIONS WITH COUNTY HWY 109

POTENTIAL SOLUTION B



POTENTIAL SOLUTION B:

- RE-ALIGN COUNTY HWY 109 INTERSECTION WITH SD 42 TO ELIMINATE SKEW
- RE-ALIGN 267TH ST. INTERSECTION WITH COUNTY HWY 109

N

No Scale

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SEH	DOT	SOUTH DAKOTA HIGHWAY 42 CORRIDOR STUDY	Geometric Issues	**FIGURE 3**

Data Sources: SDDOT, Minnehaha County, City of Sioux Falls, SECOG,South Dakota State Historical Society, Archeaological Research Center

* See G.I.S. Disclaimer note

South Dakota Highway 42 Corridor Study

Access Locations

0 500 1,000 2,000 3,000 4,000 Feet

Figure 4

Table 3
SD 42 Access Inventory

ACCESS CATEGORY	LOCATION		SEGMENT LENGTH (miles)	NUMBER OF ACCESS POINTS										ACCESSES PER MILE PER SIDE		SOUTH DAKOTA ACCESS - LOCATION CRITERIA				
	From	To		Public Road		Residential		Field		Commercial		Total				Signal Spacing Distance (mile)	Median Opening Spacing (mile)	Minimum Unsignalized Access Spacing (feet)	Access Density	Denial of Direct Access When Other Available
				L	R	L	R	L	R	L	R	L	R	L	R					
UF	SIX MILE ROAD	482ND AVENUE	3.28	8.0	9.0	3.5	2.5	0.0	0.5	2.0	4.5	13.5	16.5	4.1	5.0	1/4	1/2 F 1/4 D	1000	5 accesses / side /mile	Yes
UD	482ND AVENUE	RESIDENTIAL DRIVEWAY	0.85	5.5	5.5	1.0	1.5	3.5	3.0	0.0	0.5	10.0	10.5	11.8	12.4	1/4	1/4	100	2 accesses / block face	Yes
R	RESIDENTIAL DRIVEWAY	END SD 42 AT IOWA BORDER	2.73	4.0	7.0	2.0	2.5	0.0	2.0	2.0	2.5	8.0	14.0	2.9	5.1	N / A	N / A	1000	5 accesses / side / mile	Yes
Corridor Totals			6.86	17.5	21.5	6.5	6.5	3.5	5.5	4.0	7.5	31.5	41.0	4.6	6.0					

NOTES:

1. Access to the Interstate system is governed by SDDOT interchange policy. No new access shall be provided on non-interstate routes within 1/8 mile of interstate ramp terminals.
2. N/A = Not Applicable, F = Full Movement – all turns and through movements provided, D = Directional Only – certain turning and through movements not provided.
3. SDDOT may defer to stricter local standards.
4. SDDOT will seek opportunities to reduce access density wherever possible.
5. Rural class minimum unsignalized access spacing may be reduced to 660' by the Area Engineer, based on results of an engineering study as described in 70:09:01:02
6. Urban Developed – traffic artery with high access density. Access and through movement have equal priority.
7. Urban Fringe – rural highway serving developing area immediately adjacent to a city or town. Access regulated to provide future through-traffic priority.
8. Rural – low volume, high-speed facility. Access points are spaced for safety and operations efficiency.

X:\S\Sddot\030300\Access\[AccessDatabase.xls]Table 2

2.3 Environmental Issues Screening

2.3.1 Human Environment

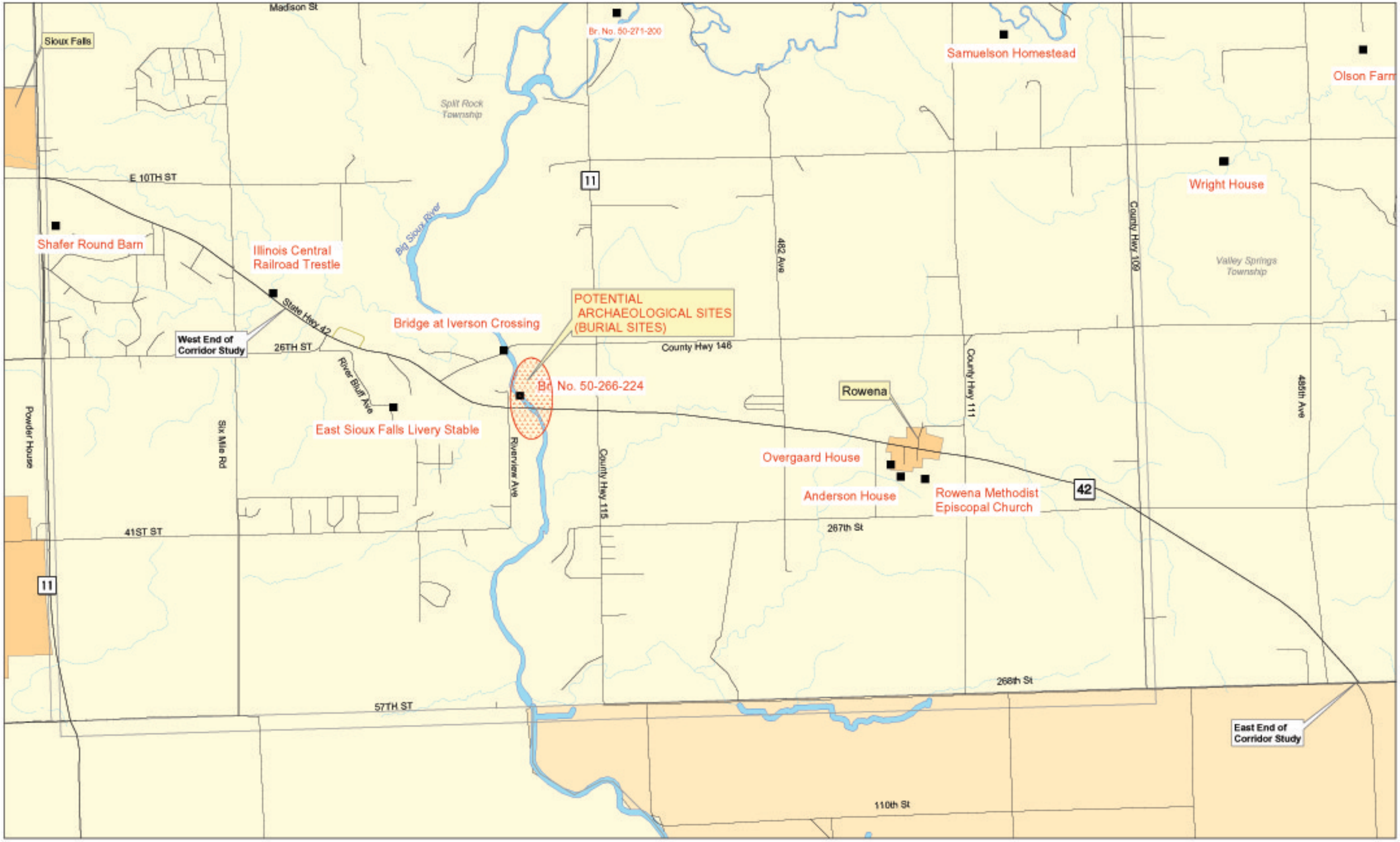
The environmental issues of the human environment include potential cultural resources, the developed areas of Rowena, a manufactured home community, and scattered single-family residential areas; and business operations (Willow Run Golf Course, a lawn and landscaping business, a paving contractor at the quarry site, and a telecommunications tower. Issues involved with these features include potential residential and business relocation with possible highway alignment changes. 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 the number of options to change the SD 42 alignment becomes restrictive. **Figure 5** identifies the historical sites that were identified by the State of South Dakota as potentially significant in the SD 42 Corridor Study Area. All railroad modifications in South Dakota also require an historic review and determination of effect.

2.3.2 Natural Environment

The environmental issues of the natural environment range from scattered small wetlands along the eastern half of the corridor study area to the extensive natural resources associated with the Big Sioux River, including parks, floodplains, threatened and endangered state and federally-listed species. The natural resource features of the Big Sioux River Valley include the following:

- Arrowhead Park
- Sioux Falls Arboretum
- East Sioux Falls Nature Area
- Mature woodlands
- Habitat for Topeka Shiner and Bald Eagle (Federally-listed threatened and endangered species)
- Habitat for Lined Snake (South Dakota-listed endangered species)
- Habitat for other species (Western Fox Snake, Plains Garter Snake, Common Garter Snake, and Northern Prairie Skink

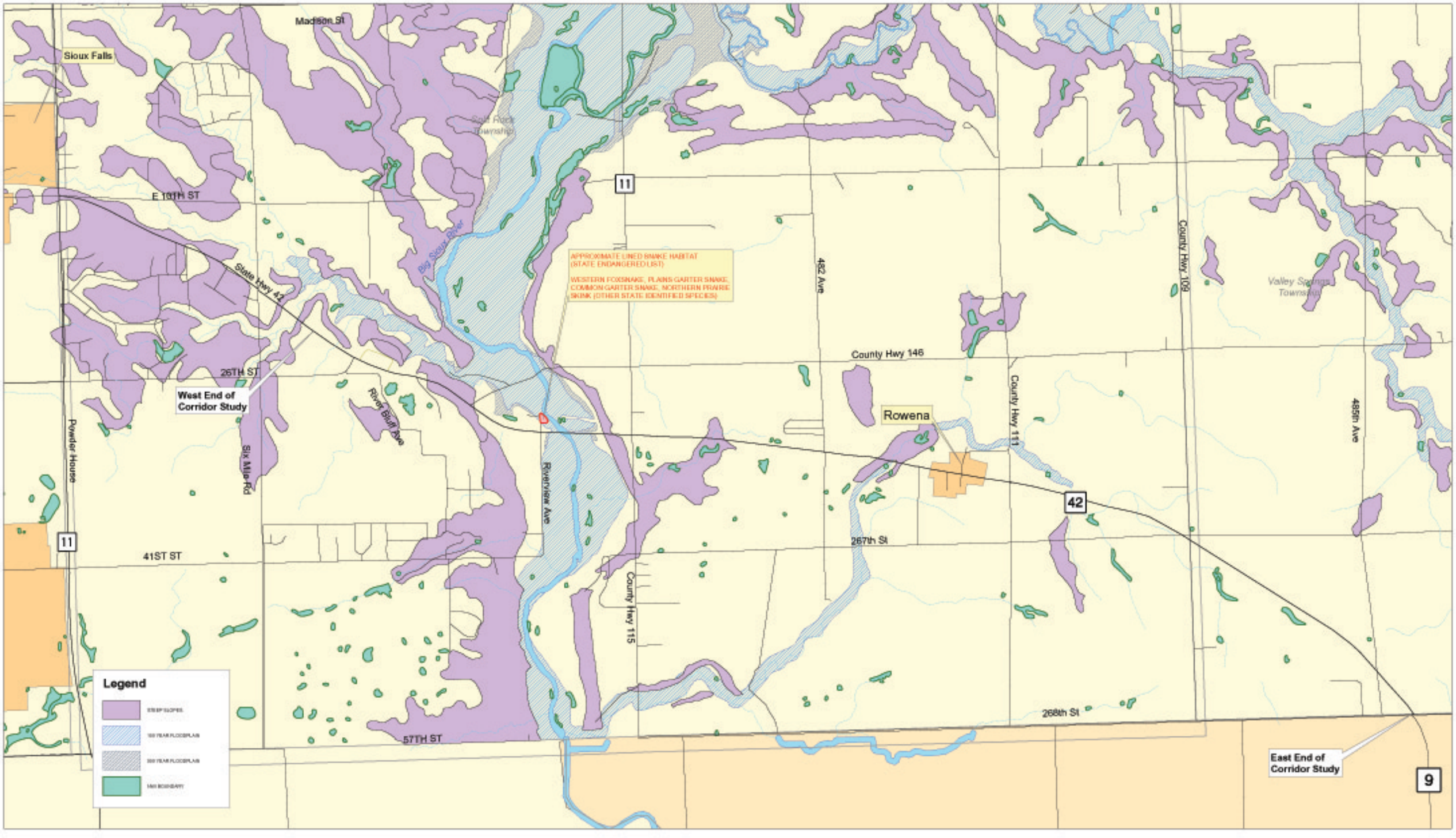
Like potentially-significant cultural resources, all natural resource impacts associated with potential changes in the SD 42 alignment must be avoided or minimized to the extent possible. The effects on public park and recreation area resources must be documented in a thorough environmental study as required by Section 4(f) of the Department of Transportation Act of 1966 (as amended). Adequate mitigation must be demonstrated before approval can be given to acquire right-of-way for any roadway improvements. **Figure 6** illustrates environmental features of the SD 42 Corridor.



Data Sources: SDDOT, Minnehaha County, City of Sioux Falls, SECOG,South Dakota State Historical Society, Archaeological Research Center

* See G.I.S. Disclaimer note

DOT	South Dakota Highway 42 Corridor Study	Archaeological & Historic Sites	SEH	Figure 5



Data Sources: SDDOT, Minnehaha County, City of Sioux Falls, SECOG

* See G.I.S. Disclaimer note

South Dakota Highway 42 Corridor Study

Environmental Issues

0 500 1,000 2,000 3,000 4,000 Feet

Figure 6

2.4 Assessment of Transportation Modal Issues

Modal needs in the SD 42 Corridor are related to commuters, ground freight, commercial and industrial business traffic, and recreational users (bicyclists and pedestrians). Issues that warrant additional investigation and development of design solutions in the SD 42 Corridor Study include the following:

Commuter Issues and Opportunities

- Growing commuter shed that may indicate the need for park and ride lots, Car-pooling and/or commuter bus service.

Freight issues and opportunities

- Trucks operating in congested areas that impact the ability to serve their customers
- Road design issues that affect truck operations on SD 42 and adjacent highways (e.g. turning radius, turn lanes, geometric and signing issues)
- Big Sioux River crossing issues that affect truck routing to major destinations
- Truck regulation issues
- Truck parking and staging facility needs
- Portable weigh station at SD 11

Access to Commercial and Industrial facilities

- Access issues into and out of major traffic generators, (i.e., Myrl and Roy's Paving / East Sioux Quarry)
- Congestion and safety issues caused by trucks entering and exiting the road

Land use and Community Transportation issues

- Potential trail development along the river
- Bike/Pedestrian difficulty in moving along or across SD 42 (pedestrian tunnel planned between Arrowhead Park, Sioux Falls Arboretum, and East Sioux Falls Nature Area)
- Extension of the existing trail system to this area
- Use of SD 42 shoulders by "A" or experienced bicycle riders

2.5 Travel Time Study

Travel time and average speed are important indicators of corridor performance. Posted speed limits for SD 42 vary throughout the study area. Posted speed limits for each segment are as follows:

Segment 1	Six Mile Road to 26th Street	55 mph
Segments 2-4	26th Street to the W. side of Rowena	65 mph
Segment 4-6	W. side of Rowena to the E. side of Rowena	45/30/45 mph
Segments 6-7	E. side of Rowena to Iowa Border	65 mph

The Manual of Traffic Engineering Studies, published by the Institute of Transportation Engineers, discusses three techniques for travel time collection, which are the Floating-car technique, Average-car technique, and the Maximum-car technique. The Maximum-car technique was used as the method of recording travel times through the corridor in this study. The Maximum-car technique allows the driver to safely collect data while traveling the posted speed limits and observing proper following and passing sight distances. The technique recommends changing speed at reasonable rates of acceleration and deceleration.

Data was collected on September 3 - 5, 2003. The western limits of the travel time data collection has been extended beyond the physical limits of the corridor study at the request of the City of Sioux Falls. The western limit of data collection is Cliff Avenue. The eastern limit for data collection is the Iowa border.

The travel time study was performed during the periods of 6:30 – 8:30 am, 11:30 am – 1:30 pm, and 4:30 pm – 6:30 pm. Two round trips were driven during each of the two-hour data collection time intervals on three different days. This provided a total of four eastbound runs and four westbound runs during each period of interest. The average travel time and travel speed for each direction and period has been computed from these four runs.

Intermediate data collection checkpoints were established at major intersections and at speed limit changes along the route. Time and mileage were recorded at each checkpoint. Speed profiles have been plotted to depict average speeds for each segment of the corridor for each direction of travel and time period. Speed profiles are included in the **Appendix B**.

For the purposes of this study, performance will be based upon average speeds during periods of peak traffic flow. As a commuter route to and from the City of Sioux Falls, SD 42 experiences peak periods of flow westbound in the morning and eastbound in the afternoon. Therefore, the eastbound pm speed profile and the westbound am speed profile have been averaged to be representative of the performance of SD 42 during peak flow conditions as shown in **Figure 7**. It should be noted that data for the travel time study was collected without exceeding the posted speed limit. Other vehicles in the traffic stream were observed to drive within the speed limit in 65 mph zones, but exceeded the posted speed in lower speed zones unless slowed due to volume congestion or signal control delay. To more accurately reflect the behavior of the average vehicle in the traffic stream in low to moderate volume conditions on rural segments of SD 42, a correction factor of 3 mph has been added to the measured travel speed on select segments of the corridor. Performance shown in **Figure 7** includes this correction.

Figure 7
SD 42 Peak Period Performance

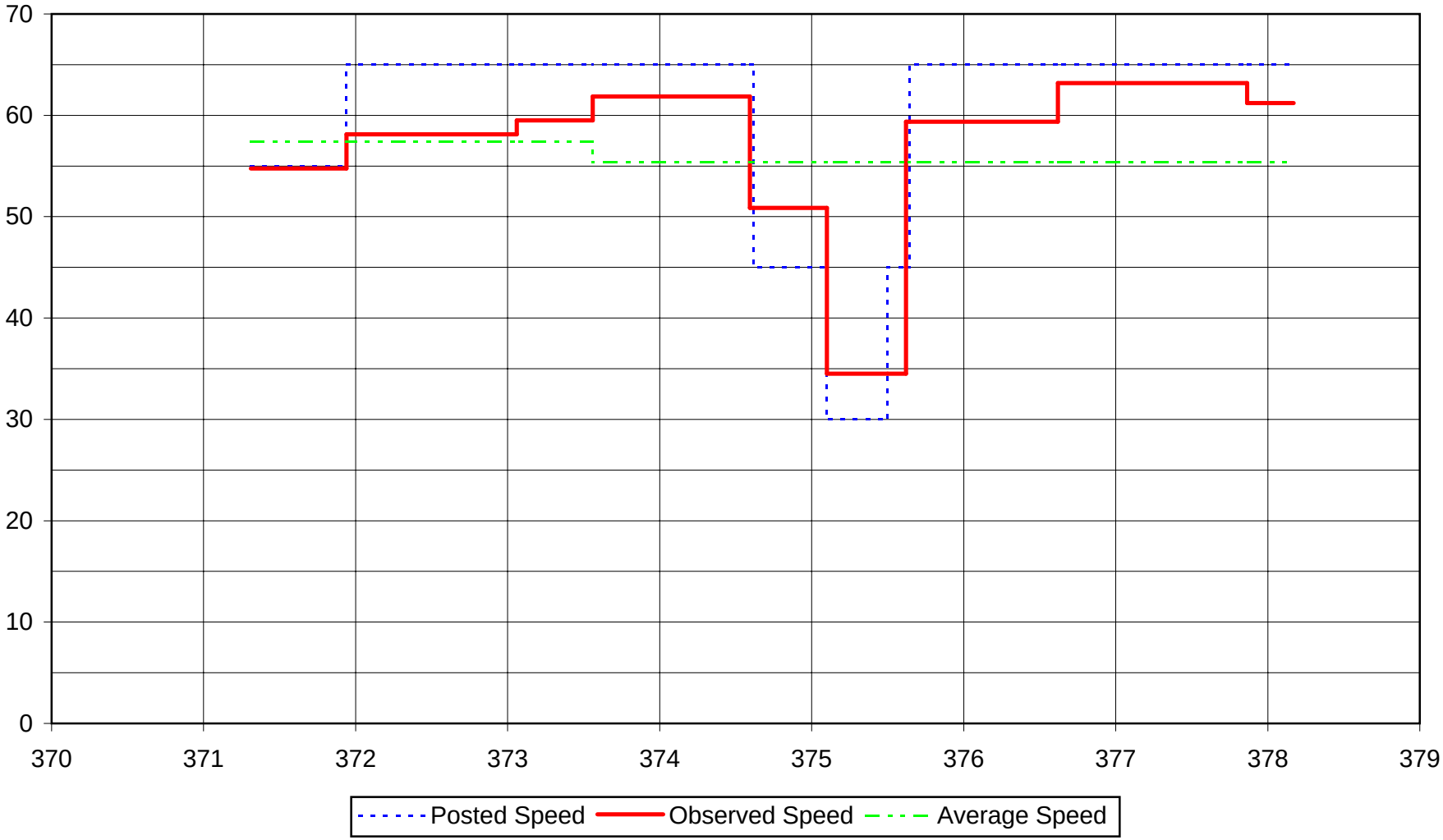


Table 4, in **Appendix D,** is the performance matrix worksheet used to predict future performance of the corridor. Forecast traffic volumes and directional splits were used to calculate a forecast of volume per lane of travel. A delay penalty is then added to the travel time based upon lane volume to represent the effect that volume congestion has on corridor performance. Additional delay can then be added due to traffic signals that are likely to be added within the corridor as the traffic volumes grow to forecasted levels. This approach facilitates prediction of future performance in the corridor. A future performance line is shown in **Figure 24** in **Appendix D** for the No-Build Alternative based upon the process described above.

2.6 Crash Analysis

Historical crash data for the three years from October 1, 1999 through September 30, 2002 has been analyzed. Crashes have been sorted and tabulated by crash type (manner of collision such as left turn, rear end, head on, etc.) and by severity (property damage, personal injury or fatality) for the corridor. Crash types are shown in **Table 5**. Crash rates and severity rates are shown in **Table 6**. Crash segment locations, type, and severity have also been displayed graphically on a map of the corridor in **Figure 8**.

As shown in **Table 5**, a total of 64 crashes were reported. One third (33%) of these were crashes involving animals, 25% were fixed object or overturned / off the road crashes and 31% were left-turn, intersection, or rear end crashes.

Conflicts with animals may be unavoidable in rural conditions. Travel speed and sight distance can play a major role in the number of animal crashes that actually occur due to the conflicts encountered. Most animal crashes occur at night or in hours of limited daylight.

The fixed object crashes and overturned vehicle crashes may indicate that drivers have lost control of their vehicles due to avoidance maneuvers (possibly animals or slowed/stopped vehicles in the roadway), limited sight distance, and high travel speeds. The relatively high percentage of rear end crashes (25%) may also be indicative of sight distance and travel speed issues.

The left turn, angle intersection and rear end crashes may be access related multi-vehicle crashes typically experienced on two-lane roadways. Contributing design and geometric factors for consideration are: availability of shoulders for right turning vehicles to slow for driveway access, availability of left and right turn lanes to separate turning traffic from high speed through traffic lanes at street intersections, availability of left-turn bypass lanes or wide shoulders to allow through vehicles to maneuver around slowed or stopped left turning vehicles.

Table 5
Crash Types
Willow Run Golf Course to Iowa / SD Border

Description		Mile point		Length (miles)	LEFT TRN	ANG-INSC	REAR END	HEAD-ON	SSW-OVTK	SSW-OPDR	ANG-NO I	OVT-ONRD	OVT-OFFR	FXD OBJI	FXD OBJO	BICYCLE	PEDEST	ANIMAL	PRKD VEH	OTHER	TOTALS	Fatalities	Personal Injury	Property Damage
From	To	Begin	End																					
Willow Run Golf Course	26th Street	371.72	371.95	0.23	1	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0	3
26th Street	Field Entrance R	371.95	372.08	0.13	1	0	0	0	0	0	0	0	0	1	0	0	0	2	0	0	4	0	1	3
Field Entrance R	Field Entrance L	372.08	372.31	0.23	0	0	1	0	0	0	0	0	0	1	1	0	0	4	1	1	9	0	0	9
Field Entrance L		372.31	372.94	0.63	0	0	1	1	0	0	0	0	0	0	0	0	0	6	0	0	8	1	0	7
	Field Entrance L	372.94	373.44	0.50	0	0	5	0	0	0	0	0	0	4	0	0	0	1	0	0	10	0	4	6
Field Entrance L	Field Entrance R	373.44	374.04	0.60	1	0	4	0	0	0	0	0	0	0	0	0	0	3	0	1	9	0	1	8
Field Entrance R	SD / Iowa State Line	374.03	378.17	4.14	0	1	5	0	0	0	0	0	4	1	5	0	0	3	0	2	21	0	8	13
Total		**371.72**	**378.17**	**6.45**	**3**	**1**	**16**	**1**	**0**	**0**	**0**	**0**	**4**	**7**	**6**	**0**	**0**	**21**	**1**	**4**	**64**	**1**	**14**	**49**

LEFT TRN	Left turn	ANG-NO I	Crash at an angle (Not at an intersection)	BICYCLE	Accident involving a bicycle
ANG-INSC	Intersection related crash at an angle	OVT-ONRD	Overturned vehicle on the roadway	PEDEST	Accident involving a pedestrian
REAR END	Rear end	OVT-OFFR	Overturned vehicle off of the roadway	ANIMAL	Accident involving an animal
HEAD-ON	Head on	FXD OBJI	Fixed object (In the roadway)	PRKD VEH	Accident involving a parked vehicle
SSW-OVTK	Sideswipe while overtaking a vehicle	FXD OBJO	Fixed object (Off the roadway)	OTHER	Other
SSW-OPDR	Sideswipe a vehicle traveling in the opposite direction				

X:\S\Sddot\030300\Traffic\Crash data\[9-17-03.xls]Rates

Table 6
Crash and Severity Rates
Willow Run Golf Course to Iowa / SD Border

Description		Mile point		Length (miles)	Segment ADT	MVMT	Fatalities	Crashes Injury	Property Damage	Total	Crash Rate	Severity Rate
From	To	Begin	End									
Six Mile Road*	26th Street	371.31	371.95	0.64	6520	4.57	0	0	3	3	0.66	0.66
26th Street	Field Entrance R	371.95	372.08	0.13	6520	0.93	0	1	3	4	4.31	7.54
Field Entrance R	Field Entrance L	372.08	372.31	0.23	6520	1.64	0	0	9	9	5.48	5.48
Field Entrance L		372.31	372.94	0.63	6520	4.50	1	0	7	8	1.78	3.78
	Field Entrance L	372.94	373.44	0.50	6520	3.57	0	4	6	10	2.80	6.16
Field Entrance L	Field Entrance R	373.44	374.04	0.60	4115	2.70	0	1	8	9	3.33	4.44
Field Entrance R	SD / Iowa State Line	374.03	378.17	4.14	3135	14.21	0	8	13	21	1.48	3.17
Total		371.31	378.17	6.86		32.12	1	14	49	64	1.99	3.58

Source of Data = SDDOT

MVMT = 3 year million vehicle miles traveled

ADT = 2002

Accidents = 10/01/1999 - 09/30/2002

Crash data segments do not match subsequent tables. The ADT values in this table have been prorated to reflect segmentation in the performance tables

* Crashes between Six Mile Road and Willow Run Golf Course not reported. Crash rate may be low.

Crash and Severity Rates

$$\text{Crash Rate} = \frac{\text{Total Number of Crashes}}{\text{MVMT}}$$

$$\text{Severity Rate} = \frac{(10 \times \text{Fatalities} + 4 \times \text{Injuries} + \text{Property Damage})}{\text{MVMT}}$$

X:\S\Sddot\030300\Traffic\Crash data\[9-17-03.xls]Rates

Split Rock Township

Valley Springs Township

E 10TH ST

41ST ST

57TH ST

267th St

268th St

42

11

West End of Corridor Study

East End of Corridor Study

26th St

River Bluff Ave

Six Mile Rd

Powder House

Riverview Ave

County Hwy 115

County Hwy 146

County Hwy 111

County Hwy 109

485th Ave

Rowena

1

2

3

4

5

6

7

MP 371.72 to 371.95 (0.23 miles)

Severity	LEFT TRN	ANIMAL	TOTALS
Fatalities	0	0	0
Personal Injury	0	0	0
Property Damage	1	2	3
Total	1	2	3

Crash Rate = 8.66
Severity Rate = 8.66

MP 372.08 to 372.31 (0.23 miles)

Severity	REAR END	FXD OBJ	FXD OBJ/O	ANIMAL	PRKD VEH	OTHER	TOTALS
Fatalities	0	0	0	0	0	0	0
Personal Injury	0	0	0	0	0	0	0
Property Damage	1	1	1	4	1	1	9
Total	1	1	1	4	1	1	9

Crash Rate = 5.40
Severity Rate = 5.40

MP 373.44 to 374.04 (0.60 miles)

Severity	LEFT TRN	REAR END	ANIMAL	OTHER	TOTALS
Fatalities	0	0	0	0	0
Personal Injury	1	0	0	0	1
Property Damage	0	4	3	1	8
Total	1	4	3	1	9

Crash Rate = 3.33
Severity Rate = 4.44

MP 374.03 to 379.17 (4.14 miles)

Severity	ANGLE/SC	REAR END	OVT-DIFFR	FXD OBJ/I	FXD OBJ/O	ANIMAL	OTHER	TOTALS
Fatalities	0	0	0	0	0	0	0	0
Personal Injury	1	2	3	0	2	0	0	8
Property Damage	0	3	1	1	3	3	2	13
Total	1	5	4	1	5	3	2	21

Crash Rate = 1.48
Severity Rate = 3.17

MP 371.95 to 372.08 (0.13 miles)

Severity	LEFT TRN	FXD OBJ	ANIMAL	TOTALS
Fatalities	0	0	0	0
Personal Injury	0	1	0	1
Property Damage	1	0	2	3
Total	1	1	2	4

Crash Rate = 4.31
Severity Rate = 7.84

MP 372.31 to 372.94 (0.63 miles)

Severity	REAR END	HEADON	ANIMAL	TOTALS
Fatalities	0	1	0	1
Personal Injury	0	0	0	0
Property Damage	1	0	0	7
Total	1	1	0	8

Crash Rate = 1.78
Severity Rate = 3.78

MP 372.94 to 373.44 (0.50 miles)

Severity	REAR END	FXD OBJ	ANIMAL	TOTALS
Fatalities	0	0	0	0
Personal Injury	4	0	0	4
Property Damage	1	4	1	6
Total	5	4	1	10

Crash Rate = 2.80
Severity Rate = 6.16

Data Sources: SDDOT, Minnehaha County, City of Sioux Falls, SECOG,South Dakota State Historical Society, Archaeological Research Center

* See G.I.S. Disclaimer note

South Dakota Highway 42 Corridor Study

Crash Data
Severity and Type

0 600 1,200 2,400 3,600 4,800 Feet

Figure 8

As shown in **Table 6**, the average crash rate for the corridor is 1.99 crashes per million vehicle miles traveled (MVMT) and the average severity rate is 3.58. Review of **Figure 8** shows that the 4 mile segment on the east of the study area experiences crash rates below these averages while most to the west experience crash rates above the average for the corridor. One fatality (due to head on crash) occurred and 13 crashes resulted in personal injury. The highest severity rates were experienced between Milepost 371.95 (approximately ¼ mile west of 26th Street intersection) and MP 373.44 (near the intersection of SD 11 north).

2.7 Existing Traffic Volumes

Existing Average Annual Daily Traffic volumes (AADT) are displayed in **Figure 9** for each segment on SD 42 and each of the major intersecting roadways.

Existing peak period turning movement counts at SD 42 intersections with SD 11 and 26th Street are shown in **Figure 10**. Intersection data was collected by the City of Sioux Falls in August 2003 for use in this study. The intersection turn counts indicate that SD 42 experiences an EB/WB directional distribution split of 29% - 71% in the am peak hour and 64% - 36% in the p.m. peak hour.

2.8 Traffic Forecasts

Traffic forecasts for 2025 were provided by the SDDOT and are display in **Figure 9** for each segment on SD 42 and each of the major intersecting roadways.

The City of Sioux Falls provided traffic forecast data for this corridor study as part of their normal service as part of the Sioux Falls MPO (Metropolitan Planning Organization). Future traffic assignments were produced using a regional traffic model created with Viper/TP+ software. The model accounts for traffic generated by existing and future land use development within the regional study area. Assignments provided by the model for the SD 42 Corridor Study area were processed by SDDOT to produce the forecasts used in this study.

2.9 Performance Analysis

Corridor performance was assessed based upon results of corridor speed and safety (crash rates). Factors that influence average travel speed and corridor safety include traffic volumes, intersection operations, lane width, vertical and horizontal alignment and sight distance, access density, and other factors. A performance matrix was developed to identify roadway deficiencies by segments of the corridor based upon these criteria. The deficiency matrix is included as **Table 7.** This tool was used in developing potential solutions to operational problems identified.

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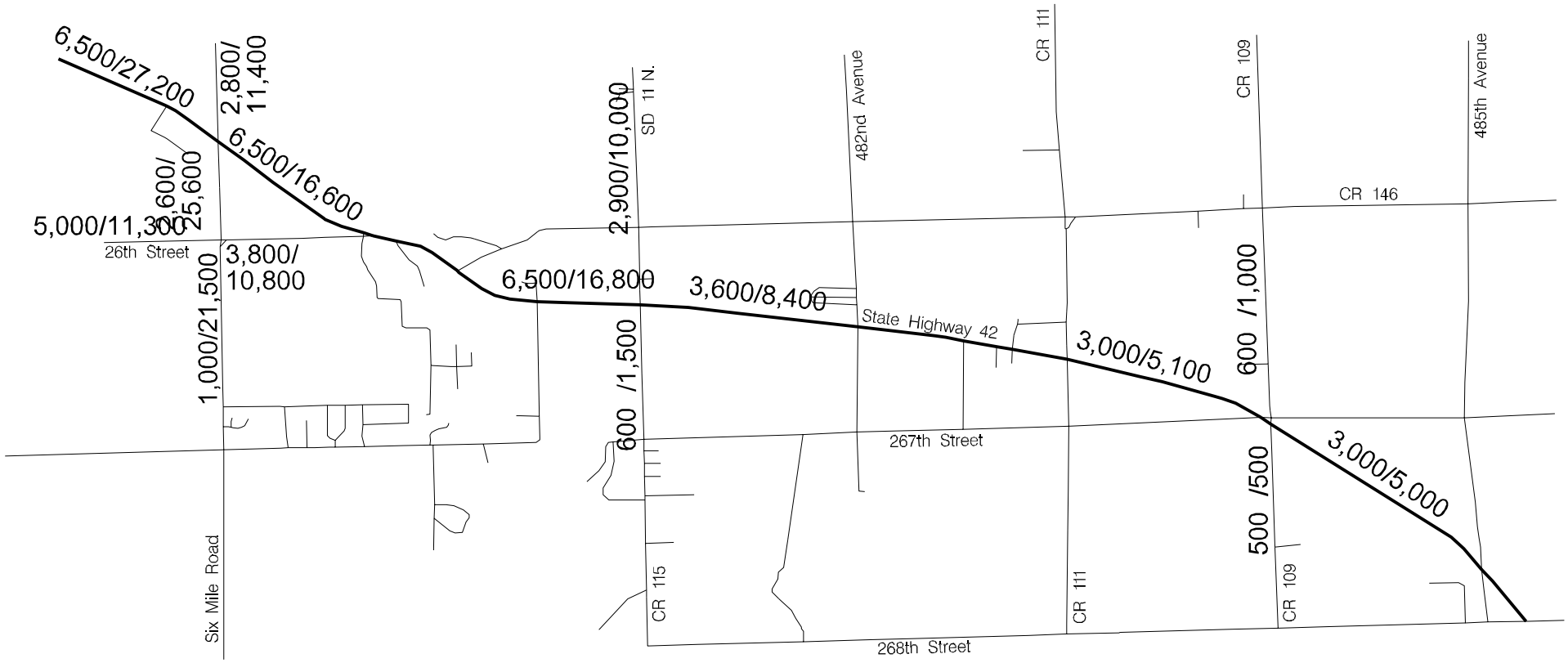
2/5/2004



LEGEND
Exist / 2025 ADT

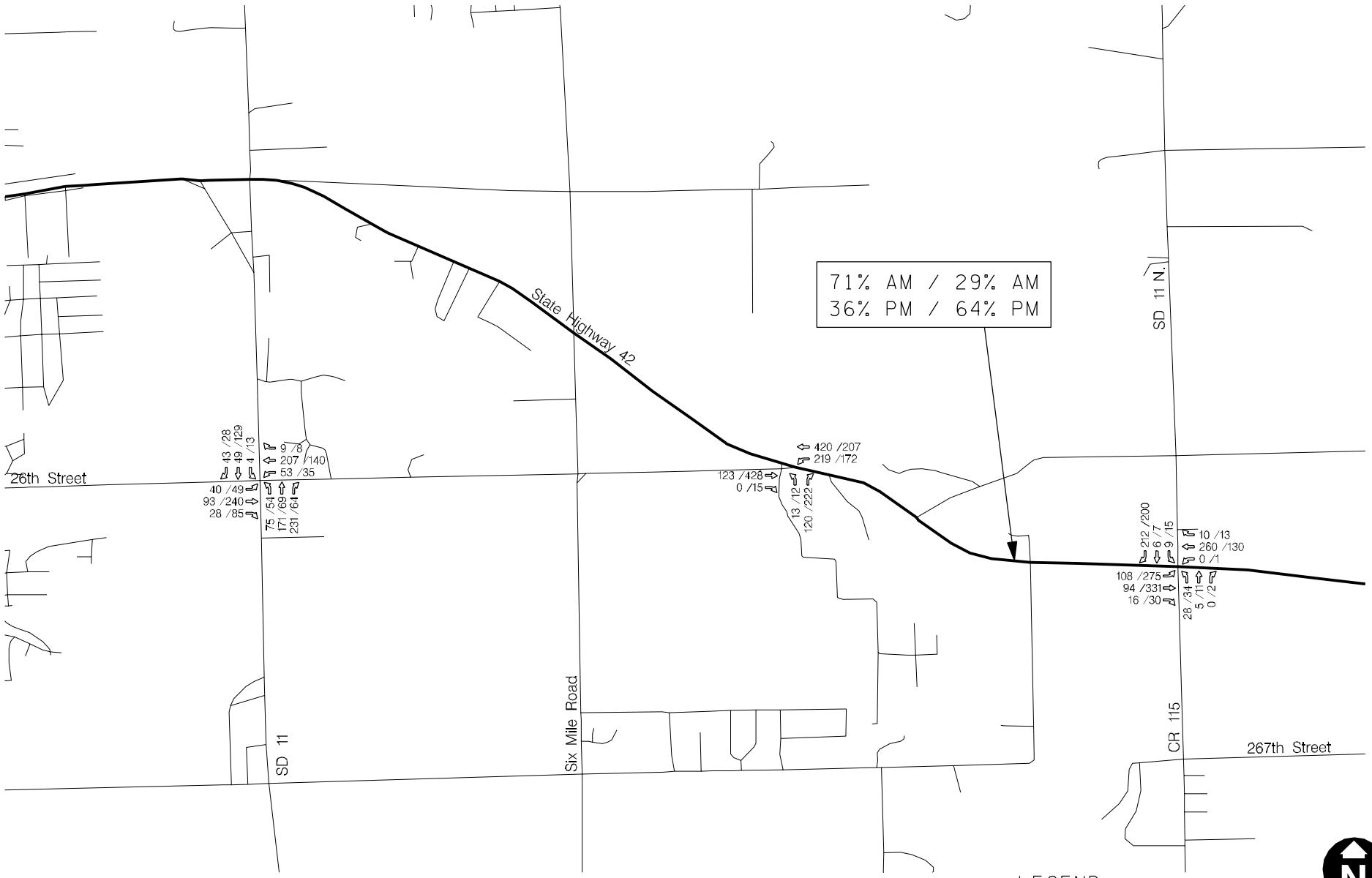
N

No Scale

ESEH	DOT		SOUTH DAKOTA HIGHWAY 42 CORRIDOR STUDY	AVERAGE DAILY TRAFFIC	FIGURE 9

x:\S\Sddot\030300\Traffic\Turn Counts\counts.dgn

2/5/2004



ESEH	DOT		SOUTH DAKOTA HIGHWAY 42 CORRIDOR STUDY	TURN COUNTS & DIRECTIONAL DISTRIBUTION	FIGURE 10

Table 7
SD 42 Corridor Deficiency Matrix

Performance Criteria		Speed	Safety (note 2)	Number of Lanes (ex. 2 lane section throughout)	Horizontal & Vertical Alignment (note 3)	Access Density (note 4)	Lane Width	Shoulder Width	ROW Width (note 5)
Performance Standard		60 mph (note 1)	Average Crash Rate = 1.99[6]	2-Lane Volume Threshold = 10,000 ADT	20% NPZ[7]	5 acc/side/mi UD - 2/block face	12 feet	8 feet	200 feet / 120 feet
Segment	1	55	4.31	16,600	72%	4.6	12	8	150
	2	58	5.48	16,800	67%	4.6	14	3	66
	3	60	3.28	16,800	74%	4.6	14	8	150
	4	58	3.28	8400	40%	4.6	14	8	150
	5	35	1.46	8400	49%	12.1	14	4	66
	6	59	1.46	5100	47%	4.0	14	4	66
	7	63	1.46	5000	36%	4.0	14	4	66
Total (1-7)		**56**	**1.99**		**51%**	**5.3**			

Shaded Cells Represent Segment Performance below Performance Standard

X:\S\Sddot\030300\Performance\[DeficiencyMatrix.xls]Sheet1

Notes:

1. SDDOT has not established a speed performance standard for Principal Arterials. A 60 mph performance goal is the standard used by Mn/DOT on High Priority Interregional Corridors and has been applied here.
2. Crash data segments do not align with Corridor segment ends. Highest crash rate within segment is shown
3. Average of EB and WB % No passing Zone used for comparison
4. See Appendix for Access management Guidelines; Segments 1-4 are UF category; Segment 5 is UD; Segment 6, 7 is R
5. 200 foot ROW width desirable for 4 lane section; 120 foot ROW for 2 lane section
6. Average crash rate for all SD / US State Highways is 2.11 accidents / MVM in 2001
7. According to Table 6-5 "Percent Restricted Passing Lengths" from the SDDOT Design Manual, a roadway with an ADT greater than 1500 should be limited to 20% restricted passing lengths in a reconstruction project, 10% in new construction

2.10 Performance Assessment

Corridor deficiencies are identified from **Table 7**. Findings from this review are provided as follows:

- Segments 1, 2, 4, 5, and 6 operate with average speeds lower than the performance goal of 60 mph.
- Segments 1, 2, 3, and 4 have crash rates above the state average.
- All segments have a high percentage of no passing zones. The recommended maximum for no passing zones on reconstruction projects is 20%.
- Segments 1, 2, and 3 have traffic forecasts that exceed the capacity of a two lane facility.
- Segments 2, 5, 6, and 7 have substandard shoulder widths
- Segments 1 – 3 and 5 - 7 have right of way widths less than desirable
- Segments 1 – 7 should be reviewed for intersection capacity and safety improvements

Potential solutions to these issues are identified as follows:

- Consider a four lane alternative for segments 1, 2 and 3.
- Consider a shoulder widening and an intersection safety improvement project alternative on segments 5, 6 and 7
- Continue right of way preservation and access management practices along the entire corridor.

3.0 Study Vision Statement, Purpose and Need

The SD 42 Corridor Steering Committee developed a Study Vision, and a Purpose and Need for the corridor preservation study, during the Issue Identification phase of the project. The Study Vision Statement identifies the project mission, as defined by the Steering Committee with public input, and the Purpose and Need for the corridor preservation study identifies the goals, objectives, and desirable outcomes of the study for the project stakeholders. Together, these principles are the guiding resources for the project's advancement, and are summarized as follows.

Study Vision Statement:

"The SD 42 Corridor Preservation Plan within Split Rock and Valley Springs Townships of Minnehaha County will observe jurisdictional needs while planning to implement common goals for the long-term development of the highway."

Goals & Objectives to Achieve the Vision Statement:

- Develop a future transportation system with safe, efficient, and appropriate access to and from SD 42 and its intersecting roadways;

- Plan to allow for orderly public and private investments in future developments;

- Provide transportation system solutions that support and build on previous local and state planning efforts, i.e. approved plans and studies completed in the SD 42 project area; and,

- Educate project stakeholders and communicate the project's Purpose and Need.

Purpose and Need:

Corridor preservation has become an important issue for South Dakota. As the state's population and economy grow, the demand for improved transportation infrastructure increases. The purpose and need for the proposed project is to:

- Protect the SD 42 Corridor from increasing developmental pressures;
- Preserve options for the SD 42 Corridor alignment for future use; and,
- Increase the ability to secure funding for SD 42 transportation improvements by implementing corridor preservation techniques.

4.0 Alternatives

4.1 Range of Alternatives Considered

All alternatives that would satisfy the project's purpose and need were considered. This includes different combinations of improvements to serve the primary function of moving people and commodities through the SD 42 Corridor. Improvements considered also need to address deficiencies identified in the Issue Summary, including:

- Traffic performance (average speeds)
- Safety concerns (roadway design/intersection geometry, crash rate reduction, heavy commercial vehicle movements)
- Access management (controls on direct private property accesses)
- Future capacity (ability to accommodate forecasted traffic volumes)
- Planned improvements and developments (example: utilities, park developments)
- 2025 and beyond planned growth (adjacent future land uses)

4.2 Alternatives Not Recommended for Further Study

Alternatives that are inappropriate to address the project's purpose and need were not recommended for further study. These alternatives are identified as follows:

- "Excessive" Build Alternatives

  These alternatives are described as inappropriate solutions given the context of the SD 42 Corridor Study. Such solutions include multi-lane highway development in unwarranted situations, grade-separated intersections (interchanges), and completely controlled access. These solutions are not supported by current or forecasted land uses, population growth, and future traffic volumes.

- Multi-Modal Alternatives (as the Primary Alternative)

  These alternatives include high occupancy vehicle lanes, transit lanes/shoulder lane use, passenger rail, or other alternative modal uses as the primary improvement solution for SD 42. These alternatives are generally associated with high-density corridors and in areas of controlled or limited access. Transit concerns and accommodations will, however, be considered in association with other improvements when recommended alternatives are studied further. Examples include the improved SD 42's effect on regional transit systems, school bus transit, and services for elderly/disabled/special needs populations, etc.

4.3 Alternatives Recommended for Further Study

Alternatives recommended for further study include the upgrade of SD 42 with additional travel lanes to accommodate forecasted capacity needs, intersection realignments, traffic control features, and access management/safety improvements. These alternatives, collectively, comprise the "Build Alternative". Typical sections of these solutions appear on **Figure 11** in **Appendix C**. The Build Alternative is illustrated on **Figures 12 – 23** in **Appendix C**.

In addition, the "No Build" Alternative will be studied further, which may include safety, maintenance, and management improvements and contribute to establishing the baseline conditions for measuring impacts of the build alternatives. The "No Build" Alternative is required for additional study by the Federal Highway Administration and will be evaluated with the Build Alternatives in the SD 42 Corridor's future environmental documentation.

The SD 42 Steering Committee has identified a most feasible Build Alternative. A summary of the Build Alternative improvements recommended for further study is included below.

<u>Mile Marker 373 (Western Terminus at Willow Run Golf Course) to SD 11</u>
(Figures 12, 13, 14, and 15)

- Four-lane divided mainline
- New four-lane bridge crossing over the Big Sioux River
- SD 42/SD 11 North intersection improvements (free right southbound turn, channelized left and right turn lanes, signalized control)
- Turn lanes at all public street intersections
- Accommodations for pedestrian crossings of the Big Sioux River

<u>SD 11 to Rowena</u>
(Figures 15, 16, and 17)

- Two-lane roadway (12 ft. travel lanes) with 10 ft. shoulders
- Turn lanes at public street intersections

<u>Rowena</u>
(Figures 17, 18, and 19)

- Three build alternative solutions (2 mainline upgrade, 2 bypasses) *– see Section 4.4 for additional discussion*

<u>Rowena to IA 9</u>
(Figures 20, 21, 22, and 23)

- Two-lane roadway (12 ft. travel lanes) with 10 ft. shoulders

- Turn lanes at public street intersections
- Skewed intersection safety corrections

4.4 Rowena Sub Area Study

There are three variations of the Build Alternative identified through the unincorporated community of Rowena. Rowena variations are identified on **Figures 17, 18, and 19** in **Appendix C**.

4.4.1 Sub Alternative A

The North Bypass Sub Alternative includes right-of-way of 120 ft. for a two-lane bypass and a shift of approximately 75 to 100 ft. north of the current alignment. The approximate length of the bypass is 2,000 ft. Much of this Sub Alternative follows an abandoned railroad alignment.

4.4.2 Sub Alternative B

Sub Alternative B includes a limited expansion of SD 42 through Rowena using the current alignment. Use of a three-lane section with a continuous center turn lane with urban or curb and gutter section would allow right-of-way requirements to be significantly reduced through the community (potentially between 20-30 ft. in some areas), although this sub alternative will require the removal of on-street parking, and access control issues will remain.

4.4.3 Sub Alternative C

Similar to the north bypass, the south bypass alternative is a two-lane section with 120 ft. of right-of-way required and extends approximately 4,600 ft. This Sub Alternative shifts the SD 42 alignment at most approximately 800 ft. south of the current roadway and is located within a predominantly agricultural area.

High-level impacts of the Rowena Sub Alternatives are discussed in Section 4.5.4. Although the SD 42 Corridor Study provides concept-level data appropriate for project scoping, Rowena Sub Alternatives will require additional investigation and public involvement such that a Preferred Sub Alternative can be selected. Many of the public comments received at the September 23rd Open House were from Rowena residents who would benefit from understanding the range of alternatives and additional impact/mitigation information to provide informed responses. Rowena Sub Alternatives should be considered when formal environmental documentation is prepared for the SD 42 Corridor.

4.5 Evaluation of Alternatives Recommended for Further Study

4.5.1 Traffic Performance Analysis

Travel time and average speed are important indicators of corridor performance. Posted speed limits for SD 42 vary throughout the study area. Posted speed limits for each segment are as follows:

Six Mile Road to 26th Street	55 mph
26th Street to the W. side of Rowena	65 mph
W. Side of Rowena to the E. side of Rowena	45/30/45 mph
E. Side of Rowena to Iowa Border	65 mph

Data were collected on September 3, 4, and 5, 2003. Intermediate data collection checkpoints were established at major intersections and at speed limit changes along the route. Time and mileage were recorded at each checkpoint. Speed profiles were plotted to depict average speeds for each segment of the corridor for each direction of travel and time period.

For the purposes of this study, performance is based upon average speeds during periods of peak traffic flow. As a commuter route to and from Sioux Falls, SD 42 experiences peak periods of flow westbound in the morning and eastbound in the afternoon. Therefore, the eastbound p.m. speed profile and the westbound a.m. speed profile have been averaged to be representative of the performance of SD 42 during peak flow conditions. **Table 4** in **Appendix D** shows the observed speed performance and **Figure 24** shows the speeds charted against the mile-markers and is compared to the posted speed limits

Also included in **Appendix D** are the performance matrix worksheets used to predict the future performance of the SD 42 Corridor. Forecast traffic volumes and directional splits were used to calculate a forecast of volume per lane of travel. A delay penalty was then added to the travel time based upon lane volume to represent the effect that volume congestion has on corridor performance. Additional delay was then added due to traffic signals that are likely to be added within the corridor as the traffic volumes grow to forecasted levels. Major traffic carrying intersections that are unsignalized today were considered to be "at risk" for signalization. Intersections in areas of development and growth were also considered as "at risk" intersections. A delay for each potential occurrence of a new signal was assigned and added to the base travel time. This approach facilitates prediction of future performance in the corridor.

Table 4 in **Appendix D** shows the calculations leading from the collected travel time data through the arrival at the future performance for the Corridor in the No Build situation. **Figure 24** is a graphical representation of this table that demonstrates the existing, future, and posted speeds

through this corridor in the No Build situation. **Table 8** in **Appendix D** is much like **Table 4**, except that it includes the improvements shown in **Figures 12-23** in **Appendix C**. These figures depict a 4-lane roadway from the western limits of the study to the intersection with SD 11 North. Improved speed performance is achieved as shown in **Table 8** and **Figure 25** in **Appendix D**. These charts can be used as a tool to assist in the development of corridor priorities based upon performance.

Table 9 *below shows a summary of the average speeds in the corridor. Today, the average corridor speed is 56 mph. The future (2025 No Build) performance is expected to decrease to about 33 mph west of SD 11 and 48 mph east of SD 11. This decrease is due to a higher traffic demand associated with forecast development combined with a greater delay due to an increased number of traffic signals along the corridor. The 2025 Build Alternative would improve speed performance west of SD 11 from 33 mph to 44 mph. Congestion-related delay would be reduced as a result of the four-lane operation. The Build Alternative (east of SD 11) includes safety improvements but retains the existing 2-lane operation. Therefore, speeds east of SD 11 are expected to be the same as the No-Build situation. The Build Alternative results in an overall average speed lower than the existing speed. However, the highway will have the capacity to safely serve a much greater traffic demand and retain the function of an arterial roadway.*

Table 9
SD 42 Corridor Average Speeds

Segment	Posted Speed (mph - weighted average)	Average Speed (mph)		
		Existing Performance	2025 No Build	2025 Build Alternative
Six Mile Road to SD 11 North	61.9	57.4	32.8	43.8
SD 11 North to Iowa Border	56.0	55.4	48.2	48.2
Total	**57.8**	**56.0**	**41.7**	**46.7**

4.5.2 Safety Analysis

The Build Alternative depicts a four-lane divided roadway from Six Mile Road to SD 11 North and a two-lane non-divided cross section from SD 11 to the east. This four-lane segment is predicted to experience a 245 percent growth in traffic volumes over the next 20 years and requires a four-lane roadway to accommodate the future traffic.

With the increasing volumes, intersection improvements in this area should include turn lanes with sufficient deceleration and storage length.

Crossroads should be aligned to reduce severe skews for improved sight lines. Turn lanes are provided at all public intersections to safely separate turning traffic from through traffic.

High speed, high volume roadways warrant shoulders with enough room to safely pull stalled vehicles out of the traffic lane and provide drivers with more space to perform avoidance maneuvers. The Build Alternative has been illustrated with 8-foot shoulders on four-lane segments and 10-foot shoulders on two lane segments.

Access management strategies should be considered as part of improvement alternatives. Full public accesses will remain where they are needed. Some of the access points on public streets will be converted from full accesses to "right in/right out" accesses. All private driveways that are in the divided roadway segment should be limited to right in / right out movements. All future driveways should exit onto public streets that access SD 42.

Improved lane delineation and/or flatter curves (horizontal and vertical) should be considered as part of improvement alternatives considered.

The following **Table 10** shows the crash and severity rates through the corridor. As shown, the current average crash rate through the corridor is 1.99 crashes per million vehicle miles traveled. This rate is not expected to change without roadway improvements. As the traffic volume increases so will the crash frequency. The Build Alternative introduces a four-lane divided section west of SD 11 and an improved two-lane design east of SD 11. The crash rates should improve when the roadway is upgraded from current geometry to that of the Build Alternative concept, with proper shoulders and turn lanes. In this study, it is assumed that the rates will improve to state averages for roadways of these types. State average crash rate for a two-lane highway is 1.02 and the state average crash rate for a four-lane divided highway is 1.70.

Table 10
SD 42 Corridor Crashes

Year	Segment of Corridor	Million Vehicles or Million Vehicle Miles	Crashes by Type				Crash Rates by Type				
			K	INJ	N	Total	*K*	*INJ*	*N*	*Total*	*Severity*
2000	**Total Corridor**	**10.71**	**0.3**	**4.7**	**16.3**	**21.3**	*1.6%*	*21.9%*	*76.6%*	*1.99*	*3.58*
No Build 2005	**Total Corridor**	**13.38**	**0.4**	**5.8**	**20.4**	**26.7**	*1.6%*	*21.9%*	*76.6%*	*1.99*	*3.58*
No Build 2025	**Total Corridor**	**24.10**	**0.8**	**10.5**	**36.8**	**48.0**	*1.6%*	*21.9%*	*76.6%*	*1.99*	*3.58*
Concept 2005	4-lane section	7.03	0.2	2.6	9.1	11.9	*1.6%*	*21.9%*	*76.6%*	*1.70*	*3.05*
	2-lane section	6.36	0.1	1.4	5.0	6.5	*1.6%*	*21.9%*	*76.6%*	*1.02*	*1.83*
	Total	**13.38**	**0.3**	**4.0**	**14.1**	**18.4**	*1.6%*	*21.9%*	*76.6%*	*1.38*	*2.47*
Concept 2025	4-lane section	13.71	0.4	5.1	17.8	23.3	*1.6%*	*21.9%*	*76.6%*	*1.70*	*3.05*
	2-lane section	10.39	0.2	2.3	8.1	10.6	*1.6%*	*21.9%*	*76.6%*	*1.02*	*1.83*
	Total	**24.10**	**0.5**	**7.4**	**26.0**	**33.9**	*1.6%*	*21.9%*	*76.6%*	*1.41*	*2.53*

K = Fatal *INJ = Personal Injury* *N = Property Damage Only*

4.5.3 Benefit-Cost Analysis

A benefit-cost analysis was conducted to quantify the relative benefits and costs for the SD 42 Build Alternative. The result from the benefit-cost analysis provides agencies with an estimate of the relative benefit of the concept to the no-build alternative. In this analysis, if the quantified benefits are greater than or equal to the quantified costs (benefit-cost ratio greater than or equal to one), the alternative represents an economically valuable option.

The monetary benefit for the concept was quantified in terms of reduced vehicle hours traveled (VHT), vehicle miles traveled (VMT), crashes, and operation and maintenance (O&M) costs for the project. The costs include construction, right-of-way (R/W), signals, bridges, and other miscellaneous construction items. The project salvage value was calculated and subtracted out of the total cost of the project.

Benefit-Cost Methodology

The following assumptions were made concerning the benefit-cost analysis.

General Assumptions:

- A 20-year benefit period was identified (based on a 2005 construction year and ending in 2025). Benefits begin accruing in 2006.
- 2025 forecast volumes were assumed constant under no-build and build scenarios.
- VHT, VMT, and crash reduction results are comprehensive and include all of SD 42 in the study area. For consistency with projected traffic growth, linear interpolation was used between 2005 and 2025 to calculate yearly VHT, VMT and crashes.
- A discount rate equal to 3.6 percent was used to determine the remaining capital value.
- The assumed auto time value per person hour (dollars per hour) was $9.92. The truck driver time value per person hour (dollars per hour) was $18.40. The auto variable operating costs (dollars per mile) was $0.28 and the truck variable operating costs (dollars per mile) was $1.43.
- The travel time data that was collected was used to determine the existing VHT. Future performance was based on the forecasted volumes and roadway cross-sections and future signals.
- Increases in background traffic were represented in the 2025 forecast obtained from the SDDOT.
- Trips on local streets were not included in the calculation since they are negligible relative to SD 42.
- The percent of heavy vehicles was calculated to be 9.21 percent based upon documentation provided by the SDDOT.

Crash Reduction Assumptions:

- Anticipated crashes were determined by coupling the expected traffic volume on each road segment in each alternative with a crash rate. The historical crash rate was used in the case of an unimproved road. Where road improvements are made, SDDOT average crash rates based on facility type and volume are used. Thus crashes are reduced on a given road segment by reducing the volume and/or improving the facility.

- The following costs were used to determine the crash reduction benefit.

Crash Type	Estimated Cost per Crash Type
Fatal Type K (when applicable)	$ 3,400,000
Injury Type B	$ 58,000
Property Damage Only	$ 4,200

Cost Estimating Assumptions:

- An LWD (Length x Width x Depth) method was used to determine the project construction costs. Caution was exercised in this analysis since these are preliminary estimates based on assumed cost information.
- The right of way required was determined from the project preliminary design layout overlaid on the Minnehaha County parcel map. Right-of-way costs have been estimated based upon the City of Sioux Falls estimate for the East Side Corridor project in 2002. In this project, land costs for a new 200 ft. corridor just west of the SD 42 project area in rural Minnehaha and Lincoln Counties outside the city limits of Sioux Falls was valued at about $9700/acre. Estimates for partial takings were calculated based upon the proportion of the total parcel area being taken.

Benefit-Cost Assumptions:

- A 20-year benefit period was identified (based on a 2005 construction year).
- Right-of-way costs were included as a salvageable cost.
- Assumed pavement grading and drainage costs accounted for 45% of the total project cost minus engineering and structures.
- Assumed pavement subbase and base costs accounted for 20% of the total project cost minus engineering and structures.
- Assumed pavement surface costs accounted for 35% of the total project cost minus engineering and structures.
- Cost breakdowns for salvageable items were applied to the specific improvement costs.

- The following assumptions were used for the expected life:
  - Right of way 100 years
  - Major Structures 60 years
  - Grading & Drainage 50 years
  - Sub-Base and Base 40 years
  - Surface 25 years

Table 11
*** Summary of the 20-Year Benefit-Cost Study**

Item	Build Alternative Concept
VHT Benefit	$ 10,689,000
Crashes Benefit	$ 10,477,000
O&M Benefit	$ 1,380,779
Total Benefit**	**$ 22,547,000**
Construction Cost	$ 15,644,238
Bridge Cost	$ 3,403,400
Signal Costs	$ 1,080,000
Retaining Walls Cost	$ -
Right-of-Way Cost	$ 107,490
Other	$ 156,442
Program Development and Delivery Contingency	$ 4,078,314
Total Cost**	**$ 24,470,000**
PV Total Cost**	$ 22,799,000
Project Salvage Value**	$ 5,598,000
PV Total Cost* - Salvage Value**	**$ 17,201,000**
Benefit-Cost Ratio	**1.3**

Notes:
Discount Rate = 3.6%
Design Period 20 years, 2005 through 2025
**** Appendix E includes calculations of the Benefit - Cost Analysis.***
** Rounded to nearest thousand

Benefit – Cost Analysis Conclusion
The results from the benefit-cost analysis provide agencies with an estimate of the relative benefit of the Build to the No Build Alternative. In this analysis, if the quantified benefits are greater than or equal to the quantified costs (benefit-cost ratio greater than one), the alternative represents an economically valuable option.

A relative comparison was made in this analysis between the proposed Build Alternative and the No-Build alternative for the SD 42 Corridor Study. The results show that the Build Alternative is an economically viable alternative from a B/C standpoint (**Table 11**), with a benefit-cost ratio greater than one.

4.5.4 Potential Land Use and Environmental Impact Analysis

Potential land use and environmental impacts of the Build Alternative were reviewed to acquire a greater understanding of the issues that will need to be thoroughly examined in a formal environmental impact documentation process prior to the project's construction. A summary of these potential impacts is as follows:

- Right-of-Way Impacts -- By far the largest impact, right-of-way acquisition, and potential displacement required for the proposed project will affect up to 84 parcels, according to the Minnehaha County's Geographic Information System parcel database information. Approximately 36 acres of land will need to be acquired outside the existing SD 42 right-of-way to provide for the 200 ft. (four-lane) and 120 ft. (two-lane) of property needed to accommodate travel lanes, turning lanes, medians, shoulders, clear zones, and drainage areas. The total estimated value of these properties (assuming partial takings in most instances) is approximately $1.3 million. These costs include impacts of the Sub Alternative "B" through Rowena, which could be higher due to developed urban land use impacts, compared to the Sub Alternative "C", for example, which would impact primarily undeveloped farmland.
- Parkland Impacts – Parkland impacts (primarily significant tree loss and other species with habitat in/near wooded areas) will result for Arrowhead Park, East Sioux Falls Arboretum, and the East Sioux Falls Nature Area. Under Section 4(f) of the 1966 Department of Transportation Act (as amended), all "feasible and prudent" alternatives to the taking of these properties will need to be studied in a Federal Section 4(f) Evaluation.
- Big Sioux River Crossing Impacts – As a major water resource in the SD 42 Study Area, the effects of crossing the river with a new four-lane bridge will need to be studied. This includes an assessment of the effects to the river's water quality, channel alteration, potential filling, and habitat impact assessment for potentially rare, threatened, and endangered species. There are also potential historical and archaeological issues, as well as tribal concerns, that will need to be addressed in this segment of the project. Crossing features to accommodate pedestrians will also need to be addressed.
- Access Management – The effect of access changes to private properties has been studied by the SD 42 Corridor Study Steering Committee. Although the majority of current properties will retain full access to SD 42, there are several examples where access modifications will need to occur commensurate with urbanizing development of the area and in conformance with SDDOT's access management policies. **Appendix F** illustrates the recommended access plan for SD 42, including a determination of future access conditions (i.e., highway entrances remain open in place, open but relocated or modified, or closed).

- Rowena and Surrounding Area Impacts – Rowena Sub Alternatives impacts will need to be assessed and a decision of the preferred Sub Alternative will

need to be made. Comparison impacts to private properties, residents and their homes, businesses, public properties, farmland, and utilities are needed, as well as public consensus on a preferred solution Sub Alternative "B" would cause the fewest impacts to Rowena; however, travel conditions will continue to erode over the forecast period and local safety concerns associated with "thru-traffic" conditions will remain. Therefore, the Sub Alternative "B" may be viewed as a short-term improvement only. This Sub Alternative may be best implemented in combination with a longer-term solution (such as a bypass). The Sub Alternative "C" requires the acquisition of considerable farmland due to all new alignment; however, the disruption to the Rowena community is perceived to be the least. The Sub Alternative "A" includes a mix of farmland and some Rowena property impacts.

Table 12 illustrates a comparative overview of the Rowena Sub Alternatives, including a cursory contrast of performance, environmental impact, access preservation, and cost issues. All of these comparisons will receive more detailed analysis in subsequent environmental impact documentation.

Table 12
Comparison of Build Sub Alternatives in the Rowena Area

Build Sub Alternative	Future Posted Speed	Additional Highway Mileage (in feet)	Time savings per trip (seconds)	Access Point Reductions ?	Need More Right of Way?	Requires acquisition of residential / commercial properties?	Farmland / Natural Environment Impacts?	Traffic congestion relief and major safety improvements through Rowena?	Estimated Cost, including Right Of Way
A North Bypass	45	25	13.3	Yes	Yes	Possibly	Yes	Yes	$1,350,000
B Improvements on Existing Alignment	45/35/45	0	0	No	Yes	Yes	No	No	$1,500,000
C South Bypass	65	243	33.2	Yes	Yes	No	Yes	Yes	$1,400,000

- Farmland Impacts – Outside of Rowena and primarily east of the Big Sioux River, farmland impacts will result from the widened right-of-way. This will include potential impacts to prime and unique farmlands and will require a special agricultural land conversion assessment from the US Department of Agriculture to determine the relative value of farmland lost to urban use.
- Soil Erosion / Steep Slopes, Water Quality – Adjacent to the Big Sioux River and west of Rowena, there are four general locations where steep slopes are prominent and potential soil erosion concerns may need to be addressed. Assuming the project's future profile will be elevated in conformance with current design standards, potential slope cutting and filling will require special sedimentation control techniques to prevent excessive erosion problems during and after construction.

- Wetlands and Floodplains – There are a number of wetlands in the study area that may be affected by the proposed project. National Wetland Inventory (NWI) maps suggest potential water resource issues in the same general areas as the previously described steep slopes. Wetlands suspected in the project area need to be field identified and mapped as a part of a formal environmental impact analysis.
- Social and Economic Impacts – In addition to the effects on the Rowena community, the social and economic effects of the proposed project will need to be measured, including potential affects to persons determined to be minority and/or low income (Environmental Justice).
- Land Use and Transportation System Planning – Effects to bicycle and pedestrian facility planning in the SD 42 Corridor will need to be considered in the design phases of the project. Accesses to future residential and business developments will also need to be monitored to limit and properly space entrances.

4.5.5 Geometric Design Analysis

SD 42 is configured as a two-lane rural highway throughout the length of the study area. Variations in the width of the traveled lanes, shoulders, and right of way for each segment of the corridor are shown in **Appendix D** (**Table 4)**. Highway performance and safety are influenced by lane width and shoulder width. Review of **Table 4** indicates that existing lane widths of at least 12 feet exist throughout the corridor. Shoulder width is sub-standard on many segments, which have shoulder widths of four feet or less. The Highway Capacity Manual indicates that shoulders less than six feet wide may inhibit vehicle speed and roadway capacity.

The Build Alternative depicts a four-lane divided roadway from Six Mile Road to SD 11 North and a two-lane non-divided cross section from SD 11 to the east. This four-lane segment is predicted to experience a 245% growth in traffic volumes over the next 20 years and requires a 4-lane roadway to accommodate the future traffic.

With the increasing volumes, intersection improvements in this area should include turn lanes with sufficient deceleration and storage length. Crossroads should be aligned to reduce severe skews for improved sight lines. Turn lanes are provided at all public intersections to safely separate turning traffic from through traffic.

High speed, high volume roadways warrant shoulders with enough room to safely pull stalled vehicles out of the traffic lane and provide drivers with more space to perform avoidance maneuvers. The Build Alternative has 8-foot shoulders on four-lane segments and 10-foot shoulders on two lane segments.

Full public accesses will remain where they are needed. Some of the access points on public streets will be converted from full accesses to "right in/right out" accesses. All private driveways that are in the divided roadway segment should be limited to right in / right out movements. All future driveways should exit onto public streets that access SD 42 (see **Appendix F**). As the Sioux Falls metropolitan area grows eastward, access management strategies need to be monitored when new requests for access are reviewed and permitted.

Specific recommended geometric improvements are as follows:

- The intersection of SD 42 and Willow Run Golf Course should be allowed in the future (see **Figure 12**). A future leg to the south is expected as shown on the layout. All movements at this intersection should be allowed. Turn lanes should be provided.
- The intersection of 26th Street should be relocated slightly to the east to line up with the western side of Willow Ridge Place (see **Figure 12**). All movements at this intersection should be allowed. Turn lanes should be provided. The northbound and eastbound right turns should be served with channelized "free" right turn lanes. River Bluff Road would be relocated with the construction of Arrowhead Park and the stub out to tie into the relocated River Bluff Road is shown. This intersection is considered to be at high risk for future signalization.
- The intersection of SD 42 and the eastern side of Willow Ridge Place (see **Figure 13**) should be converted to a right in / right out intersection. A right turn lane should be provided on SD 42 to access this roadway.
- The intersection of SD 42 and Perry Place (see **Figure 14**) should be relocated with the construction of the Sioux Falls Arboretum. This intersection is not the primary access to the park and it would be limited to a right in / right out access point with a right turn lane from SD 42.
- The intersection of SD 42 and Riverview Avenue (See **Figure 14**) would become a full access public intersection. The proposed main entrance to the Sioux Falls Arboretum should line up with Riverview Avenue. This intersection is considered to be at high risk for future signalization. Turn lanes should be provided.
- The intersection of SD 42 and SD 11 (see **Figure 15**) will be a major intersection on the SD 42 corridor. Traffic flow conditions at this intersection were modeled using Synchro / Sim Traffic software. For this intersection to properly function, the geometry should include dual left turn lanes from eastbound SD 42. Therefore SD 11 North would need two lanes to properly receive two lanes of traffic. Left and right turn lanes are provided in all directions at this intersection. The movement from southbound SD

11 to westbound 42 is in high demand and would require a channelized "free" right turn lane. This intersection is considered to be a high-risk intersection for future signalization.

- SD 11, north of SD 42, would require improvements to accommodate the previous mentioned intersection mitigation (see **Figure 15**). The two northbound lanes should be carried for 750' and then taper down to a single lane. A continuous left turn lane is provided from the end of the median to the north to provide the residential properties with a means to access their property. The intersection of SD 11 and 266th Street would be upgraded to tie in all of the improvements to the south. Turn lanes would be provided on SD 11 in both directions.
- The quarry entrance at SD 42 would require a westbound left turn lane and an eastbound right turn lane as shown in **Figure 16**.
- The intersection of SD 42 and 482nd Avenue would remain a full access intersection (see **Figure 17**). Left and right turn lanes should be provided from SD 42. This intersection is considered to be at high risk of future signalization.
- Intersections through Rowena (Ledge Rock Avenue through 483rd Avenue) would require improvements. This subarea needs more study before geometric solutions can be recommended. It is assumed that one intersection within Rowena would be at high risk for future signalization. The roadway geometry currently proposed through this area can be seen in **Figures 18 and 19**.
- Depending on the preferred solution through the Rowena area that will be determined as an outcome of the federal environmental impact review process, the intersection of 267th Street, 484th Avenue and SD 42 should be considered for realignment (see **Figures 20 and 21**). The southern leg of 267th Street should be terminated east of the last residential access with a cul-de-sac. The skew angle at 484th Avenue should be reduced to improve sight distance. Left and right turn lanes should be provided from SD 42 to 484th Avenue.
- The intersection of 485th Avenue and SD 42 would also need realignment (see **Figure 23**). As shown the skew will be greatly reduced to improve sight lines. Turn lanes would be provided from SD 42 to 485th Avenue.
- The intersection of SD 42 with 268th Street would be enhanced with a right turn lane added from eastbound 42 to 268th Street.

4.5.6 Utility Assessment

A survey of major public and private utilities potentially affected by the recommended development plan of SD 42 was conducted in the project corridor. Potential effects on power and energy, sewer and water, and telephone utilities were assessed. A utility

coordination meeting was conducted on December 4, 2003, to discuss potential impacts of the conceptual SD 42 corridor plan and joint long-range planning to improve coordination between projects and minimize possible conflicts. Representatives from SDDOT, MidAmerican Energy, Minnehaha Community Water, Sioux Valley Energy, City of Sioux Falls, L and O Power Cooperative, East River Electric, and Qwest Corporation were in attendance.

Through coordination with the local and regional utility companies, it was learned that many utilities follow the SD 42 right-of-way or cross it (overhead and underground) at various locations. Major crossings occur at 26th Street (L & O and East River Electric lines), and 484th Avenue (Sioux Valley Energy). Water utilities are generally outside the current SD 42 right-of-way. There are underground utilities owned by Sioux Valley Energy that are located in future park areas.

The December SD 42 utility coordination meeting reaffirmed the need for annual meetings of utility stakeholders, at a minimum, and continued coordination procedures during planning and development stages of each agency's projects. As the preliminary and final designs for SD 42 are prepared, these utilities will need to continue coordination meetings to plan or relocate facilities and discuss mitigation measures.

5.0 Public Outreach

The SD 42 Corridor Steering Committee conducted public outreach activities in accordance with the Sioux Falls Metropolitan Planning Organization's public involvement process, including development and monthly updating of a project internet web site (www.sehinc.com/online/SD42), distribution of two study newsletters, and coordination of two public open house meetings.

The SD Highway 42 Corridor Study's first open house was attended by more than 100 persons. The open house was held at the Willow Run Golf Course (at the project's western terminus) on September 23, 2003. Attendees viewed more than a dozen poster boards illustrating the Corridor's issues and concerns, including the project's purpose and need, results of travel time (performance) samples, traffic forecasts, high crash rate areas, potential environmental impact concerns. Changeable message signs set up by the SDDOT to inform SD Highway 42 travelers of the Open House location and time worked very well. Members of the SD Highway 42 Corridor Study Steering Committee were in attendance to answer questions and receive comments.

A summary of anecdotal and written public comments received from the first open house follows:

- Install traffic signals – SD 11 North, 26th Street
- Add turning lanes at street intersections
- Reduce speeds from 65 mph to 55 mph
- Install intersection lighting – Willow Road
- Bypass Rowena
- Fix poor intersections – e.g. Six Mile Road, 26th Street
- Extend shoulder width – for safety, bicyclists
- Straighten road curves and flatten dips
- Plan to implement other roadway improvements – 57th Street extension to IA 9, E. 10th Street to 485th and then south to IA 9

A second open house was held on December 16, 2003, with more than 50 persons in attendance. The open house was held at the Kenny Anderson Community Center and changeable message signs were again used to announce the event. A primary focus of the open house was the presentation of a series of aerial photoboards with an overlay of the Steering Committee's recommended conceptual design and access management plan for SD 42. Members of the SD Highway 42 Corridor Study Steering Committee and other SDDOT staff were in attendance to answer questions and receive comments.

A summary of anecdotal and written public comments received from the second open house is as follows:

- A 57th Street Feasibility Study should be undertaken soon.
- Don't close 267th Street completely. It is used by farmers to cross SD 42 between fields, etc. Perhaps a farm entrance could be incorporated instead.
- Don't install a stoplight at 482nd and SD42. Just have turn lanes.
- Route extra traffic on improved 41st Street or 57th Street and plan bridge access across the river. This would relieve congestion at SD 11 N. and Hwy. 42.
- No clear consensus on Rowena Sub Alternatives was given, but many persons in attendance favored leaving the highway "as is" or minimally improving it through the community. For those persons, a more significant law enforcement presence to enforce speed limits would be desirable. Other comments pertaining to the Rowena segment of the project are as follows:
- Farmland severance and access impacts are concerns Rowena SubAlternative "C".
- If Rowena SubAlternative "C" is selected for further study, it should not reconnect with SD 42 east of Rowena but rather follow along 268th Street.
- Solve the Rowena traffic dangers before the timeline of 2010.
- Make 57th Street the bypass for Rowena.
- Go further south with the Rowena bypass

Comments received by members of the public will be considered by the SDDOT as refinements to the concept plan are made during its preliminary and final design stages. SDDOT will continue to work with property owners to resolve issues and preserve right-of-way options.

6.0 Recommendations and Implementation Planning

The SD 42 Corridor Steering Committee prepared the following list of recommendations and implementation planning for the study.

1. Approve the SD 42 Corridor Study through the MPO's committee planning process.
2. Continue Steering Team meetings and public involvement activities through construction.
3. Prioritize implementation phases. Recommended development phases and order of priority include the following:
    - Phase I – Western terminus to SD 11 (highest priority)
    - Phase II – Rowena Solution (high priority)
    - Phase III – SD 11 to Rowena (medium priority)
    - Phase IV – Rowena to Iowa 9 (medium priority)
4. Begin to preserve and acquire right-of-way by selecting among the following appropriate techniques:
    - Possible early acquisition of a few selected properties prior to environmental study, as specified in the Transportation Efficiency Act (TEA-21);
    - Purchase of development rights;
    - Purchase options;
    - Letters of agreement with developers;
    - Right of first refusal;
    - Donations of property;
    - Contributions, exchanges of property
    - Access management; and,
    - Use of local government land use tools.

    The best candidates to explore for right-of-way acquisition at this time include property adjacent to existing right-of-way near 26th Street and SD 11 North. Minnehaha County and the City of Sioux Falls will also explore the development of an "Overlay" zoning district in current and future areas under joint zoning control to protect properties designated for future right-of-way acquisition from further development.

5. Advance planning to construct the selected build alternative.
    - Begin a Federal environmental study (likely an Environmental Assessment or "EA")
    - Conduct additional analyses and determine recommended Sub Alternative for the Rowena area
    - Determine Composite Most Feasible Build Alternative and Complete the EA process

- Include the project in the State of South Dakota State Transportation Improvement Plan (STIP) and Sioux Falls MPO's Transportation Improvement Plan (TIP)
- Refine design concepts / continue work on Preliminary Design plans – mainline, bridges

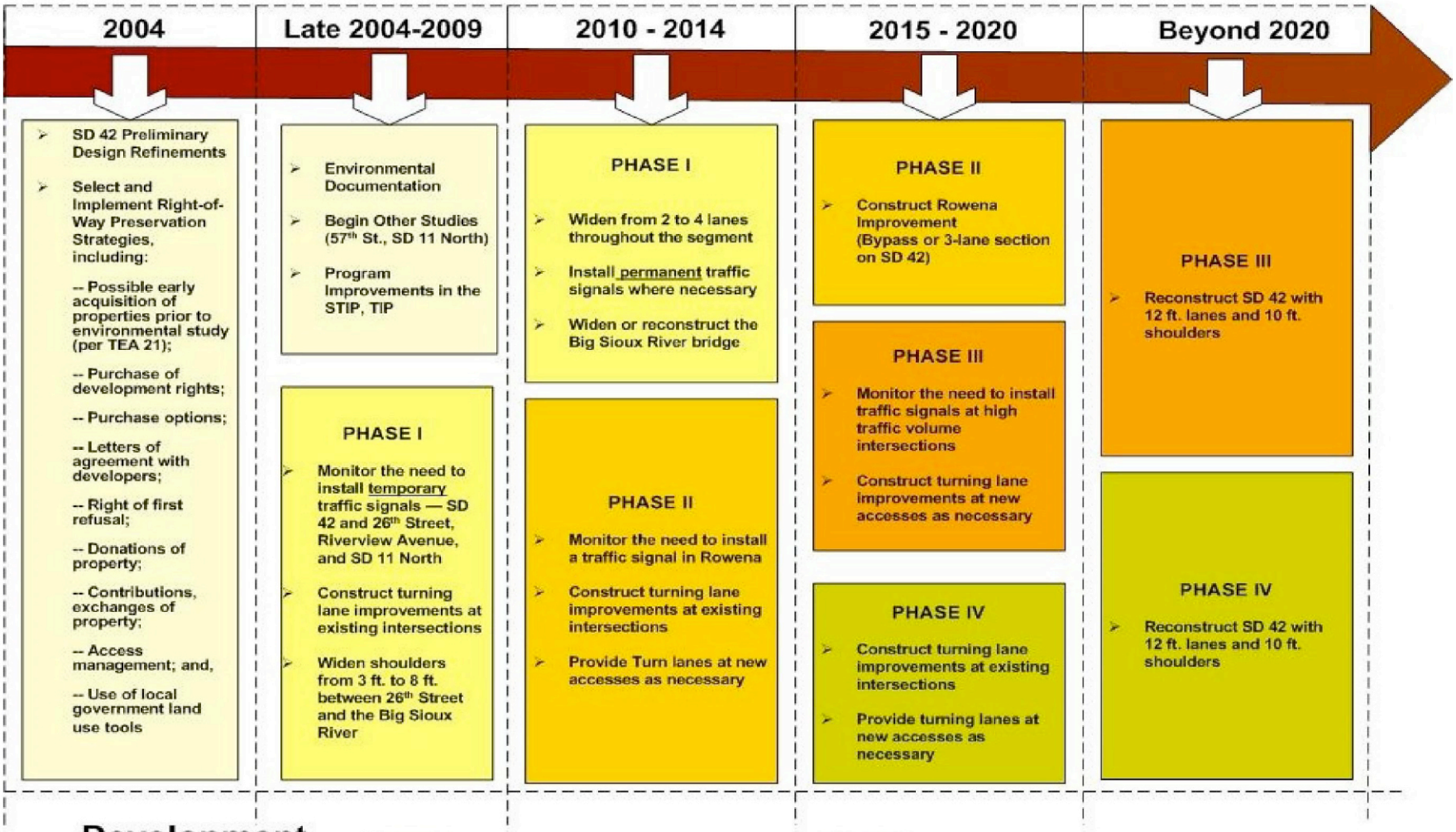
6. Conduct additional joint planning studies as part of the Region's growth planning efforts
    - SD 11 North to Brandon
    - 57th Street extension to Iowa Highway 9
    - Private and Public Utility Coordination
    - Transit Service Improvements
    - Explore Travel Demand Management (TDM) Strategies such as Park and Ride lot(s) near Iowa border (in cooperation with IDOT) to encourage car, van pooling and transit service use.

7. Complete final design and program short-and long-term construction projects.
8. Secure project funding.

The diagram on the following page illustrates the Steering Committee's recommended approach to programming major project activities and short-term/long-term construction projects identified in the recommended SD 42 plan. "Short-term" projects are defined as those that implement a temporary or permanent solution to issues identified in this report from the current period through 2014. "Long–term" projects are defined as those projects that will be completed after 2014.

Next Steps and Implementation by Development Phase

SD 42 Corridor Study - *Willow Run Golf Course to Iowa Highway 9*



Appendix A

SD 42 Corridor Study Area Access Location Criteria

South Dakota Access-Location Criteria

Access Class	Signal Spacing Distance (mile)	Median Opening Spacing (mile)	Minimum Unsignalized Access Spacing (feet)	Access Density	Denial of Direct Access When Other Available
Interstate	N/A	N/A	N/A	N/A	Yes
Expressway	1/2	1/2	2640	at half-mile increments	Yes
Free Flow Urban	1/2	1/2 F, 1/4 D	1320	at quarter-mile increments	Yes
Intermediate Urban	1/2	1/2 F, 1/4 D	660	at eighth-mile increments	Yes
Urban Developed	1/4	1/4	100	2 accesses/block face	Yes
Urban Fringe	1/4	1/2 F, 1/4 D	1000	5 accesses/side/mile	Yes
Rural	N/A	N/A	1000	5 accesses/side/mile	Yes

NOTES:

1. Access to the Interstate system is governed by SDDOT interchange policy. No new access shall be provided on non-interstate routes within 1/8 mile of interstate ramp terminals.
2. N/A = Not Applicable, F = Full Movement – all turns and through movements provided, D = Directional Only – certain turning and through movements not provided.
3. SDDOT may defer to stricter local standards.
4. SDDOT will seek opportunities to reduce access density wherever possible.
5. Rural class minimum unsignalized access spacing may be reduced to 660' by the Area Engineer, based on results of an engineering study as described in 70:09:01:02

Access Class Definitions

Interstate – the designated Interstate highway system, including I-90, I-29, I-229, and I-190.
Expressway – high-speed divided highways serving interstate and regional travel needs.
Free Flow Urban – higher speed facilities with access subordinate to through traffic movement.
Intermediate Urban – serves through traffic while allowing moderate access density.
Urban Developed – traffic artery with high access density. Access and through movement have equal priority.
Urban Fringe – rural highway serving developing area immediately adjacent to a city or town. Access regulated to provide future through-traffic priority.
Rural – low volume, high-speed facility. Access points are spaced for safety and operations efficiency.

Appendix B

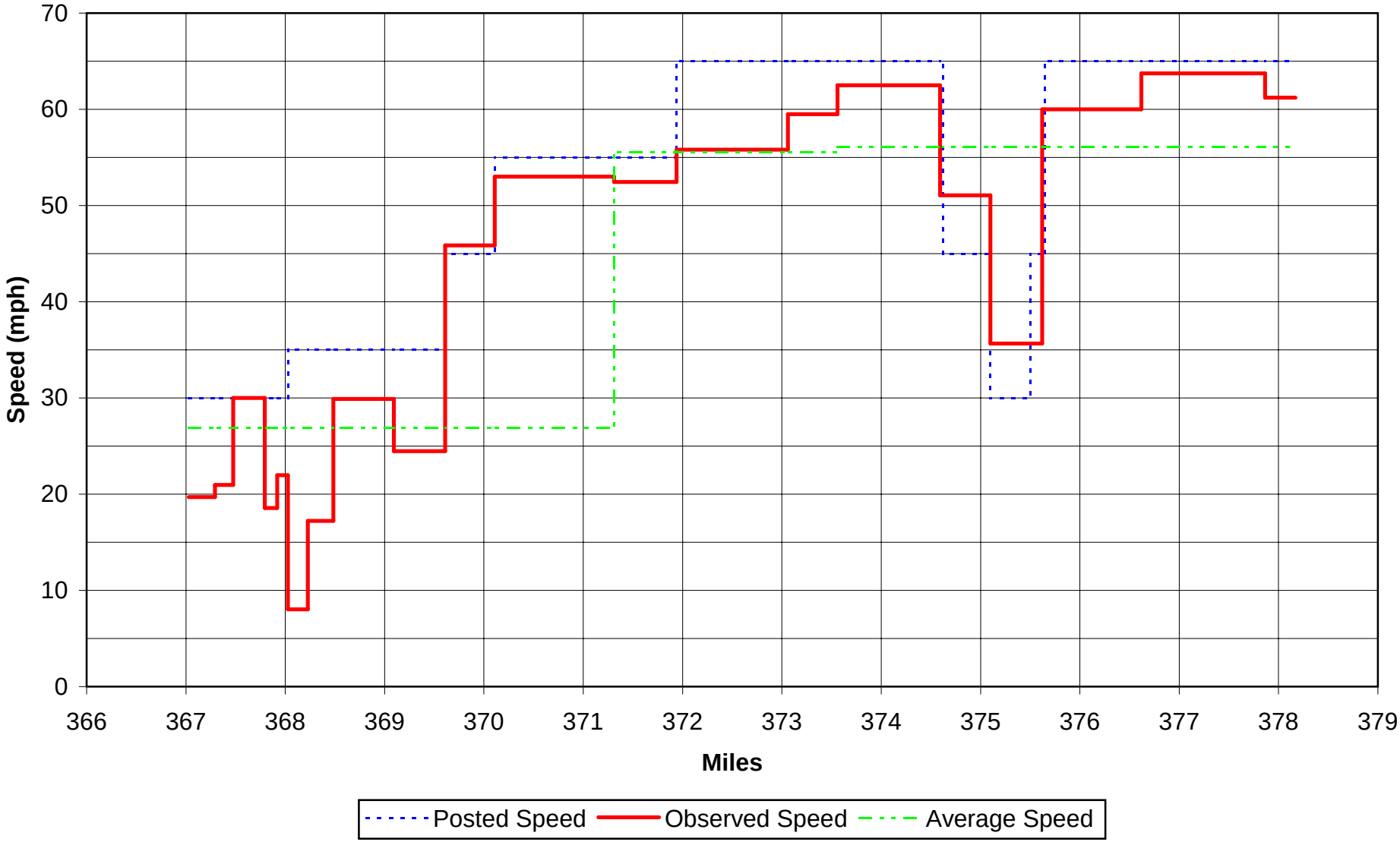
SD 42 Corridor Study Area Speed Profiles

SD 42 Performance
EB AM Peak (6:30-8:30 AM)

SEH, Inc.

12/30/2003

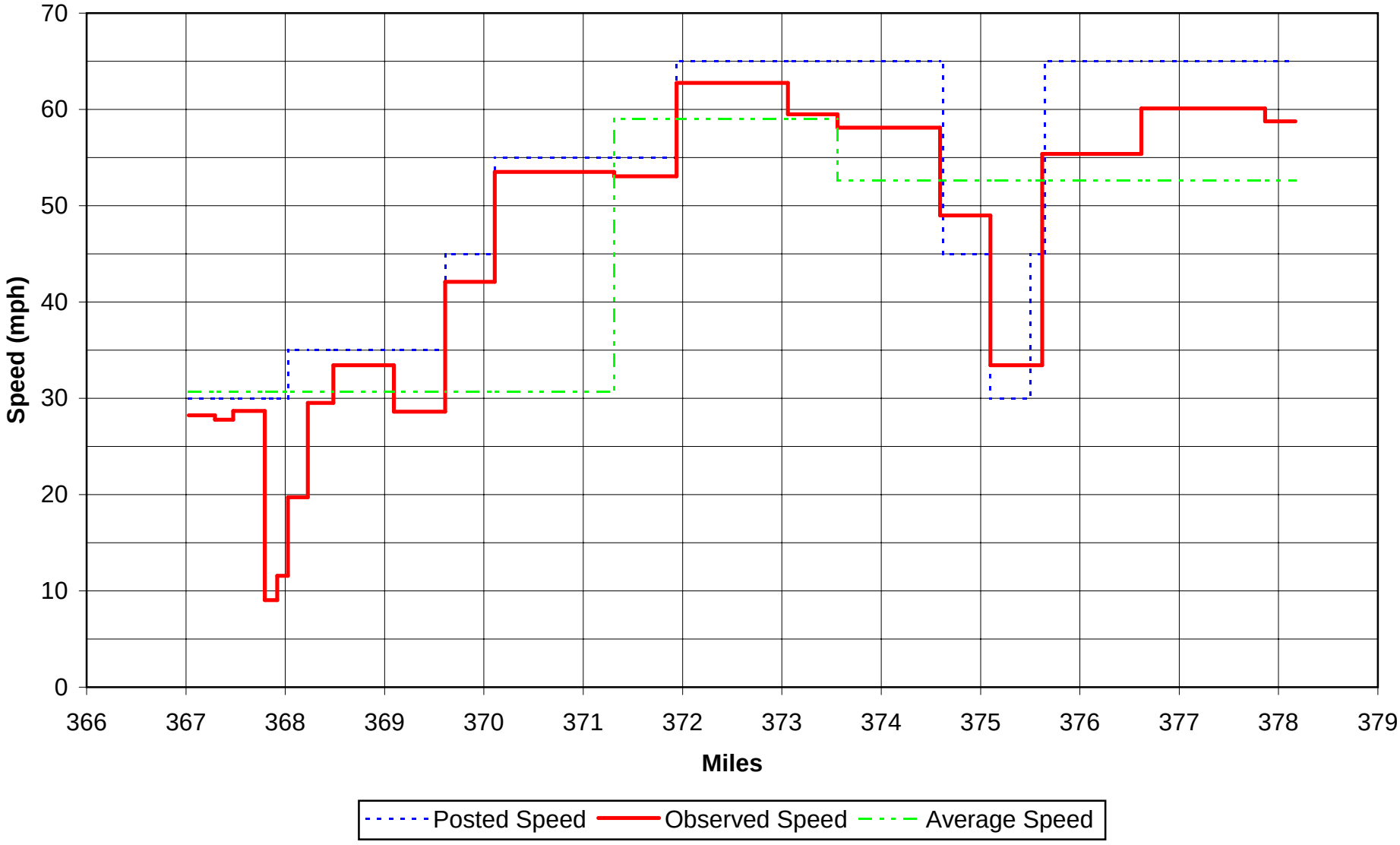
SD 42 Performance
WB AM Peak (6:30-8:30 AM)



SEH, Inc.

12/30/2003

SD 42 Performance
EB Noon Peak (11:30-1:30 PM)



SEH, Inc.

12/30/2003

SD 42 Performance
WB Noon Peak (11:30-1:30 PM)

SEH, Inc.

12/30/2003

SD 42 Performance
EB PM Peak (4:30-6:30 PM)

SEH, Inc.

12/30/2003

SD 42 Performance
WB PM Peak (4:30-6:30 PM)

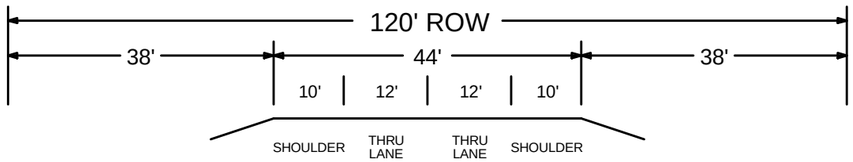
SEH, Inc.

12/30/2003

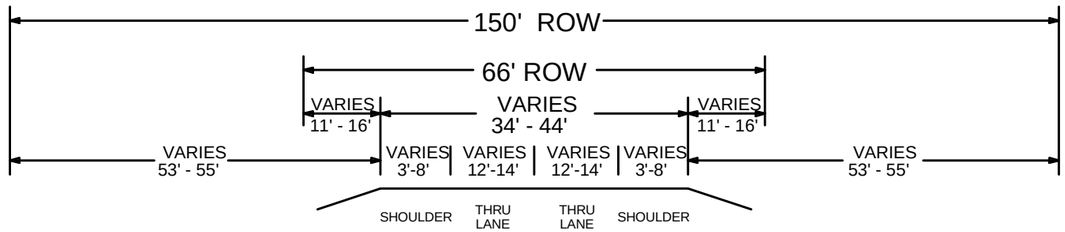
Appendix C
Figures 11-23

SD 42 Corridor Study Area
Typical Section Drawings
Concept Layouts

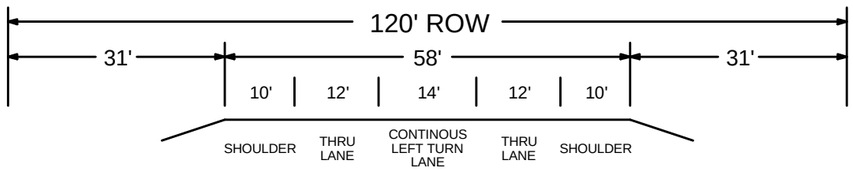
TWO LANE CONCEPT



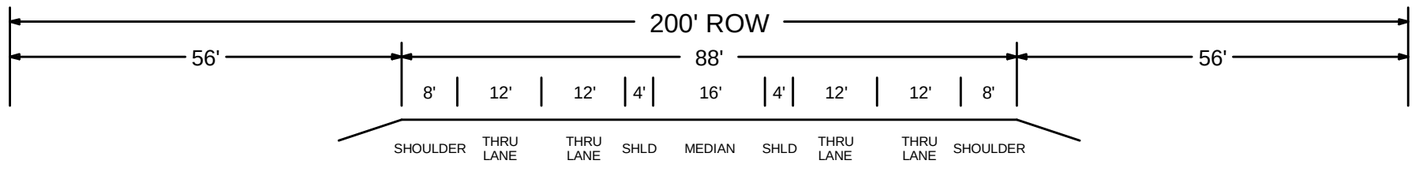
EXISTING 2 LANE SECTION



THREE LANE CONCEPT



FOUR LANE CONCEPT



South Dakota DOT — Connecting South Dakota and the Nation

South Dakota Highway 42 Corridor Study

Typical Sections

SEH

Figure 11

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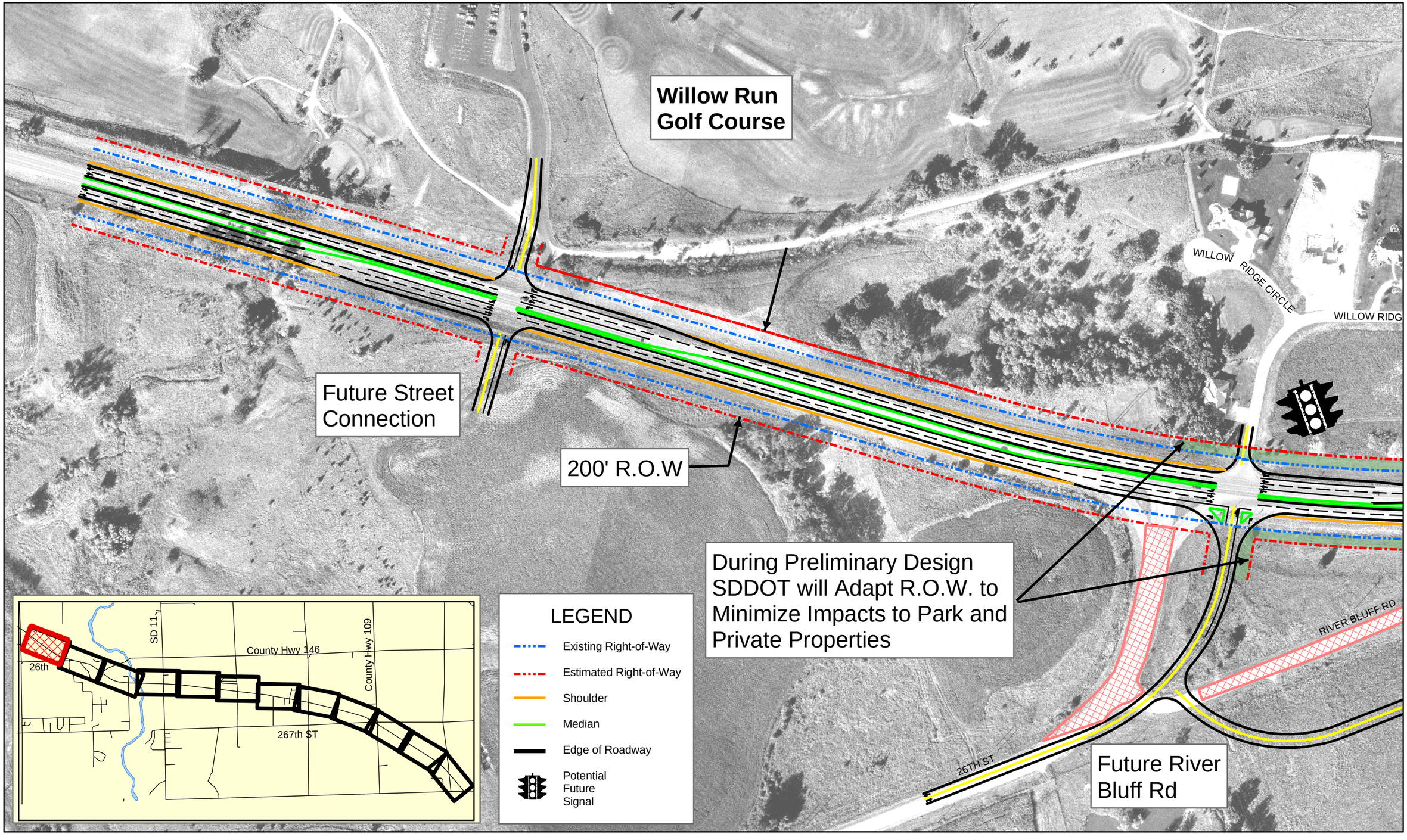


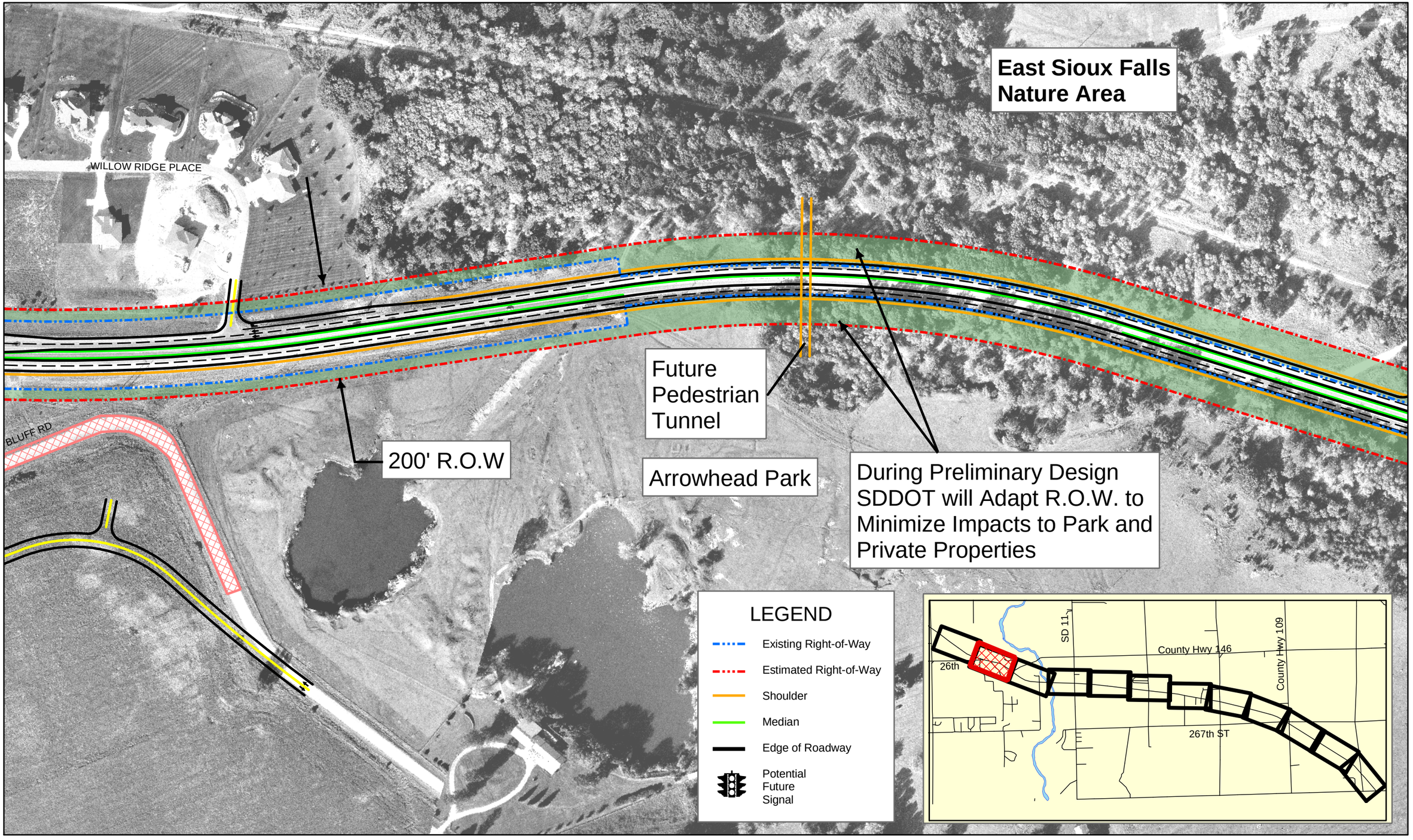
South Dakota Highway 42
Corridor Study

Mainline - Build Alternative
Segment - 1

0 100 200 400 Feet

Figure 12

Map Document: (D:\projects\sd42\airphotos.mxd)
9/19/03 -- 9:48:12 AM



South Dakota Highway 42
Corridor Study

Mainline - Build Alternative
Segment - 2

0 100 200 400 Feet

Figure 13

Map Document: (D:\projects\sd42\airphotos.mxd)
9/19/03 -- 9:48:12 AM

East Sioux Falls Nature Area

PERRY PLACE

Planned Arboretum

During Preliminary Design SDDOT will Adapt R.O.W to Minimize Impacts to Park and Private Properties

Mountable Median (For Event Purposes)

Future Entrance

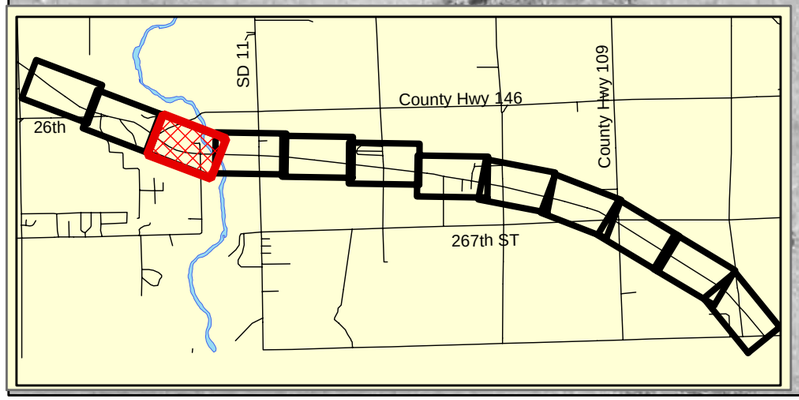
BIG SIOUX RIVER

RIVERVIEW AVE

200' R.O.W

LEGEND

- Existing Right-of-Way
- Estimated Right-of-Way
- Shoulder
- Median
- Edge of Roadway
- Potential Future Signal



South Dakota DOT
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South Dakota Highway 42 Corridor Study

Mainline - Build Alternative Segment - 3

SEH

0 100 200 400 Feet

Figure 14

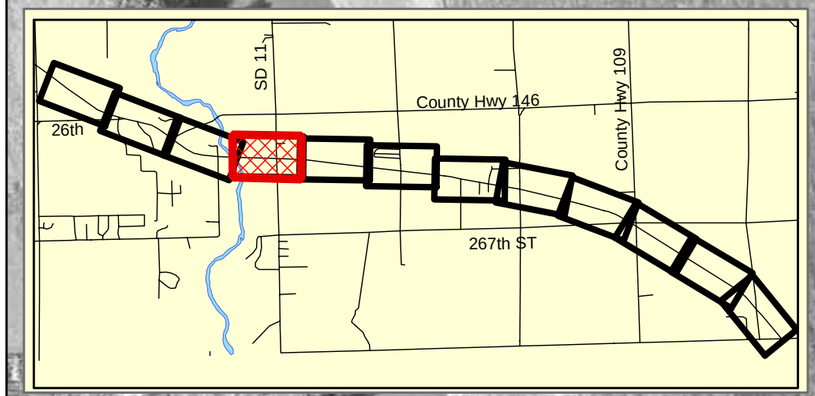
Map Document: (D:\projects\sd42\airphotos.mxd)
9/19/03 -- 9:48:12 AM

TUCKER DR

SD HWY 11

481 AVE

200' R.O.W



LEGEND

- Existing Right-of-Way
- Estimated Right-of-Way
- Shoulder
- Median
- Edge of Roadway
- Potential Future Signal

0 100 200 400 Feet

South Dakota Highway 42 Corridor Study

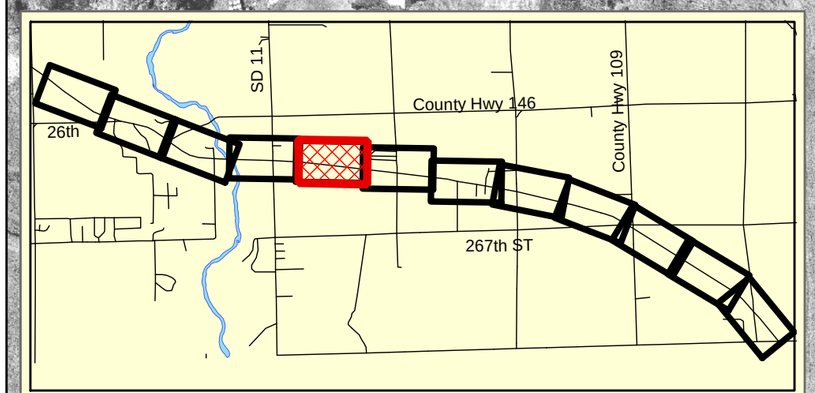
Mainline - Build Alternative Segment - 4

Figure 15

Map Document: (D:\projects\sd42\airphotos.mxd)
9/19/03 -- 9:48:12 AM

200' R.O.W

120' R.O.W



LEGEND

- Existing Right-of-Way
- Estimated Right-of-Way
- Shoulder
- Median
- Edge of Roadway
- Potential Future Signal

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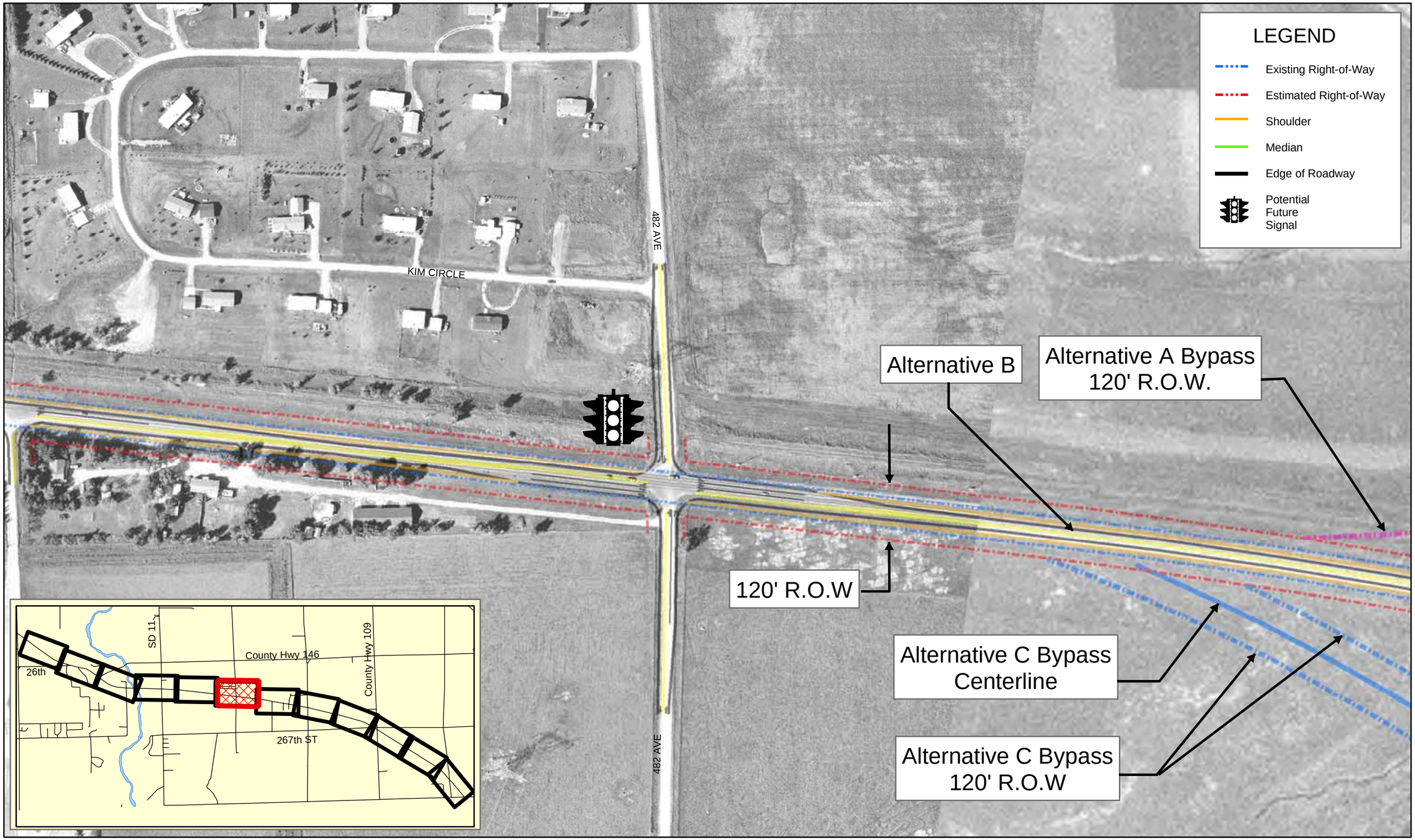
South Dakota Highway 42
Corridor Study

Mainline - Build Alternative
Segment - 5

0 100 200 400 Feet

Figure 16

Map Document: (D:\projects\sd42\airphotos.mxd)
9/3/2013 -- 9:48:12 AM



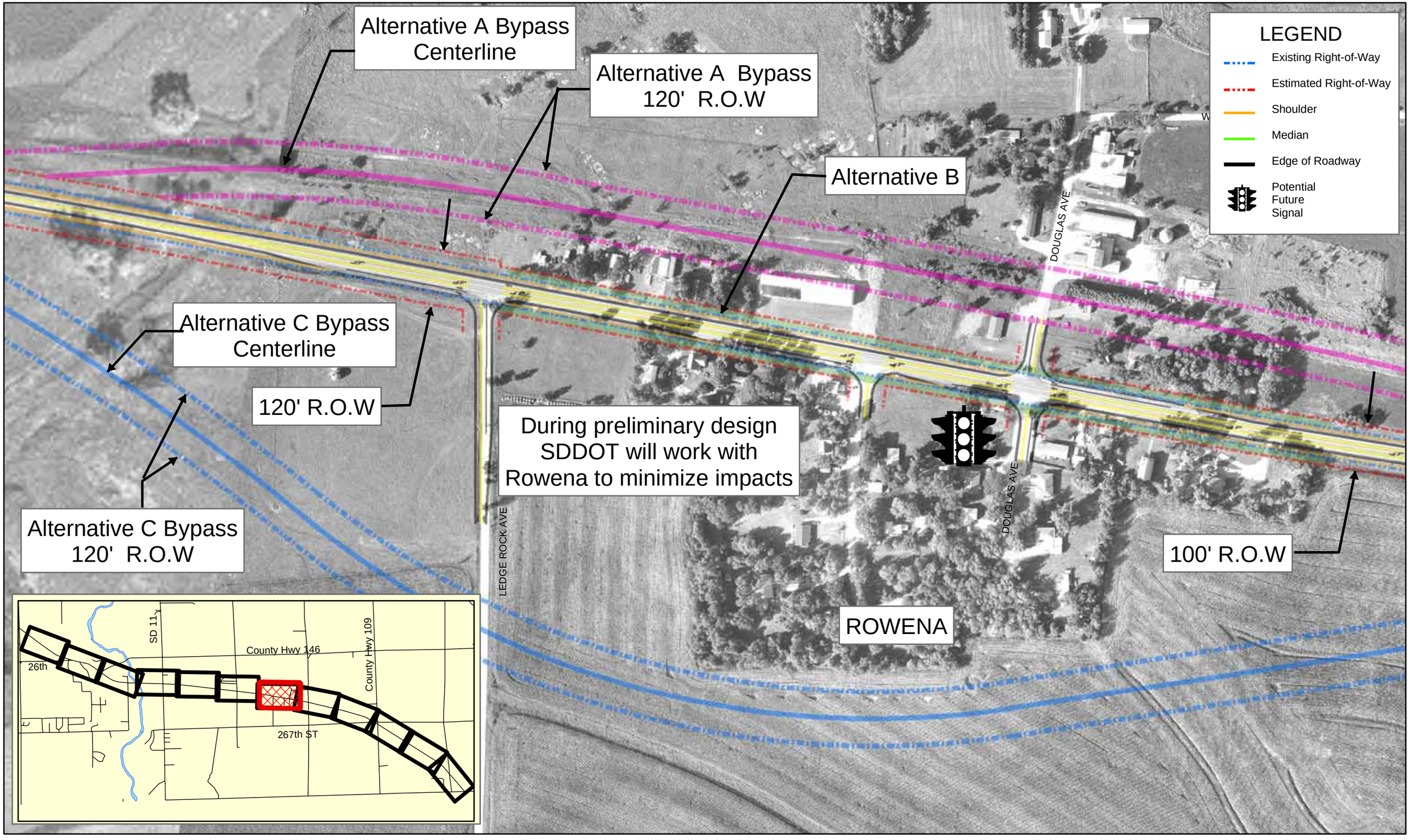
South Dakota Highway 42 Corridor Study

Mainline - Build Alternative Segment - 6

0 100 200 400 Feet

Figure 17

Map Document: (D:\projects\sd42\airphotos.mxd)
9/19/03 -- 9:48:12 AM



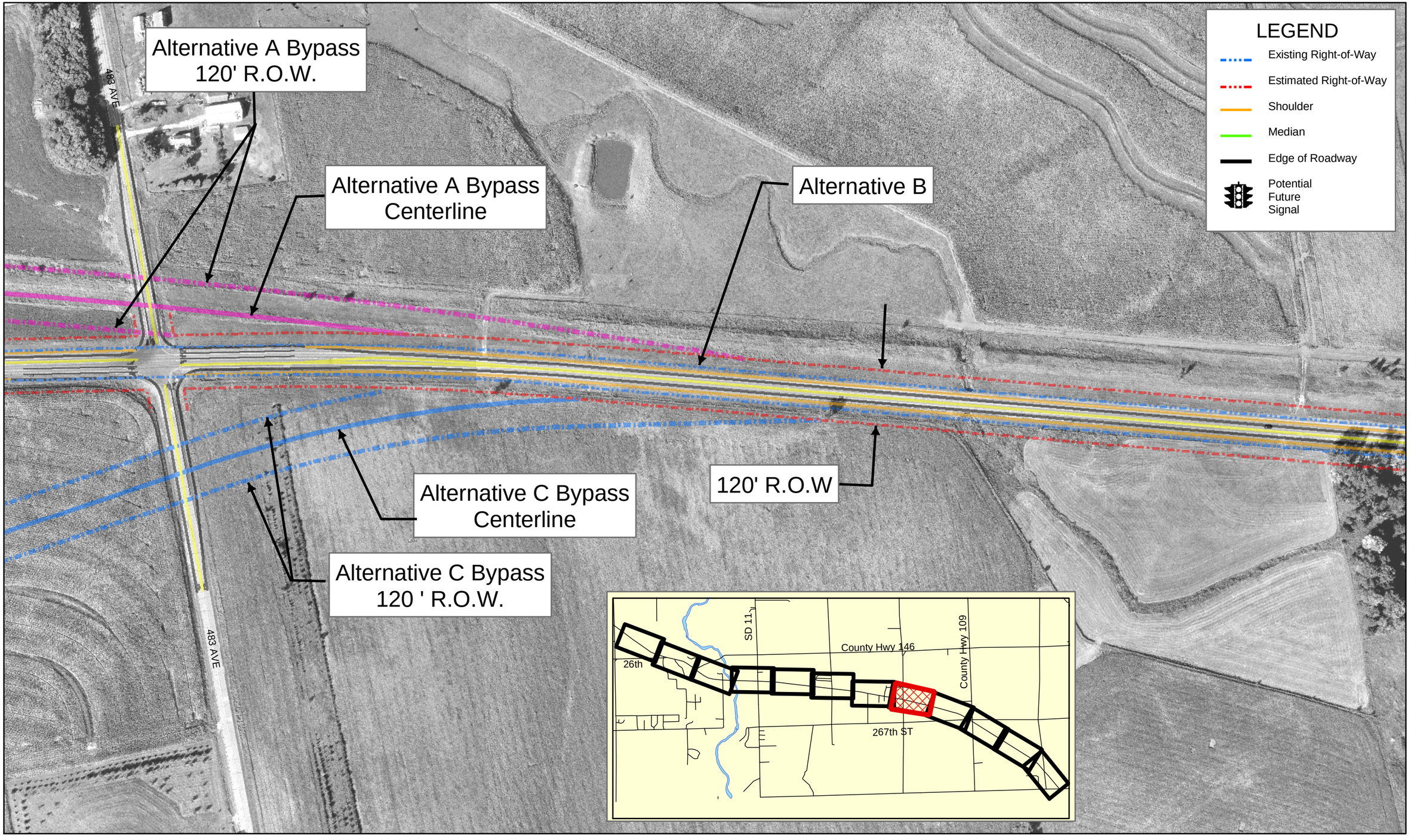
South Dakota Highway 42 Corridor Study

Mainline - Build Alternative Segment - 7

0 100 200 400 Feet

Figure 18

Map Document: (D:\projects\sd42\arphotos.mxd)
9/19/03 -- 9:48:12 AM



South Dakota Highway 42
Corridor Study

Mainline - Build Alternative
Segment - 8

0 100 200 400 Feet

Figure 19

Map Document: (D:\projects\sd42\arsphotos.mxd)
9/19/03 -- 9:48:12 AM

South Dakota Highway 42 Corridor Study

Mainline - Build Alternative Segment - 9

0 100 200 400 Feet

Figure 20

Map Document: (D:\projects\sd42\airphotos.mxd)
9/19/03 -- 9:48:12 AM

South Dakota Highway 42 Corridor Study

Mainline - Build Alternative
Segment - 10

0 100 200 400 Feet

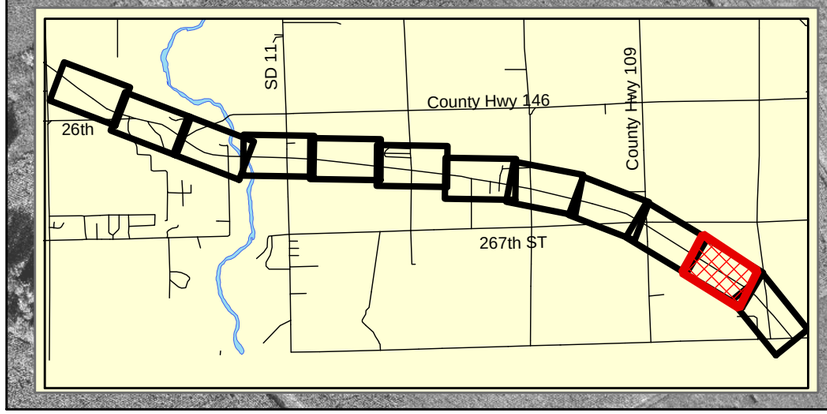
Figure 21

Map Document: (D:\projects\sd42\airphotos.mxd)
9/19/03 – 9:48:12 AM

LEGEND

- Existing Right-of-Way
- Estimated Right-of-Way
- Shoulder
- Median
- Edge of Roadway
- Potential Future Signal

120' R.O.W



South Dakota DOT
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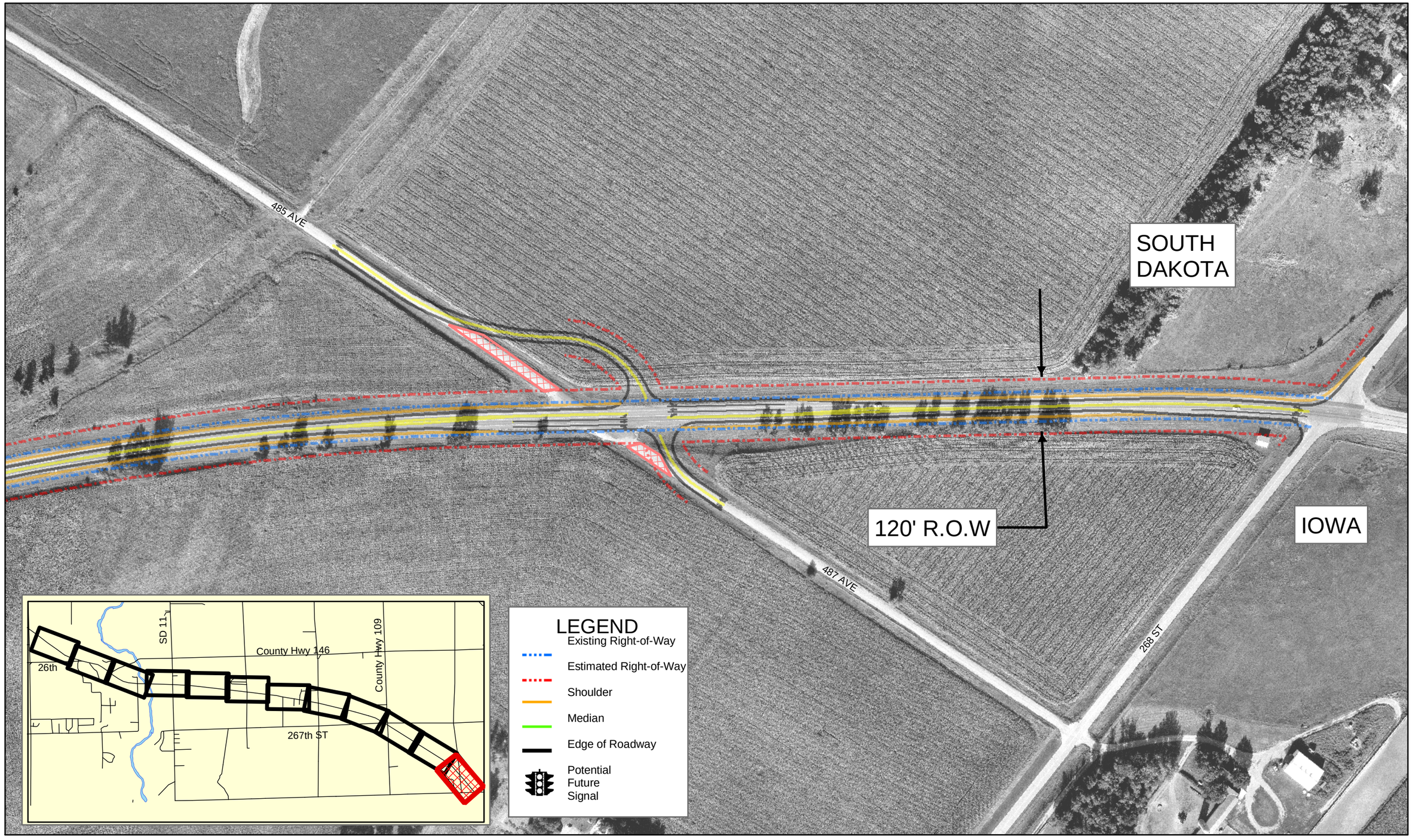
South Dakota Highway 42
Corridor Study

Mainline - Build Alternative
Segment - 11

0 100 200 400 Feet

Figure 22

Map Document: (D:\projects\sd42\airphotos.mxd)
9/18/03 -- 9:48:12 AM



South Dakota Highway 42 Corridor Study

Mainline - Build Alternative Segment - 12

0 100 200 400 Feet

Figure 23

Map Document: (D:\projects\sd42\airphotos.mxd)
9/19/03 -- 8:48:12 AM

Appendix D
Figures 24-25
Tables 4 & 8

SD 42 Corridor Study Performance Assessment

Table 4

SD 42 PERFORMANCE MATRIX

PREDICTION OF EXISTING AND FUTURE PERFORMANCE

No Build Alternative

Peak Hour (6:30am to 8:30am WB and 4:30pm to 6:30pm EB)

Segment	Description From	Description To	Milepoint From	Milepoint To	True Length (miles)	Year 2000 Volume (AADT)	Existing Signals	Existing No. of Lanes	Posted Speed		Observed Speed Performance		Future Volumes 2025 (ADT)	Future Facility Type	Future No. of Lanes	Future Operating Speed	Future Base Time (secs)	Future AADT per lane	Congestion Index Risk[2]	Added Delay Penalty	Added Congestion Delay (secs)	Additional Signals (Future)	Added Signal Delay (secs)	Existing Signal Delay (secs)	Total Delay (secs)	Future Performance	
									Time (secs)	Speed (mph)	Time (secs)	Speed (mph)														Time (secs)	Speed (mph)
1	Six Mile Road	26th Street	371.31	371.94	0.63	6,520	0	2	41.2	55	41.4	54.7	16,600	TL	2	58	39.1	8,300	Severe	50%	20	1	20	0	40	78.7	28.8
2	26th Street	Riverview Ave	371.94	373.06	1.12	6,520	0	2	62.0	65	69.4	58.1	16,700	TL	2	68	59.3	8,350	Severe	50%	30	1	20	0	50	108.9	37.0
3	Riverview Ave	SD 11 North	373.06	373.56	0.50	6,520	0	2	27.7	65	30.3	59.5	16,800	TL	2	68	26.5	8,400	Severe	50%	13	1	20	0	33	59.7	30.1
1-3	***Subtotal***				***2.25***		***0***		***131.0***	***61.9***	***141.0***	***57.4***					***124.9***				***62***	***3***	***60***	***0***	***122.4***	***247.3***	***32.8***
4	SD 11 North	482nd Ave	373.56	374.59	1.03	3,588	0	2	57.2	65	60.1	61.9	8,400	TL	2	68	54.7	4,200	Low	0%	0	1	20	0	20	86.1	44.3
	482nd Ave	45 / 65 mph sign	374.59	374.62	0.03	3,282	0	2	1.5	65	35.9	50.9	6,750	TL	2	68	1.4	3,375	Low	0%	0	0.5	10	0	10		
	45 / 65 mph sign	Ledge Rock Ave (30 / 45 mph sign)	374.62	375.10	0.48	3,282	0	2	38.4	45			6,750	TL	2	48	36.0	3,375	Low	0%	0	0	0	0	0	36.0	48.0
5	Ledge Rock Ave (30 / 45 mph sign)	30 / 45 mph sign	375.10	375.50	0.40	3,282	0	2	48.0	30	54.2	34.5	6,750	TL	2	33	43.6	3,375	Low	0%	0	1	20	0	20	63.6	22.6
	30 / 45 mph sign	CR 111 (Appx. Rowena East Side City Limits)	375.50	375.62	0.12	3,282	0	2	9.6	45			6,750	TL	2	48	9.0	3,375	Low	0%	0	0	0	0	0	9.0	48.0
6	CR 111 (Appx. Rowena East Side City Limits)	45 / 65 mph sign	375.62	375.64	0.02	2,975	0	2	1.9	45	60.6	59.4	5,100	TL	2	48	1.8	2,550	Low	0%	0	0	0	0	0	1.8	48.0
	45 / 65 mph sign	CR 109	375.64	376.62	0.98	2,975	0	2	54.1	65			5,100	TL	2	68	51.7	2,550	Low	0%	0	0	0	0	0	58.8	59.7
7	CR 109	485th Ave	376.62	377.86	1.24	2,975	0	2	68.9	65	70.9	63.2	5,000	TL	2	68	65.9	2,500	Low	0%	0	0	0	0	0	70.9	63.2
	485th Ave	SD / Iowa State Line	377.86	378.17	0.31	2,975	0	2	16.9	65	18.0	61.2	5,000	TL	2	68	16.2	2,500	Low	0%	0	0	0	0	0	18.0	61.2
4-7	***Subtotal***				***4.61***		***0***		***296.5***	***56.0***	***299.8***	***55.4***					***280.3***				***0***	***2.5***	***50***	***0***	***50.0***	***344.3***	***48.2***
1-7	***Total***				***6.86***		***0.0***		***427.5***	***57.8***	***440.8***	***56.0***					***405.2***				***62***	***5.5***	***110***	***0***	***172***	***591.6***	***41.7***

X:\S\Sddot\030300\Performance\[11-05-03.xls]No_Build_Performance

Operating Speed Above Posted (Grace) - mph	3

Figure 25
"Concept"
SD 42 Peak Period Performance

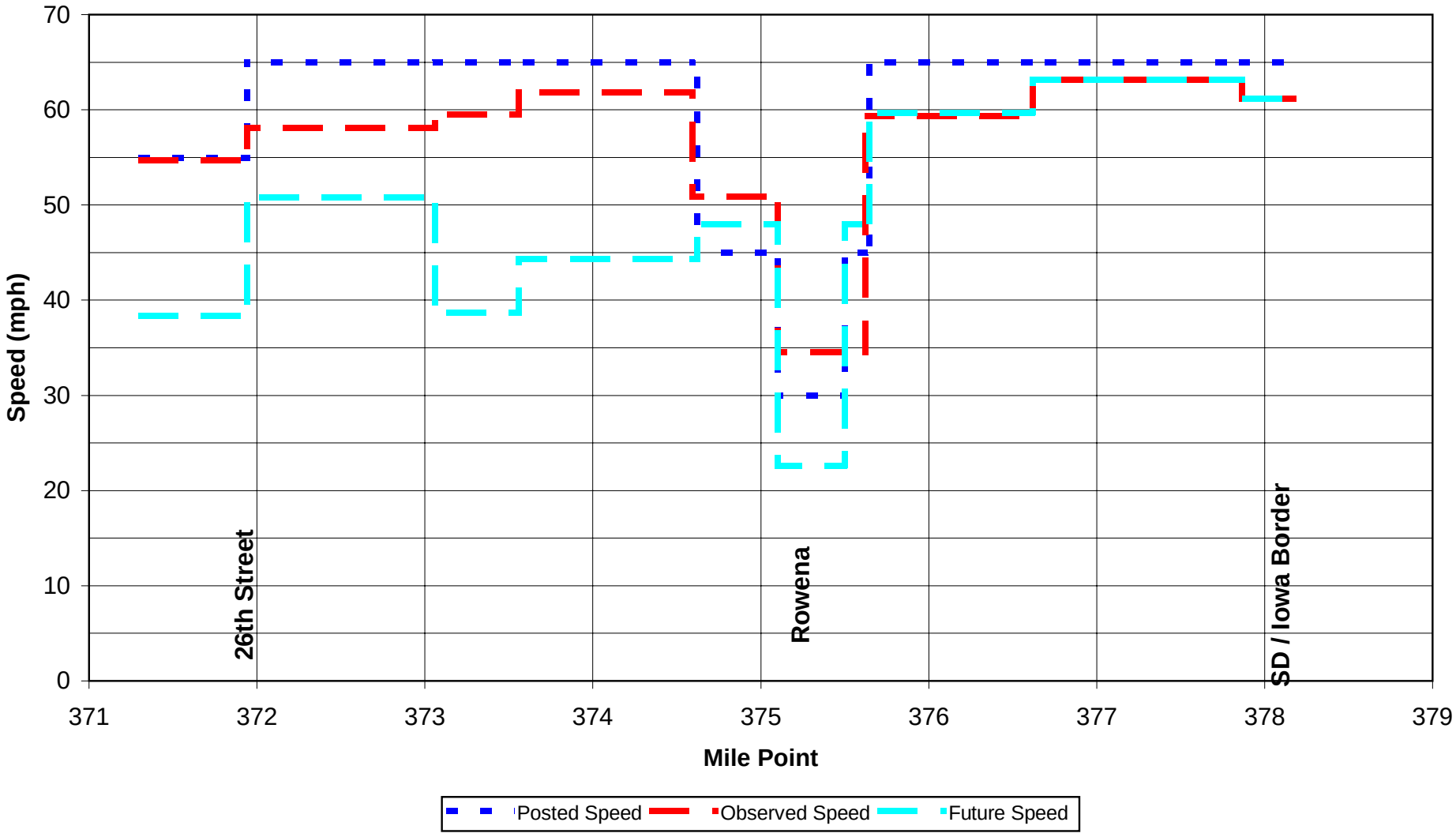


Table 8

SD 42 PERFORMANCE MATRIX

PREDICTION OF EXISTING AND FUTURE PERFORMANCE

Concept

Peak Hour (6:30am to 8:30am WB and 4:30pm to 6:30pm EB)

Segment	Description From	Description To	Milepoint From	Milepoint To	True Length (miles)	Year 2000 Volume (AADT)	Existing Signals	Existing No. of Lanes	Posted Speed		Observed Speed Performance		Future Volumes 2025 (ADT)	Future Facility Type	Future No. of Lanes	Future Operating Speed	Future Base Time (secs)	Future AADT per lane	Congestion Index Risk[2]	Added Delay Penalty	Added Congestion Delay (secs)	Additional Signals (Future)	Added Signal Delay (secs)	Existing Signal Delay (secs)	Total Delay (secs)	Future Performance	
									Time (secs)	Speed (mph)	Time (secs)	Speed (mph)														Time (secs)	Speed (mph)
1	Six Mile Road	26th Street	371.31	371.94	0.63	6,520	0	2	41.2	55	41.4	54.7	16,600	UE	4	58	39.1	4,150	Low	0%	0	1	20	0	20	59.1	38.4
2	26th Street	Riverview Ave	371.94	373.06	1.12	6,520	0	2	62.0	65	69.4	58.1	16,700	UE	4	68	59.3	4,175	Low	0%	0	1	20	0	20	79.3	50.8
3	Riverview Ave	SD 11 North	373.06	373.56	0.50	6,520	0	2	27.7	65	30.3	59.5	16,800	UE	4	68	26.5	4,200	Low	0%	0	1	20	0	20	46.5	38.7
1-3	***Subtotal***				***2.25***		***0***		***131.0***	***61.9***	***141.0***	***57.4***					***124.9***				***0***	***3***	***60***	***0***	***60.0***	***184.9***	***43.8***
4	SD 11 North	482nd Ave	373.56	374.59	1.03	3,588	0	2	57.2	65	60.1	61.9	8,400	TL	2	68	54.7	4,200	Low	0%	0	1	20	0	20	86.1	44.3
	482nd Ave	45 / 65 mph sign	374.59	374.62	0.03	3,282	0	2	1.5	65	35.9	50.9	6,750	TL	2	68	1.4	3,375	Low	0%	0	0.5	10	0	10		
	45 / 65 mph sign	Ledge Rock Ave (30 / 45 mph sign)	374.62	375.10	0.48	3,282	0	2	38.4	45			6,750	TL	2	48	36.0	3,375	Low	0%	0	0	0	0	0	36.0	48.0
5	Ledge Rock Ave (30 / 45 mph sign)	30 / 45 mph sign	375.10	375.50	0.40	3,282	0	2	48.0	30	54.2	34.5	6,750	TL	2	33	43.6	3,375	Low	0%	0	1	20	0	20	63.6	22.6
	30 / 45 mph sign	CR 111 (Appx. Rowena East Side City Limits)	375.50	375.62	0.12	3,282	0	2	9.6	45			6,750	TL	2	48	9.0	3,375	Low	0%	0	0	0	0	0	9.0	48.0
6	CR 111 (Appx. Rowena East Side City Limits)	45 / 65 mph sign	375.62	375.64	0.02	2,975	0	2	1.9	45	60.6	59.4	5,100	TL	2	48	1.8	2,550	Low	0%	0	0	0	0	0	1.8	48.0
	45 / 65 mph sign	CR 109	375.64	376.62	0.98	2,975	0	2	54.1	65			5,100	TL	2	68	51.7	2,550	Low	0%	0	0	0	0	0	58.8	59.7
7	CR 109	485th Ave	376.62	377.86	1.24	2,975	0	2	68.9	65	70.9	63.2	5,000	TL	2	68	65.9	2,500	Low	0%	0	0	0	0	0	70.9	63.2
	485th Ave	SD / Iowa State Line	377.86	378.17	0.31	2,975	0	2	16.9	65	18.0	61.2	5,000	TL	2	68	16.2	2,500	Low	0%	0	0	0	0	0	18.0	61.2
4-7	***Subtotal***				***4.61***		***0***		***296.5***	***56.0***	***299.8***	***55.4***					***280.3***				***0***	***2.5***	***50***	***0***	***50.0***	***344.3***	***48.2***
1-7	***Total***				***6.86***		***0.0***		***427.5***	***57.8***	***440.8***	***56.0***					***405.2***				***0***	***5.5***	***110***	***0***	***110***	***529.1***	***46.7***

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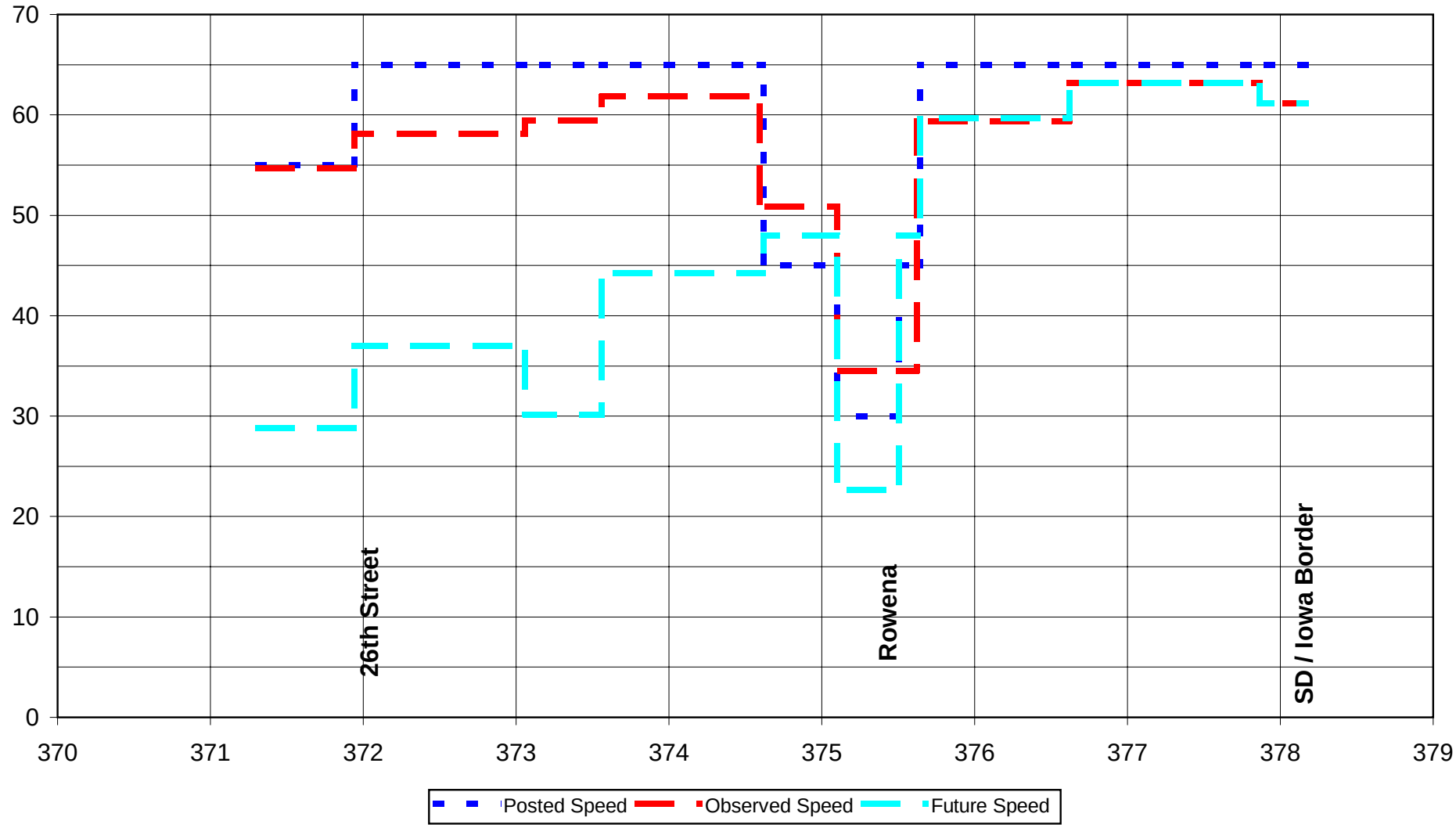
Operating Speed Above Posted (Grace) - mph	3

Figure 24
"No Build"
SD 42 Peak Period Performance



Appendix E

SD 42 Corridor Study
Benefit-Cost Analysis Worksheets

Summary of the 20-Year Benefit-Cost Study for the SD 42 Project.

Item	Concept	
VHT Benefit	$	10,689,000
Crashes Benefit	$	10,477,000
O&M Benefit	$	1,380,779
Total Benefit*	**$**	**22,547,000**
Construction Cost	$	15,644,238
Bridge Cost	$	3,403,400
Signal Costs	$	1,080,000
Retaining Walls Cost	$	-
Right-of-Way Cost	$	107,490
Other	$	156,442
Program Development and Delivery Contigency	$	4,078,314
Total Cost*	**$**	**24,470,000**
PV Total Cost*	$	22,799,000
Project Salvage Value*	$	5,598,000
PV Total Cost* - Salvage Value*	**$**	**17,201,000**
Benefit-Cost Ratio		**1.3**

*Rounded to nearest thousand

Discount Rate = 3.6%

Design Period 20 years, 2005 through 2025

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Itemized Costs (2003)

Item	Concept	
Pavement	$	15,644,238
Bridge Over the Big Sioux River	$	3,403,400
Other	$	156,442
Signals	$	1,080,000
Retaining Walls	$	-
R/W Costs	$	107,490
Program Development & Delivery Contingency	$	4,078,314
TOTAL COST	**$**	**24,469,884**

Concept Description : 4-lane from Six Mile Road past SD 11 North and 2-lane to Iowa border

Segment Description	Segment	Length, miles
Six Mile Road to SD 11 North (4 lane section)	1	2.25
SD 11 North to the Iowa Border (2 lane section)	2	4.61
Total	1+2	6.86

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Assumptions Used in the Benefit-Cost Study.

Crash Costs (2003 Dollars)

Estimating change in crashes	Fatal Type K	$ 3,400,000
Mn/DOT Standard Values [1]	Injury	$ 58,000
	Property Damage Only	$ 4,200

Operating Costs

Estimating change in travel costs (Vehicle Miles of Travel)		
	Automobile (per mile) [1]	$ 0.28
	Heavy Vehicle (per mile) [1]	$ 1.43
Percent vehicles varies per segment and alternative		

Time Costs

Estimating change in time costs (Vehicle Hours of Travel)		
	Automobile (per occupant use vehicle occupancy to adjust) [1]	$ 9.92
	Heavy Commercial (per hour, assume avg occupancy = 1.0) [1]	$ 18.40
	Average Automobile Occupancy (persons)	1.2

Vehicle Occupancy

National Person Travel Survey	All Auto Trips	1.29
Met Council 1990 TBI	Home	1.30
	Work	1.08
	Shopping	1.31
	School	2.21
	Percent heavy vehicles	9.21%
	Percent automobiles	96%

Capital Cost Estimate (See Costs) (2003 Dollars)

Program Development and Delivery Contingency	20%

Routine Maintenance Cost Maintenance costs - from District

/lane/mile/year	$	1,600

New Road PM

/lane/mile/year 15	$	35,000
/lane/mile/year 25	$	76,600

No Build Includes No Cost at Time of Construction

Component Service Life (years) [1]

Engineering	0
Right-of-Way	100
Bridge	60
Mass Grading and Drainage	50
Base	40
Surface	25
Signal System	20

Analysis Period for Roadway Projects

20 Years

Depreciation Method

Sinking Fund [2]

Discount Rate (annual)

South Dakota	3.6%

Notes:

(1) OIM

(2) MicroBencost

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Salvage Values

Service Life	RCV Factor	F/P	(P/A,I,n)	P/A
50	78.84%	2.03	23.04	14.08
40	66.98%	2.03	21.03	14.08
25	27.61%	2.03	16.30	14.08
60	86.00%	2.03	24.45	14.08
100	96.92%	2.03	26.97	14.08

Item (2003 Dollars)	Concept
Total Construction Cost	$ 15,644,238
Grading & Drainage (45%)	$ 7,039,907
Subbase & Base (20%)	$ 3,128,848
Surface (35%)	$ 5,475,483
Construction SV	**$ 9,158,094**
Bridge Over the Big Sioux River	$ 3,403,400
Retaining Walls	$ -
Total Structures Cost	$ 3,403,400
Bridge SV	**$ 2,926,986**
R/W Costs	$ 107,490
Total R/W Cost	$ 107,490
R/W SV	**$ 104,175**
Other Costs	$ 5,314,756
TOTAL COST	$ 24,469,884
TOTAL SV yr 2025	$ 12,189,255
PV SALVAGE VALUE yr 2003	**$ 5,598,382**
Discount Rate =	3.6%

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Operating Benefit for the concept

Year	Vehicle Miles Traveled (VMT)		Annual Operating Cost		Operating Benefit	PW Operating Benefit
	No-Build Alt.	Concept	No-Build Alt.	Concept	Concept	Concept
2003						
2004						
2005	13,384,880	13,384,880	$5,360,667	$5,360,667	$0	$0
2006	13,920,528	13,920,528	$ 5,575,194	$ 5,575,194	$0	$0
2007	14,456,175	14,456,175	$ 5,789,722	$ 5,789,722	$0	$0
2008	14,991,822	14,991,822	$ 6,004,250	$ 6,004,250	$0	$0
2009	15,527,470	15,527,470	$ 6,218,778	$ 6,218,778	$0	$0
2010	16,063,117	16,063,117	$ 6,433,305	$ 6,433,305	$0	$0
2011	16,598,765	16,598,765	$ 6,647,833	$ 6,647,833	$0	$0
2012	17,134,412	17,134,412	$ 6,862,361	$ 6,862,361	$0	$0
2013	17,670,060	17,670,060	$ 7,076,888	$ 7,076,888	$0	$0
2014	18,205,707	18,205,707	$ 7,291,416	$ 7,291,416	$0	$0
2015	18,741,355	18,741,355	$ 7,505,944	$ 7,505,944	$0	$0
2016	19,277,002	19,277,002	$ 7,720,471	$ 7,720,471	$0	$0
2017	19,812,650	19,812,650	$ 7,934,999	$ 7,934,999	$0	$0
2018	20,348,297	20,348,297	$ 8,149,527	$ 8,149,527	$0	$0
2019	20,883,945	20,883,945	$ 8,364,055	$ 8,364,055	$0	$0
2020	21,419,592	21,419,592	$ 8,578,582	$ 8,578,582	$0	$0
2021	21,955,239	21,955,239	$ 8,793,110	$ 8,793,110	$0	$0
2022	22,490,887	22,490,887	$ 9,007,638	$ 9,007,638	$0	$0
2023	23,026,534	23,026,534	$ 9,222,165	$ 9,222,165	$0	$0
2024	23,562,182	23,562,182	$ 9,436,693	$ 9,436,693	$0	$0
2025	24,097,829	24,097,829	$9,651,221	$9,651,221	$0	$0
					TOTAL =	$ -

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Travel Time Benefit for the concept

Year	Vehicle Hours Traveled (VHT)		Annual Time Cost		Time Benefit	PW Time Benefit
	No-Build Alt.	Concept	No-Build Alt.	Concept	Concept	Concept
2003						
2004						
2005	279,244	258,115	$ 3,664,375	$ 3,387,100	$ 277,275	$ 258,340
2006	297,054	271,698	$ 3,898,077	$ 3,565,347	$ 332,730	$ 299,235
2007	314,863	285,281	$ 4,131,778	$ 3,743,593	$ 388,185	$ 336,977
2008	332,672	298,865	$ 4,365,479	$ 3,921,839	$ 443,640	$ 371,734
2009	350,482	312,448	$ 4,599,181	$ 4,100,086	$ 499,095	$ 403,668
2010	368,291	326,031	$ 4,832,882	$ 4,278,332	$ 554,550	$ 432,935
2011	386,100	339,614	$ 5,066,583	$ 4,456,578	$ 610,005	$ 459,680
2012	403,909	353,198	$ 5,300,285	$ 4,634,825	$ 665,460	$ 484,043
2013	421,719	366,781	$ 5,533,986	$ 4,813,071	$ 720,915	$ 506,158
2014	439,528	380,364	$ 5,767,687	$ 4,991,317	$ 776,370	$ 526,152
2015	457,337	393,948	$ 6,001,389	$ 5,169,564	$ 831,825	$ 544,145
2016	475,146	407,531	$ 6,235,090	$ 5,347,810	$ 887,280	$ 560,253
2017	492,956	421,114	$ 6,468,791	$ 5,526,056	$ 942,735	$ 574,583
2018	510,765	434,698	$ 6,702,493	$ 5,704,303	$ 998,190	$ 587,242
2019	528,574	448,281	$ 6,936,194	$ 5,882,549	$ 1,053,645	$ 598,326
2020	546,383	461,864	$ 7,169,895	$ 6,060,795	$ 1,109,100	$ 607,932
2021	564,193	475,447	$ 7,403,597	$ 6,239,042	$ 1,164,555	$ 616,147
2022	582,002	489,031	$ 7,637,298	$ 6,417,288	$ 1,220,010	$ 623,057
2023	599,811	502,614	$ 7,870,999	$ 6,595,534	$ 1,275,465	$ 628,743
2024	617,620	516,197	$ 8,104,701	$ 6,773,781	$ 1,330,920	$ 633,282
2025	635,430	529,781	$ 8,338,402	$ 6,952,027	$ 1,386,375	$ 636,746
					TOTAL =	$ 10,689,378

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Crash Reduction Benefit for the concept

Year	Annual Crash Cost		Crash Reduction Benefit	PW (2003) Crash Benefit
	No-Build Alt.	Concept	Concept	Concept
2003				
2004				
2005	$ 1,840,967	$ 1,272,190	$ 568,776	$ 529,934
2006	$ 1,914,640	$ 1,325,593	$ 589,047	$ 529,750
2007	$ 1,988,314	$ 1,378,995	$ 609,318	$ 528,939
2008	$ 2,061,987	$ 1,432,398	$ 629,589	$ 527,544
2009	$ 2,135,660	$ 1,485,800	$ 649,860	$ 525,607
2010	$ 2,209,334	$ 1,539,202	$ 670,131	$ 523,169
2011	$ 2,283,007	$ 1,592,605	$ 690,402	$ 520,265
2012	$ 2,356,680	$ 1,646,007	$ 710,673	$ 516,931
2013	$ 2,430,354	$ 1,699,409	$ 730,944	$ 513,200
2014	$ 2,504,027	$ 1,752,812	$ 751,215	$ 509,105
2015	$ 2,577,701	$ 1,806,214	$ 771,486	$ 504,674
2016	$ 2,651,374	$ 1,859,617	$ 791,757	$ 499,937
2017	$ 2,725,047	$ 1,913,019	$ 812,028	$ 494,920
2018	$ 2,798,721	$ 1,966,421	$ 832,299	$ 489,647
2019	$ 2,872,394	$ 2,019,824	$ 852,570	$ 484,143
2020	$ 2,946,067	$ 2,073,226	$ 872,841	$ 478,431
2021	$ 3,019,741	$ 2,126,629	$ 893,112	$ 472,531
2022	$ 3,093,414	$ 2,180,031	$ 913,383	$ 466,464
2023	$ 3,167,087	$ 2,233,433	$ 933,654	$ 460,247
2024	$ 3,240,761	$ 2,286,836	$ 953,925	$ 453,899
2025	$ 3,314,434	$ 2,340,238	$ 974,196	$ 447,437
			TOTAL =	$ 10,476,773

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Operating and Maintenance Benefits for the Concept

Year	Operating & Maintenance Costs		Difference in Concept	PW Diff. in O&M Concept
	No-Build Alt.	Concept		
2003				
2004				
2005	$29,152	$ -	$29,152	$27,161
2006	$29,152	$29,152	$0	$0
2007	$29,152	$29,152	$0	$0
2008	$29,152	$29,152	$0	$0
2009	$29,152	$29,152	$0	$0
2010	$29,152	$29,152	$0	$0
2011	$29,152	$29,152	$0	$0
2012	$1,424,804	$29,152	$1,395,652	$1,015,171
2013	$29,152	$29,152	$0	$0
2014	$29,152	$29,152	$0	$0
2015	$29,152	$29,152	$0	$0
2016	$29,152	$29,152	$0	$0
2017	$29,152	$29,152	$0	$0
2018	$29,152	$29,152	$0	$0
2019	$29,152	$29,152	$0	$0
2020	$29,152	$666,852	($637,700)	($349,543)
2021	$29,152	$29,152	$0	$0
2022	$29,152	$29,152	$0	$0
2023	$1,424,804	$29,152	$1,395,652	$687,990
2024	$29,152	$29,152	$0	$0
2025	$29,152	$29,152	$0	$0
Discount Rate = 3.6%			**Total**	**$ 1,380,779**

Maintenance costs (year 2003 dollars)

Routine Maintenance Cost

$ 1,600 /lane/mile/year from district

New Road PM

$ 35,000 /lane/mile/year 15 Medium OL (3"), from District

No-Build Minor Reconstruction, year 2012

$ 76,600 /lane/mile/year 2012, Medium Mill & OL (3") per lane mile, from District

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VHT / VMT Calculations

Segment	Description From	Description To	True Length (miles)	Observed Speed Performance		Year 2000 Volume (AADT)	No Build Future Performance		Concept Future Performance		Future Volumes *2025* (ADT)	NB Year 2000 VHT	NB Year 2005 VHT	Concept Year 2005 VHT	NB Year 2025 VHT	Concept Year 2025 VHT	NB Year 2000 VMT	NB Year 2005 VMT	NB Year 2025 VMT	Concept Year 2025 VMT
				Time (secs)	Speed (mph)		Time (secs)	Speed (mph)	Time (secs)	Speed (mph)										
1	Six Mile Road	26th Street	0.63	41.4	54.7	6,520	78.7	28.8	59.1	38.4	16,600	27,384	48,384	41,802	132,381	99,474	1,499,274	1,962,853	3,817,170	3,817,170
2	26th Street	Riverview Ave	1.12	69.4	58.1	6,520	108.9	37.0	79.3	50.8	16,700	45,861	73,580	63,541	184,459	134,260	2,665,376	3,497,693	6,826,960	6,826,960
3	Riverview Ave	SD 11 North	0.50	30.3	59.5	6,520	59.7	30.1	46.5	38.7	16,800	19,997	36,337	31,829	101,699	79,155	1,189,900	1,565,120	3,066,000	3,066,000
1-3	***Subtotal***		***2.25***	***141.0***	***57.4***		***247.3***	***32.8***	***184.9***	***43.8***		***93,242***	***158,301***	***137,171***	***418,539***	***312,890***	***5,354,550***	***7,025,666***	***13,710,130***	***13,710,130***
4	SD 11 North	482nd Ave	1.03	60.1	61.9	3,588	86.1	44.3	86.1	44.3	8,400	21,872	45,204	45,204	66,140	66,140	1,352,837	1,715,706	3,167,178	3,167,178
	482nd Ave	45 / 65 mph sign	0.03	35.9	50.9	3,282					6,750	11,938					32,344	39,180	66,521	66,521
	45 / 65 mph sign	Ledge Rock Ave (30 / 45 mph sign)	0.48			3,282	36.0	48.0	36.0	48.0	6,750				24,638	24,638	575,006	696,525	1,182,600	1,182,600
5	Ledge Rock Ave (30 / 45 mph sign)	30 / 45 mph sign	0.40	54.2	34.5	3,282	63.6	22.6	63.6	22.6	6,750	18,052	24,384	24,384	43,551	43,551	479,172	580,438	985,500	985,500
	30 / 45 mph sign	CR 111 (Appx. Rowena East Side City Limits)	0.12			3,282	9.0	48.0	9.0	48.0	6,750				6,159	6,159	143,752	174,131	295,650	295,650
6	CR 111 (Appx. Rowena East Side City Limits)	45 / 65 mph sign	0.02	60.6	59.4	2,975	1.8	48.0	1.8	48.0	5,100	18,286	20,899	20,899	931	931	26,061	29,784	44,676	44,676
	45 / 65 mph sign	CR 109	0.98			2,975	58.8	59.7	58.8	59.7	5,100				30,417	30,417	1,059,814	1,211,216	1,816,824	1,816,824
7	CR 109	485th Ave	1.24	70.9	63.2	2,975	70.9	63.2	70.9	63.2	5,000	21,378	24,288	24,288	35,930	35,930	1,350,828	1,534,723	2,270,300	2,270,300
	485th Ave	SD / Iowa State Line	0.31	18.0	61.2	2,975	18.0	61.2	18.0	61.2	5,000	5,429	6,169	6,169	9,125	9,125	332,278	377,512	558,450	558,450
4-7	***Subtotal***		***4.61***	***299.8***	***55.4***		***344.3***	***48.2***	***344.3***	***48.2***		***96,956***	***120,943***	***120,943***	***216,891***	***216,891***	***5,352,093***	***6,359,214***	***10,387,699***	***10,387,699***

1-7	***Total***		***6.86***	***440.8***	***56.0***		***591.6***	***41.7***	***529.1***	***46.7***		***190,198.2***	***279,244.5***	***258,114.7***	***635,429.7***	***529,780.7***	***10,706,643***	***13,384,880***	***24,097,829***	***24,097,829***

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% Heavy Vehicles on the Corridor

Length (miles)	Current ADT	Number of Trucks	% Trucks	Weighted Average
0.227	6520	522	8.01%	0.018
0.128	6520	522	8.01%	0.010
0.232	6520	522	8.01%	0.019
0.626	6520	522	8.01%	0.050
0.5	6520	522	8.01%	0.040
0.607	3588	329	9.17%	0.056
4.137	2975	289	9.71%	0.402
6.457	**Total**			**9.21%**

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Crashes

		Million Vehicles or Million Vehicle Miles	Crashes				Crash Rates				
			K	INJ	N	Total	*K*	*INJ*	*N*	*Total*	*Sev.*
2000	**Total**	**10.71**	**0.3**	**4.7**	**16.3**	**21.3**	*1.6%*	*21.9%*	*76.6%*	*1.99*	*3.58*
No Build 2005	**Total**	**13.38**	**0.4**	**5.8**	**20.4**	**26.7**	*1.6%*	*21.9%*	*76.6%*	*1.99*	*3.58*
No Build 2025	**Total**	**24.10**	**0.8**	**10.5**	**36.8**	**48.0**	*1.6%*	*21.9%*	*76.6%*	*1.99*	*3.58*
Concept 2005	4-lane section	7.03	0.2	2.6	9.1	11.9	*1.6%*	*21.9%*	*76.6%*	*1.70*	*3.05*
	2-lane section	6.36	0.1	1.4	5.0	6.5	*1.6%*	*21.9%*	*76.6%*	*1.02*	*1.83*
	Total	**13.38**	**0.3**	**4.0**	**14.1**	**18.4**	*1.6%*	*21.9%*	*76.6%*	*1.38*	*2.47*
Concept 2025	4-lane section	13.71	0.4	5.1	17.8	23.3	*1.6%*	*21.9%*	*76.6%*	*1.70*	*3.05*
	2-lane section	10.39	0.2	2.3	8.1	10.6	*1.6%*	*21.9%*	*76.6%*	*1.02*	*1.83*
	Total	**24.10**	**0.5**	**7.4**	**26.0**	**33.9**	*1.6%*	*21.9%*	*76.6%*	*1.41*	*2.53*

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ESTIMATE FOR: IMPROVEMENTS TO SD 42

ESTIMATE DATE 10/16/2003

SD 42 IN MINNEHAHA COUNTY

4-LANE ROADWAY FROM SIX MILE ROAD TO SD 11 NORTH AND 2-LANE FROM SD 11 NORTH TO THE IOWA BORDER

GRADING, SURFACING, DRAINAGE, UTILITIES, NOISE & RETAINING WALLS

PROJECT ROADWAY COST CALCULATIONS						
ROADWAY	**NUMBER OF LANES**	**SQUARE FEET**	**DEPTH (feet)**	**LWD FACTOR**	**LWD COST MULTIPLIER**	**COST**
SD 42 MAINLINE 371.31 TO 373.56	4	712,094	0.75	101.15	$60,000	$6,068,983
SD 42 SHOULDER LT 371.31 TO 373.56	4	87,478	0.25	4.14	$60,000	$248,517
SD 42 SHOULDER RT 371.31 TO 373.56	4	155,046	0.25	7.34	$60,000	$440,472
SD 42 MAINLINE 373.56 TO 375.10	2	232,338	0.75	33.00	$60,000	$1,980,153
SD 42 MAINLINE 375.10 TO 378.17	2	523,497	0.38	37.18	$60,000	$2,230,811
SD 42 SHOULDER RT 373.56 TO 378.17	2	388,902	0.25	18.41	$60,000	$1,104,835
SD 11 MAINLINE	2	179,225	1.08	36.77	$60,000	$2,206,368
SD 11 SHOULDER	2	179,225	0.25	8.49	$60,000	$509,162
OTHER INTERSECTION IMPROVEMENTS	2	200,625	0.38	14.25	$60,000	$854,936
TOTAL		**2,658,430**		**260.74**		**$15,644,238**

BRIDGE COST CALCULATIONS						
BRIDGE	**NUMBER OF LANES**	**LENGTH (FEET)**	**WIDTH (FEET)**	**SQUARE FEET**	**$ / SQ FT**	**COST**
BRIDGE OVER THE BIG SIOUX	4	455.0	88.0	40,040	$85	$3,403,400
TOTAL						**$3,403,400**

PROJECT COST TOTALS		
1 ROADWAY COST	(LWD Method)	$15,644,238
2 BRIDGE COST	(From Bridge)	$3,403,400
3 ADDITIONAL COST ITEM	Aesthetics (1% construction cost)	$156,442
4 DRAINAGE COSTS ABOVE NORMAL PROJECT NEEDS	(From _)	$0
5 SIGNAL SYSTEM COST	(6 signal systems at $180,000 each)	$1,080,000
6 NOISE WALL COST	(From _)	$0
7 RETAINING WALL COST	(From _)	$0
8 RIGHT OF WAY	(From _)	$107,490
9 PROGRAM DEVELOPMENT AND DELIVERY CONTINGENCY	(20% of project cost)	$4,078,314
	TOTAL ESTIMATED PROJECT COST > > >	**$24,470,000**

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Appendix F

Recommended Future SD 42 Corridor Access Plan

Proposed Access Plan - SD Highway 42 Corridor Study

Access Classification	Mile Point	Side	Type	Future Condition	Description
Urban Fringe / Sioux Falls	371.68	Left	Commercial	1	WILLOW RUN GOLF COURSE
	371.70	Right	Field	2, 3	FIELD ENTRANCE
	371.94	Right	Public	4	26TH STREET
	371.97	Left	Public	1	WILLOW RIDGE PLACE
	372.05	Right	Field	2, 3	FIELD ENTRANCE
	372.14	Left	Public	3	WILLOW RIDGE PLACE
	372.20	Left	Field	2, 3	FIELD ENTRANCE
	372.30	Right	Field	2, 3	FIELD ENTRANCE
	372.31	Left	Field	2, 3	FIELD ENTRANCE
	372.57	Right	Field	2, 3	FIELD ENTRANCE
	372.57	Left	Public	4[a]	HISTORICAL MARKER
	372.61	Left	Public	3	PERRY PLACE
	372.77	Right	Field	2, 3	FIELD ENTRANCE
	373.05	Right	Public	1	RIVERVIEW ROAD
	373.05	Left	Commercial	3[b]	FRATERNAL ORDER OF POLICE
Urban Fringe	373.42	Both	Field	2, 3	FIELD ENTRANCE
	373.48	Left	Field	2, 3	FIELD ENTRANCE
	373.56	Both	Public	1	SD 11 NORTH
	373.67	Left	Commercial	3	WEIGHT STATION EXIT
	373.72	Right	Field	2, 3	FIELD ENTRANCE
	373.76	Left	Commercial	3	WEIGHT STATION ENTRANCE
	373.83	Right	Residential	3	RESIDENTIAL DRIVEWAY
	373.89	Right	Field	2, 3	FIELD ENTRANCE
	373.93	Left	Commercial	1	PREHEIM LANDSCAPING
	374.07	Right	Field	2	FIELD ENTRANCE
	374.32	Right	Commercial	1	MYRL AND ROY'S QUARRY
	374.38	Right	Commercial	1[c]	WALTER'S SPORTS BAR
	374.42	Right	Commercial	1[c]	WALTER'S SPORTS BAR
	374.59	Both	Public	1	482ND AVENUE
Urban Developed	375.10	Right	Public	1	LEDGEROCK AVENUE
	375.12	Right	Field	2	FIELD ENTRANCE
	375.13	Left	Residential	1	RESIDENTIAL DRIVEWAY
	375.15	Left	Residential	1	RESIDENTIAL DRIVEWAY
	375.17	Left	Commercial	1	L & L AUTO
	375.18	Right	Residential	1	RESIDENTIAL DRIVEWAY
	375.20	Left	Residential	1	RESIDENTIAL DRIVEWAY
	375.20	Right	Residential	1	RESIDENTIAL DRIVEWAY
	375.22	Left	Commercial	1	MINI STORAGE
	375.23	Right	Residential	1	RESIDENTIAL DRIVEWAY
	375.24	Right	Commercial	1	ROWENA SERVICE
	375.26	Both	Public	1	BROWNSTONE AVENUE
	375.34	Both	Public	1	DOUGLAS AVENUE
	375.37	Right	Residential	1	RESIDENTIAL DRIVEWAY
	375.37	Right	Residential	1	RESIDENTIAL DRIVEWAY
	375.38	Right	Residential	1	RESIDENTIAL DRIVEWAY
	375.38	Left	Residential	1	RESIDENTIAL DRIVEWAY
	375.40	Left	Residential	1	RESIDENTIAL DRIVEWAY
	375.44	Left	Residential	1	RESIDENTIAL DRIVEWAY
	375.44	Left	Residential	1	RESIDENTIAL DRIVEWAY
Rural	375.61	Both	Public	1	483RD AVENUE
	375.62	Right	Field	2	FIELD ENTRANCE
	375.76	Right	Field	2	FIELD ENTRANCE
	376.08	Left	Field	2	FIELD ENTRANCE
	376.16	Right	Residential	1	RESIDENTIAL DRIVEWAY
	376.24	Left	Field	2	FIELD ENTRANCE
	376.25	Right	Field	2	FIELD ENTRANCE
	376.56	Right	Public	5	267TH STREET
	376.61	Both	Public	4	484TH AVENUE
	376.64	Right	Residential	1	RESIDENTIAL DRIVEWAY
	376.66	Right	Residential	1	RESIDENTIAL DRIVEWAY
	376.86	Both	Field	2	FIELD ENTRANCE
	376.93	Right	Residential	1	RESIDENTIAL DRIVEWAY
	377.33	Both	Field	2	FIELD ENTRANCE
	377.86	Both	Public	4	485TH AVENUE
	378.17	Both	Public	1	END SD 42 AT IOWA BORDER

1 Access point will remain

2 Access will remain as long as it is classified as a field entrance. If development occurs that intensifies the use, the access will be closed forcing frontage roads to be constructed.

3 Access point will be converted to a right-in / right-out when the Build Alternative is constructed.

4 Access point will remain - realignment will occur with the construction of the Build Alternative

5 Access point will be closed when the construction of the build alternative occurs

a This access point will be incorporated with the construction of the East Sioux Falls Arboretum and redirected to Perry Place.

b This access point will be the primary access for the East Sioux Falls Arboretum.

c When construction of the build alternative occurs these two access points should be converted to one access point

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