INTERSTATE 90
BLACK HAWK - STURGIS
CORRIDOR PRESERVATION STUDY

December 2004

FELSBURG HOLT & ULLEVIG

INTERSTATE 90
BLACK HAWK - STURGIS
(Exit 48 – Exit 34)

CORRIDOR PRESERVATION STUDY FINAL REPORT

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Introduction

Project Background

The Interstate 90 (I-90) corridor serves as the primary connection between Sturgis and Rapid City, South Dakota. The area encompassed by the corridor has been the setting of recent population growth and land development, which is expected to continue into the future. With the increase in activity, the corridor roadway network has been subjected to increased traffic volumes. Much of the new development has clustered around freeway interchanges, increasing the importance of and difficulty associated with the provision of adequate access management and sufficient traffic capacity. Completion of roadway improvements in densely developed environments is always more costly and difficult than early action.

In the midst of development pressures, it is vital to create a strategy that outlines needed roadway improvements and preserves the opportunity to implement those improvements in anticipation of, rather than reaction to, development. To protect the I-90 Corridor from increasing developmental pressures, to preserve alignments for future use, and to potentially increase the funding available for transportation improvements, corridor preservation techniques can be useful.

To this end, The South Dakota Department of Transportation (SDDOT) has undertaken a process of developing and implementing Corridor Preservation strategies along the Interstate 90 corridor between Sturgis and Black Hawk. These efforts will produce a plan of action for SDDOT, in cooperation with Meade County, to preserve the right of way for needed corridor improvements. Corridor improvements will be identified to address roadway design deficiencies, traffic safety problems, traffic volume growth, environmental constraints, and economic development impacts.

Project Purpose

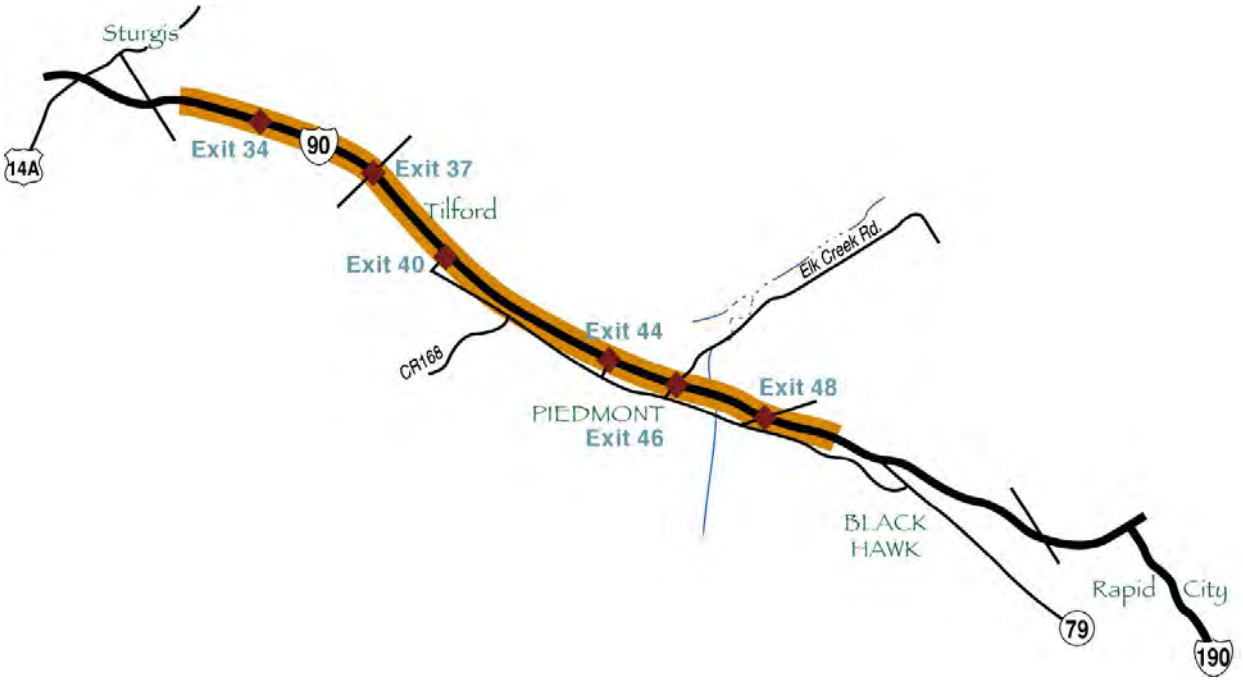
The goal of this project is to preserve the needed right of way in this corridor for the project improvements that are found to be most feasible by this study. The objectives that comprise the attainment of this primary goal include the following:

- Involve the public and local, state, and federal government stakeholders in planning and selecting improvements to the I-90 corridor between Black Hawk and Sturgis.
- Evaluate the potential for and impacts of buildout of development within the corridor.
- Select a most feasible alternative for implementation at each of the 6 study area interchanges and along mainline I-90, including service roads and parallel facilities.
- Develop implementation plans that outline the steps necessary to construct selected improvements.

Study Corridor

The project study corridor included the I-90 Corridor between the east side of the City of Sturgis and the community of Black Hawk in the southwest portion of South Dakota. A map of the study corridor is shown on Figure S-1. The length of the corridor spans the Interstate between approximately Mileage Reference Markers (MRMs) 32 and 52 and includes 6 freeway interchanges. Interstate 90 is oriented east-west across the upper United States, connecting Seattle, Washington with Boston, Massachusetts. The study section of I-90 is oriented northwest – southeast between Sturgis and Black Hawk.

Figure S-1. Study Corridor



Project Process

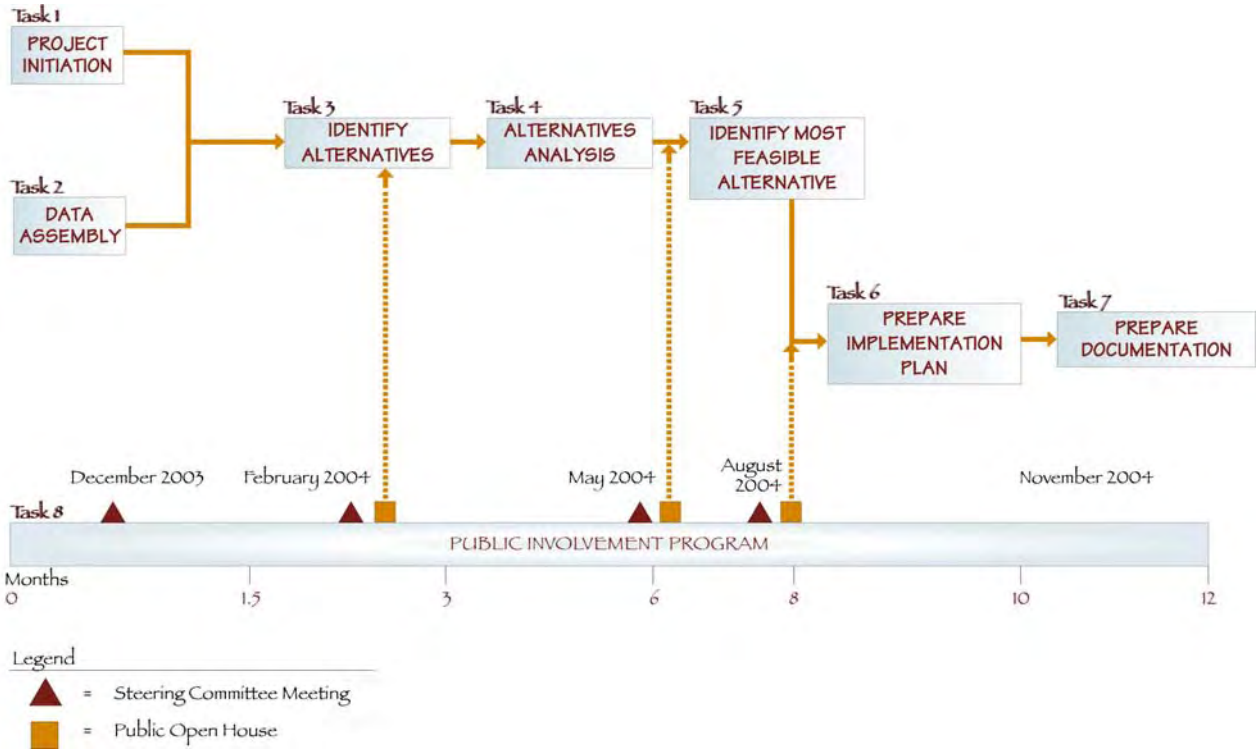
The project process is depicted graphically on Figure S-2. The study began in December of 2003 with project initiation and data assembly. Existing traffic operations, safety, and geometric conditions were assessed based on information contained in previous studies of the corridor and updated data gathered by the SDDOT. Future traffic volume projections were developed to assess Year 2025 traffic operations. Based on these evaluations, a set of alternatives was conceived to address needs throughout the corridor. These alternatives were developed and presented to the project Steering Committee and the public. Based on the input from these meetings, the alternatives were refined. This shortened list of alternatives was then evaluated comparatively to develop a recommended Most Feasible Alternative for the Corridor. The Final Project Report documents that selection process and provides an Implementation Plan for preserving the Right of way to construct the Most Feasible Alternative.

The public involvement plan for the project included three public open house meetings, development of a website, and circulation of multiple newsletters to the public meeting attendees. A kickoff public meeting was held in February 2004 to gather input on needed corridor improvements and to make members of the public aware of corridor preservation plans. The second public meeting, held in May of 2004, presented preliminary analysis results and alternatives. The final public meeting in August of 2004 presented the recommended Most Feasible Alternative and provided the public with an opportunity to suggest changes to the Alternative.

The project website, found at http://www.i90corridor.com, provided information to visitors throughout the project.

A project Steering Committee comprised of SDDOT staff, Federal Highway Administration (FHWA) staff and representatives of Meade County, the Rapid City Metropolitan Planning Organization (MPO), and other local stakeholders was convened for the purpose of coordinating public input, serving as a resource for the consultant, and reviewing consultant deliverables. The Steering Committee convened for a project kickoff meeting in December of 2003 and three subsequent meetings held concurrent with the public open houses.

Figure S-2. Project Process



Evaluation of Existing Conditions

Existing geometric, safety and operational conditions were examined based on: (1) geometric data collected for the South Dakota Interstate Corridor Study, completed by Kirkham Michael and Felsburg Holt & Ullevig in the Year 2000; (2) Year 2000 to 2002 accident data; and (3) Year 2003 traffic counts collected by the SDDOT.

Geometric Conditions

A variety of interchange and mainline geometric deficiencies exists throughout the study corridor. Common conditions include the following:

- Spacing between ramp terminal intersections and adjacent frontage road or local access intersections is substandard.
- The stopping sight distances and k-values for interchange ramps do not meet design standards.
- The on-ramp taper rates at interchanges do not meet current design standards.
- The ramp intersection sight distance is extremely limited due to horizontal curves and bridge skew angles.
- Frontage roads are located immediately adjacent to the mainline I-90 in several locations.

As substandard conditions, these geometric deficiencies represent safety hazards to motorists and operational bottlenecks.

Traffic Operations

To test the operational performance of the study corridor, capacity analyses of Year 2003 conditions were performed using methodology outlined in the Highway Capacity Manual. The SDDOT seeks to maintain LOS C or better operations along mainline freeway sections and LOS D or better operations at surface street intersections and ramp termini. Analyses of interchange ramp terminal intersections and the mainline freeway indicated acceptable levels of service (LOS) for all sections analyzed.

Traffic Safety

An investigation of historic accident data was performed to identify any locations with elevated accident rates within the corridor. Accident rates per Million Entering Vehicles were calculated for interchanges and for one-mile segments of I-90. Accident data from the larger dataset used for the Corridor Study (including portions of Interstates 29 and 229) served as the basis for developing an average interchange weighted accident rate. Interchanges with accident rates exceeding 2.12 weighted accidents per million entering vehicles could be classified as significant accident locations. Of the six interchanges in the study corridor, the Exit 44 interchange exhibited the highest weighted accident rate at 1.25. Therefore, none of the interchanges would be classified as significant accident locations.

A similar accident analysis was performed for one-mile segments of I-90 to identify significant accident locations. Weighted accident rates for each section were calculated and compared with the average mainline accident rate for the corridor to identify any significant accident locations. Locations with accident rates exceeding 2.21 weighted accidents per million vehicle-miles traveled were classified as significant accident locations. The one-mile segment of I-90 between MRMs 33 and 34 was found to be a significant accident location, with a rate of 3.07. Based on a closer examination of the accident records for this section of I-90, it is apparent that horizontal curvature contributed in part to the heightened accident rate. Icy and wet roadway conditions, however, were the leading contributor to off-road crashes rather than the failure of the driver to react to the curvature. Several accident countermeasures could be implemented to address conditions along the curve, including static advisory signs or Variable Message Signs (VMS) warning drivers of hazardous conditions.

Year 2025 Traffic Conditions

Year 2025 corridor growth projections were developed based on historical growth patterns and anticipated future growth. Historic growth rates were calculated by comparing the sum of Year 2003 interchange ramp daily traffic volumes with the sum of comparable traffic counts conducted in the Year 1998. Because the pace and nature of development currently varies and will continue to vary throughout the corridor, growth rates specific to each interchange were developed. In addition, growth north of the interchanges is likely to differ from growth south due to topography and existing development. An average of the north and south growth rates was applied to eastbound and westbound traffic volumes at the interchanges.

Table S-1. Future Interchange Growth Rates

Interchange	North Growth Rate	South Growth Rate	Future Growth Considerations
#34 Black Hills National Cemetery	2.00%	2.00%	Area surrounding interchange largely built out.
#37 Pleasant Valley Road	3.00%	3.00%	Future growth likely to be consistent with recent history.
#40 Tilford Road	3.00%	3.00%	Area surrounding Exit 40 similar to Exits 34 and 37.
#44 Deerview Road	2.00%	4.00%	Increased development anticipated south of interchange.
#46 Elk Creek Road	6.00%	3.00%	Significant residential growth proposed north of interchange. Area south of interchange limited by topography.
#48 Stage Stop Road	3.00%	6.00%	Summerset development south of interchange.

Based on historical traffic growth along I-90 and conversation with SDDOT staff, mainline I-90 was assigned an annual growth rate of 4 percent. Traffic counts gathered from two Automated Traffic Recording (ATR) stations along I-90 within Rapid City indicated that traffic volumes grew annually by approximately 3 percent between 1989 and 2003.

Operational analyses were performed to determine how the existing corridor roadway network would perform under increased traffic loading. The results of this analysis indicated that Levels of Service would remain at Level of Service C or better throughout the corridor, with the exception of conditions at the Exit 48 interchange ramp terminal intersections. Similarly, operational conditions along mainline I-90 are expected to remain at LOS C or better throughout the corridor to the Year 2025.

Analysis of mainline I-90 traffic growth beyond the Year 2025 was performed to identify the time at which widening from 4 to 6 lanes would need to occur to meet traffic needs along each interchange-to-interchange segment. It was found that widening would need to occur in the period between Years 2026 and 2035, generally progressing from east to west.

Alternatives

Development of Alternatives

A set of alternatives was developed for the corridor to address existing geometric and safety issues and existing and future traffic needs. Based on the assessment of existing conditions, the primary concern within the corridor is geometric deficiencies. The existence of multiple geometric deficiencies at the 6 interchanges within the study corridor, however, was not found to be a specific cause of elevated accident rates. Traffic operations are a secondary concern within the study corridor, as the majority of intersections and mainline I-90 through the study corridor are anticipated to operate satisfactorily to the Year 2025. The Exit 46 and Exit 48 interchanges and mainline I-90 in the vicinity of Exits 46 and 48, however, show a more urgent need for improvements to ensure acceptable future operations. Traffic volume growth beyond

the Year 2025 indicates the need for operational improvements throughout the remainder of the corridor.

A list of the alternatives is included in Table S-2. A single alternative was developed to address conditions at Exits 37 and 40, while multiple alternatives were developed to address the remaining interchanges.

Table S-2. Listing of Interchange Alternatives

Location / Alternatives	Description
Exit 34 Alternatives	
Alternative 1	Diamond Interchange in current location.
Alternative 1a	Single-Point Urban Interchange in current location.
Alternative 2	Diamond Interchange shifted east.
Exit 37 Alternative 1	Diamond Interchange in current location.
Exit 40 Alternative 1	Diamond Interchange in current location.
Exit 44 Alternatives	
Alternative 1	Diamond Interchange in current location with I-90 over Deerview Road.
Alternative 1a	Diamond Interchange in current location with Deerview Road over I-90.
Alternative 1b	Diamond Interchange in current location with I-90 over Deerview Road and south ramp terminal roundabout.
Exit 46 Alternatives	
Alternative 1	Diamond Interchange in current location.
Alternative 2	Diamond Interchange shifted east of current location.
Alternative 3	Single-Point Urban interchange shifted east of current location.
Exit 48 Alternatives	
Alternative 1	Diamond Interchange in current location.
Alternative 2	Single-Point Urban Interchange in current location.
Alternative 3	Diamond Interchange with north ramp terminal shifted west.
Alternative 3a	Diamond Interchange shifted farther west than Alternative 3.

Mainline I-90 and local / frontage road alternatives were developed in addition to the interchange alternatives shown in Table S-2. The single alternative developed for I-90 consisted of a continuous widening from 4 to 6 lanes. Realignment of mainline I-90 between Exits 44 and 46 and east of Exit 48 is included in the I-90 Alternative. Local / frontage road alternatives included realignments of the frontage roads between Exits 40 and 44 and between Exits 44 and 46 and reconfigured local accesses in the Exit 48 interchange area.

Evaluation of Alternatives

The set of corridor alternatives was presented to the project Steering Committee and the public and was evaluated to identify a set of projects comprising a Most Feasible Alternative for the Study Corridor. To identify a Most Feasible Alternative, the alternatives described above were evaluated in ten categories. The evaluation categories are listed in Table S-3, along with the criteria considered in evaluating each.

Table S-3. Alternative Evaluation Categories and Criteria

Category	Criteria
Traffic and Service	Level of Service enhancement, need for signalization, impacts on local access
Geometrics	Improvement of existing geometric deficiencies
Right of way	Estimate of necessary acquisitions
Safety	Improvement of existing hazardous conditions
Environmental	Potential for wetland area, noise, water quality, wildlife, and 4(f) / 6(f) impacts
Development	Required relocations, impacts on businesses / residences which will remain
Utilities	Impacts to existing utilities (water, gas, electrical)
Costs	Preliminary opinion of probable construction cost
Flexibility	Ease of construction in phases
Constructability	Ease or difficulty associated with construction of the alternative

The performance of each alternative was evaluated according to these criteria and assigned a rating of good, fair, or poor in each category. The ratings were compiled to provide SDDOT decision makers with a tool for comparing the alternatives and selecting a Most Feasible Alternative for each location for which multiple alternatives were developed. Included in this list were the Exit 34, 44, 46, and 48 interchanges and the Exit 48 north and south access alternatives. Improvements necessary at the other locations were captured with a single alternative.

Most Feasible Alternative

The results of the evaluation of the alternatives were compiled in the form of evaluation matrices to facilitate comparison between the alternatives. The full matrices are included in tabular form in Appendix B. The Most Feasible Alternatives for each location are listed in Table S-4 along with the basic reason for their selection. The selections made at each interchange were combined to form the Most Feasible Alternative for the corridor. In some cases, more than one Most Feasible Alternative was selected to provide additional flexibility in future implementation.

Table S-4. Summary of Most Feasible Alternative

Location	Most Feasible Alternative(s)	Principal Reasons for Selection	Figure Number[1]
Exit 34	1	Minimal right of way needs, good constructability, lesser impacts to Black Hills National Cemetery.	10
	2	Would be adaptable to potential future SD 79 extension and would provide grade-separated railroad crossing.	11
Exit 37	1	Would address geometric deficiencies.	12
Exit 40	1	Would address geometric deficiencies.	13
Exit 44	1	Would address geometric deficiencies.	14
	1a	Would address geometric deficiencies and add grade-separated railroad crossing.	15
Exit 46	3	Would address severe bridge skew and grade-separate the railroad crossing, would maximize separation between potential future signalized intersections.	18
Exit 48	2	Would address geometric deficiencies and minimize need for right of way acquisition.	19
	3	Would provide additional flexibility in phasing of construction, would address bridge skew angle, would address tight access condition north of interchange.	20
Exit 40 to 44 south frontage road	1	Would realign frontage road to accommodate six-lane I-90 and provide separation from mainline.	26
Exit 40 north access road	1	Would realign north access road to provide separation from I-90.	26
Exit 44 south frontage road	1	Would realign south frontage road to connect with County Road	27
Exit 46 south frontage road	1	Would realign south frontage road to connect with County Road	27
Exit 44 to 46 north frontage road	1	Would realign frontage roads to provide separation from I-90 and additional space for main Piedmont access road south of I-90. Removes multiple at-grade railroad crossings.	27
Exit 48 north access	1	Would be relatively inexpensive to construct while improving access spacing, lesser right of way impacts.	22
Exit 48 south access	2	Would be flexible to accommodate a variety of future development plans and would enhance access control along the service road.	24

[1] Figure Number refers to Figure in body of Corridor Preservation Report

It is clear from the alternative evaluation process that the driving factors behind the selection of the Most Feasible Alternative were geometric conditions, access control, flexibility, and projected traffic conditions. The Most Feasible Alternative would introduce two Single-Point Urban interchanges (Exits 46 and 48), while the remaining interchanges would be configured as standard diamond interchanges. The widening of I-90 to 6 lanes throughout the project corridor would trigger the need for realignment of frontage roads in several locations, most notably between Exits 44 and 46.

Projected Year 2025 traffic operations were analyzed with the Most Feasible Alternative constructed, and all interchange ramp terminal intersections would operate at LOS B or better with implementation of the Most Feasible Alternative. All segments of mainline I-90 would operate at LOS B. Analysis of railroad crossings associated with the Most Feasible Alternative was also performed, showing that the addition of an at-grade crossing with Exit 48 North Access Alternative 1 would be more than balanced by the 6 to 8 at-grade crossings that would be removed with implementation of the Most Feasible Alternative.

Implementation Plan

Corridor Preservation Strategy

A Corridor Preservation Strategy is necessary to protect the opportunity to implement the Most Feasible Alternative within the study corridor. As discussed in the Introduction, the goal of this project is to preserve the needed right of way in this corridor for the project improvements that are found to be most feasible by this study. The selection of a Most Feasible Alternative served to identify needed improvements within the study corridor, and a corridor preservation strategy outlines the steps necessary to preserve needed right of way. It should include the following elements:

1. Develop listing of projects within the Most Feasible Alternative
2. Prioritize those projects based on relative benefits and costs
3. List early action items, including priority right of way designation
4. Identify next steps in the project implementation process

Project Listing

A project-by-project listing of the efforts needed to implement the Most Feasible Alternative is shown in Table S-5. The projects are categorized as one of three project types: Interchange Reconstruction (ICR), Interstate Widening (W), or Frontage Road / Local Road improvement (F/L).

Table S-5. Most Feasible Alternative Projects

Project Location	Project Type[1]	Alternative	Project Description	Figure Number[2]
Exit 34	ICR	1	Diamond Interchange	10
		2	Shifted Diamond Interchange	11
Exit 37	ICR	1	Diamond Interchange	12
Exit 40	ICR	1	Diamond Interchange	13
Exit 44	ICR	1	Diamond Interchange (I-90 over)	14
		1a	Diamond Interchange (I-90 under)	15
Exit 46	ICR	3	Shifted Single-Point Urban Interchange	18
Exit 48	ICR	2	Single-Point Urban Interchange	19
		3	Shifted Single-Point Urban Interchange	20
East of Exit 48	W	1	4 to 6 lane widening	25
Exit 48 to Exit 46	W	1	4 to 6 lane widening	n/a
Exit 46 to 44	W	1	4 to 6 lane widening	n/a
Exit 44 to 40	W	1	4 to 6 lane widening	n/a
Exit 40 to 37	W	1	4 to 6 lane widening	n/a
Exit 37 to 34	W	1	4 to 6 lane widening	n/a
West of Exit 34	W	1	4 to 6 lane widening	n/a
Exit 40 to 44 south frontage road	F/L	1	Realign south frontage road to provide distance from mainline I-90.	26
Exit 40 north access road	F/L	1	Realign north access road to provide distance from mainline I-90.	26
Exit 44 south frontage road	F/L	1	Realign south frontage road to connect with County Road.	27
Exit 44 to 46 north frontage road	F/L	1	Realign north frontage road north of railroad tracks.	27
Exit 48-north access	F/L	1	Realign north frontage road to intersect with cross road north of RR tracks.	22
Exit 48-south access	F/L	2	Reconstruct south frontage road to connect with service road.	24

[1] W = Interstate Widening
F/L = Frontage / Local Road Improvement
ICR = Interchange Reconstruction

[2] Figure Number refers to Figure in body of Final Corridor Preservation Report

Project Prioritization

A project prioritization methodology was developed to rank the projects identified in Table S-6 based on relative costs and benefits. Cost information was compiled for each project based on the sum of the estimated right of way costs and estimated construction costs. Project benefits were assessed in four categories:

1. Traffic operations
2. Traffic safety
3. Improvements to structural and / or geometric deficiencies, and
4. Ability to implement improvements.

Information used in the initial Alternatives evaluation process was used to comparatively assess benefits in the four categories listed above. Locations showing greater existing or projected traffic congestion translated to higher operational benefits to be delivered by implementation of the project. Similarly, improvements to locations with higher accident rates were ranked highly in the traffic safety category. Improvements to structural and / or pavement deficiencies were highlighted based on the year of construction and structural rating (where available) and corrected geometric deficiencies. The ability to implement improvements was rated based on the flexibility and constructability measures included in the evaluation of alternatives. Also considered in the ability to implement category was the likelihood of obstacles to project completion, such as neighborhood resistance. Projects currently listed in the Statewide Transportation Improvement Program (STIP) were highly rated in the ability to implement.

The relative costs and benefits of each project were ranked as High, Moderate, or Low, and then charted using the prioritization grid below. The higher priority projects were those showing relatively high benefits for low costs (upper right portion of chart) and, conversely, lower priority projects were those showing relatively low benefits for high costs (lower left).

The projects are listed in Table S-6 as High, Moderate or Low priorities based on the relative project benefits and costs.

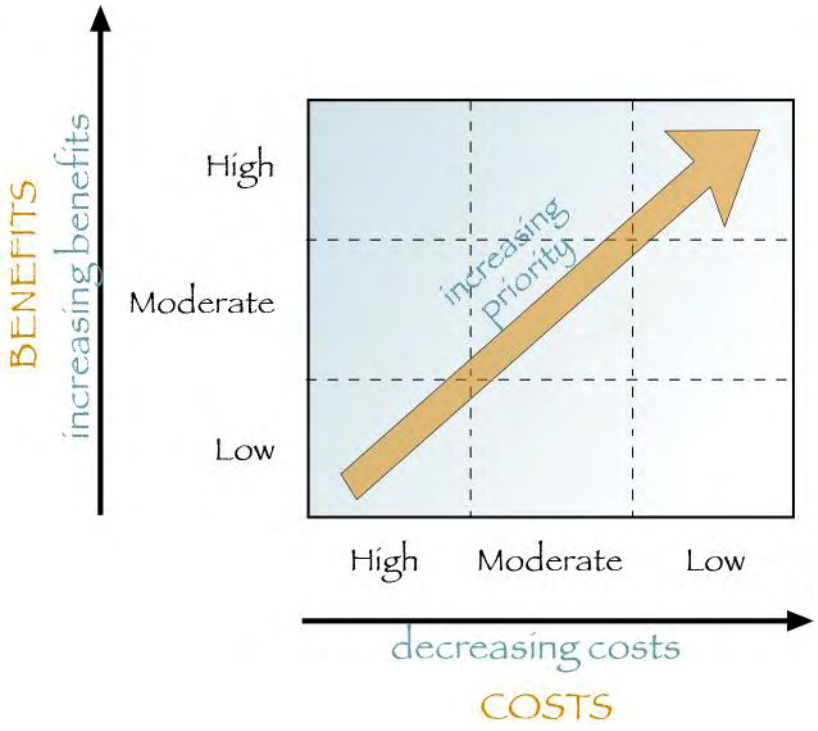


Table S-6. Prioritized List of Projects

Project Location	Project Type*	Alternative	Project Description
High Priority Projects			
Exit 48-north access	F/L	1	Realign north frontage road to intersect with cross road north of RR tracks.
Exit 48-south access	F/L	2	Reconstruct south frontage road to connect with service road.
Exit 44 to 46 north frontage road	F/L	1	Realign north frontage road north of railroad tracks.
Exit 46 south frontage road	F/L	1	Realign south frontage road to connect with County Road.
Exit 44 south frontage road	F/L	1	Realign south frontage road to connect with County Road.
Exit 46	ICR	3	Shifted Single-Point Urban Interchange
Exit 44	ICR	1	Diamond Interchange (I-90 over)
		1a	Diamond Interchange (I-90 under)
Moderate Priority Projects			
Exit 48	ICR	2	Single-Point Urban Interchange
		3	Shifted Single-Point Urban Interchange
Exit 34	ICR	1	Diamond Interchange
		2	Shifted Diamond Interchange
Exit 40 to 44 south frontage road	F/L	1	Realign south frontage road to provide distance from mainline I-90.
East of Exit 48	W	1	4 to 6 lane widening
Exit 48 to 46	W	1	4 to 6 lane widening
Exit 46 to 44	W	1	4 to 6 lane widening
Low Priority Projects			
West of Exit 34	W	1	4 to 6 lane widening
Exit 37 to 34	W	1	4 to 6 lane widening
Exit 40 to 37	W	1	4 to 6 lane widening
Exit 44 to 40	W	1	4 to 6 lane widening
Exit 40 north access road	F/L	1	Realign north access road to provide distance from mainline I-90.
Exit 37	ICR	1	Diamond Interchange
Exit 40	ICR	1	Diamond Interchange

* W = Interstate Widening
F/L = Frontage / Local Road Improvement
ICR = Interchange Reconstruction

As shown in Table S-6, the projects are split nearly evenly into High, Moderate, and Low priority categories. The High priority projects include interchange reconstruction and access enhancements to Exit 48 and interchange reconstruction of Exits 46 and 44. The Moderate category includes the realignment of frontage roads between Exits 44 and 46, along with widening of I-90 for this segment. The majority of corridor widening projects are included in the Low priority category, along with interchange reconstruction at Exits 37 and 40. Reconstruction of Exits 37 and 40 is not planned to include major changes to the existing configurations, so those projects may be completed when the physical condition (pavement, structures) so requires.

The project prioritization shown in Table S-6 provides a basis for initiating the process of planning and constructing the improvements included in the Most Feasible Alternative.

Project Implementation Steps

The project implementation process is depicted graphically on Figure S-3. This diagram depicts the steps necessary to progress from the Corridor Preservation Study / Strategy to eventual construction. The implementation process includes the development of an agreement between the SDDOT and Meade County to accept the Corridor Preservation Plan and to establish guidelines for preservation of right of way for future improvements; inclusion of projects in the Regional Transportation Plan and STIP; completion of appropriate environmental clearance documents; and final design / construction.

As shown on Figure S-3, responsibilities for various elements of the implementation process would be distributed among several entities. The SDDOT would bear primary responsibility for the majority of tasks, while the Federal Highway Administration would serve as the Lead Agency for the NEPA documentation and the Rapid City Metropolitan Planning Organization (MPO) would include Corridor Preservation projects in the regional plan.

Immediate Next Steps

SDDOT / Meade County Agreement

It is important to secure an agreement between the SDDOT and Meade County to facilitate the process of reserving and / or acquiring the right of way necessary to construct the Most Feasible Alternative. An intergovernmental agreement or Memorandum of Understanding may serve this purpose. The signed agreement should state that SDDOT and Meade County will, to the best of their ability, adhere to the recommendations of this Corridor Preservation Study.

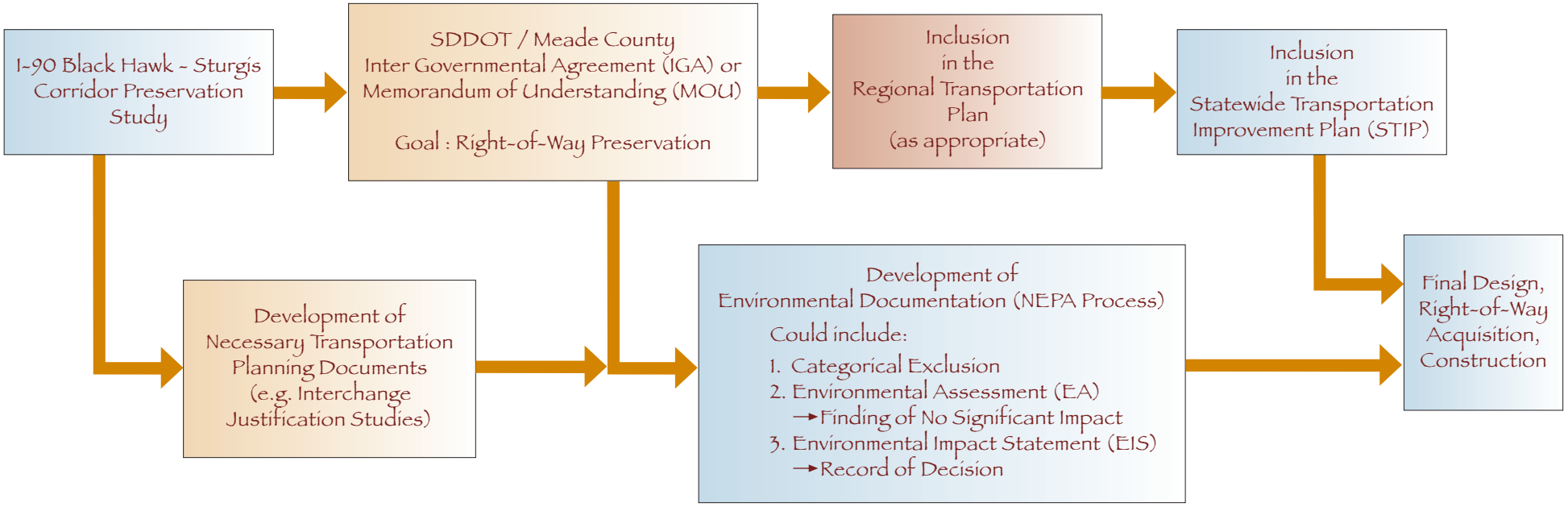
Right of Way Strategic Plan

Detailed right of way information was not available for this study. However, it is important that additional research be performed to better identify existing right of way limits and to better define specific portions of right of way (plats, etc.) to be preserved / acquired.

As a central goal of the project, the process of preserving the right of way necessary to construct the Most Feasible Alternative is considered an immediate next step. At the discretion of the SDDOT, this process could be pursued in one of two ways:

- Right of way preservation could be performed corridor wide before any further steps in the implementation process, or
- Right of way preservation / acquisition could occur on a project-by-project basis in the midst of the implementation process.

PROJECT IMPLEMENTATION PROCESS



LEGEND

= Primary Responsibility = SDDOT

= Primary Responsibility = Rapid City Metropolitan Planning Organization (MPO)

= Joint SDDOT / Meade County Responsiblity

Figure S-3

Identification of Project Limits

There are multiple options available to SDDOT decision makers in identifying project limits for the purpose of implementing the Most Feasible Alternative, including the following:

- The projects may be implemented together as a corridor wide improvement.
- Projects may be implemented individually.
- Projects may be linked together in logical packages.

As an example of the last option, the widening of I-90 between Exits 44 and 46 could be constructed in tandem with the realignment of frontage roads within this segment. Improvements to Exit 48, including access road realignments and interchange reconstruction, are all rated as high priority projects that could be packaged together.

An immediate next step would be for the SDDOT to make a determination on the appropriate approach to identifying project limits.

Subsequent Steps

Following these immediate next steps, when decisions regarding the right of way strategy and project limits have been made, the remainder of the implementation process can proceed. Specific needs for planning and environmental documentation will be apparent. Interchange Justification Studies may be conducted as needed, the NEPA process may be initiated for an individual project or collection of projects, and the necessary institutional actions (local, MPO, State) can be undertaken.

1.0 INTRODUCTION

1.1 Project Background

The Interstate 90 (I-90) corridor serves as the primary connection between Sturgis and Rapid City, South Dakota. The area encompassed by the corridor has been the setting of recent population growth and land development, which is expected to continue into the future. With the increase in activity, the corridor roadway network has been subjected to increased traffic volumes. Much of the new development has clustered around freeway interchanges, increasing the importance of and difficulty associated with the provision of adequate access management and sufficient vehicle capacity. Completion of roadway improvements in densely developed environments is always more costly and difficult than early action.

In the midst of development pressures, it is vital to create a strategy that outlines needed roadway improvements and preserves the opportunity to implement those improvements in anticipation of rather than reaction to development. To protect the I-90 Corridor from increasing developmental pressures, to preserve alignments for future use, and to increase the funding available for transportation improvements, corridor preservation techniques can be useful.

To this end, The South Dakota Department of Transportation (SDDOT) is in the process of developing and implementing Corridor Preservation strategies along the Interstate 90 corridor between Sturgis and Black Hawk. The project will produce a plan of action for SDDOT, in cooperation with Meade County, to preserve the right of way for needed corridor improvements. Corridor improvements will be identified to address roadway design deficiencies, traffic safety problems, traffic volume growth, environmental constraints, and economic development impacts.

1.2 Project Purpose

The goal of this project is to preserve the needed right of way in this corridor for the project improvements that are found to be most feasible by this study. The objectives that comprise the attainment of this primary goal include the following:

- Involve the public and local, state, and federal stakeholders in planning and selecting improvements to the I-90 corridor between Black Hawk and Sturgis.
- Evaluate the potential for and impacts of buildout of development within the corridor.
- Select a most feasible alternative for implementation at each of the 6 study interchanges and along mainline I-90, including service roads and parallel facilities.
- Develop implementation plans that outline the steps necessary to construct selected improvements.

1.3 Study Corridor

The project study corridor included the I-90 Corridor between the east side of Sturgis and Black Hawk in the southwest portion of South Dakota. A vicinity map is shown on Figure 1. The length of the corridor spans the Interstate between Mileage Reference Markers (MRMs) 32 and 52 and includes 6 freeway interchanges. Interstate 90 is oriented east-west across the upper United States, connecting Seattle, Washington with Boston, Massachusetts. The study section of I-90 is oriented northwest – southeast between Sturgis and Black Hawk and is depicted graphically on Figure 2.

The study corridor is located entirely within Meade County, which covers an area of 3,471 square miles.

Land Use

Land in the vicinity of the Study Corridor includes farm and ranch land, residential development, commercial retail, institutional and industrial uses. The Black Hills National Cemetery lies at the west end of the study area, and the towns of Piedmont and Black Hawk lie at the east end.

Development within the towns of Piedmont and Black Hawk consists of clustered commercial activity surrounding the interchanges at Exits 46 and 48, and residential communities farther away from the interchanges. The Summerset Planned Community is located south and east of Exit 48 along south service road.

Development within the central and west portions of the corridor is more rural and less dense than at the east end of the corridor. Development located in the vicinity of the interchanges includes campground facilities, Recreational Vehicle (RV) storage lots, and clusters of residential property.

Roadway Network

Interstate 90 is a 4-lane Interstate freeway that runs northwest – southeast through the study corridor. For the purposes of this study, however, I-90 will be described as having an east-west alignment. The cardinal North direction will be referred to as North and will correspond to locations north / east of I-90. The cardinal South direction will be referred to as South and will describe locations south / west of I-90. Following a similar convention, the west end of the corridor is the City of Sturgis and the east end of the corridor is the town of Black Hawk.

There are six freeway interchanges within the study corridor, and each is configured as a standard diamond interchange. Referenced in this report by exit number and progressing from west to east, the interchanges are Exits 34, 37, 40, 44, 46 and 48. The interchanges at Exits 32 and 51 are located within the study area; however, they were not examined due to ongoing design and construction efforts at both locations. Descriptions of the corridor contained in this report generally track from the west end to the east end.

VICINITY MAP

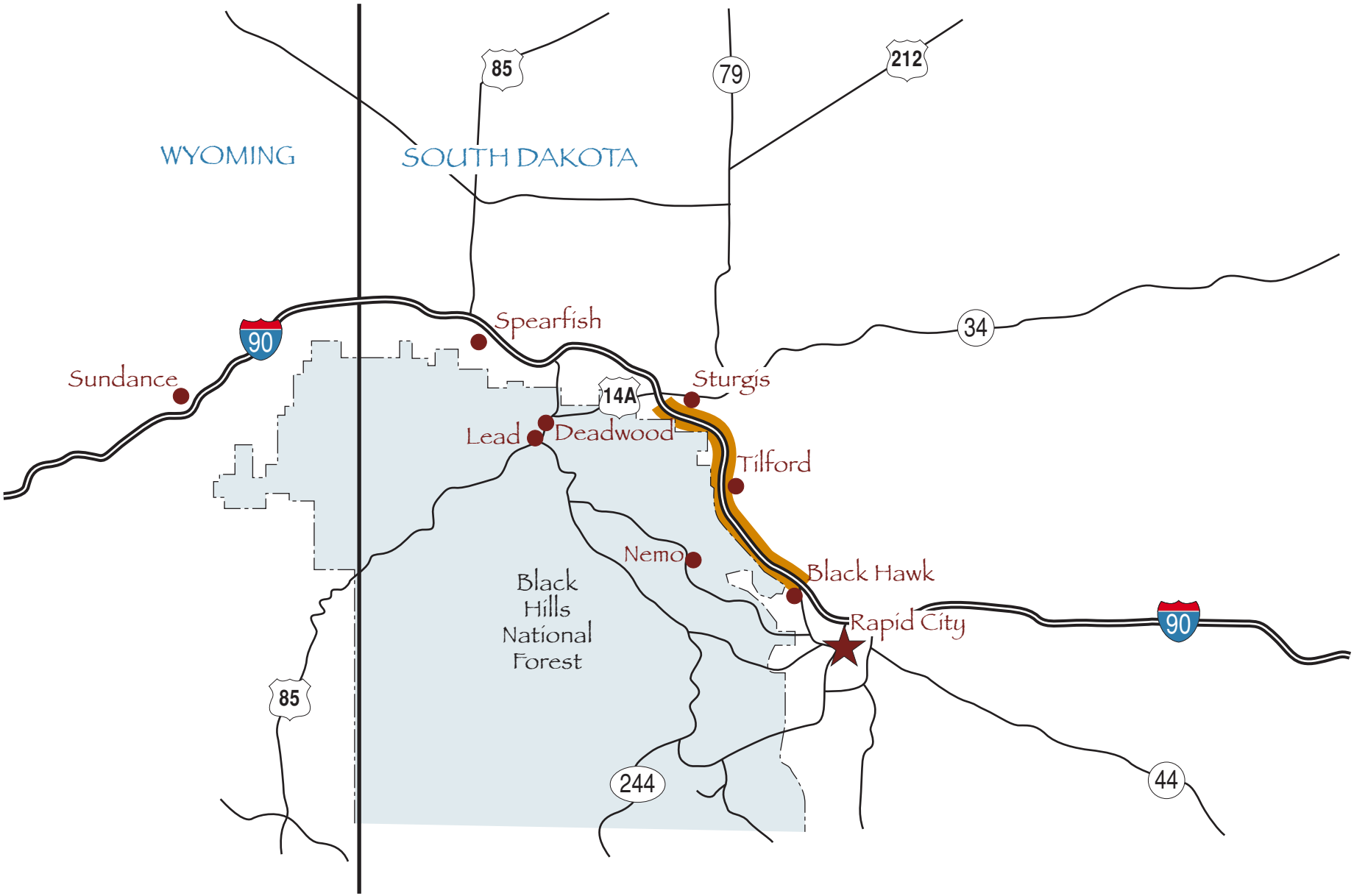


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Figure 1

STUDY CORRIDOR

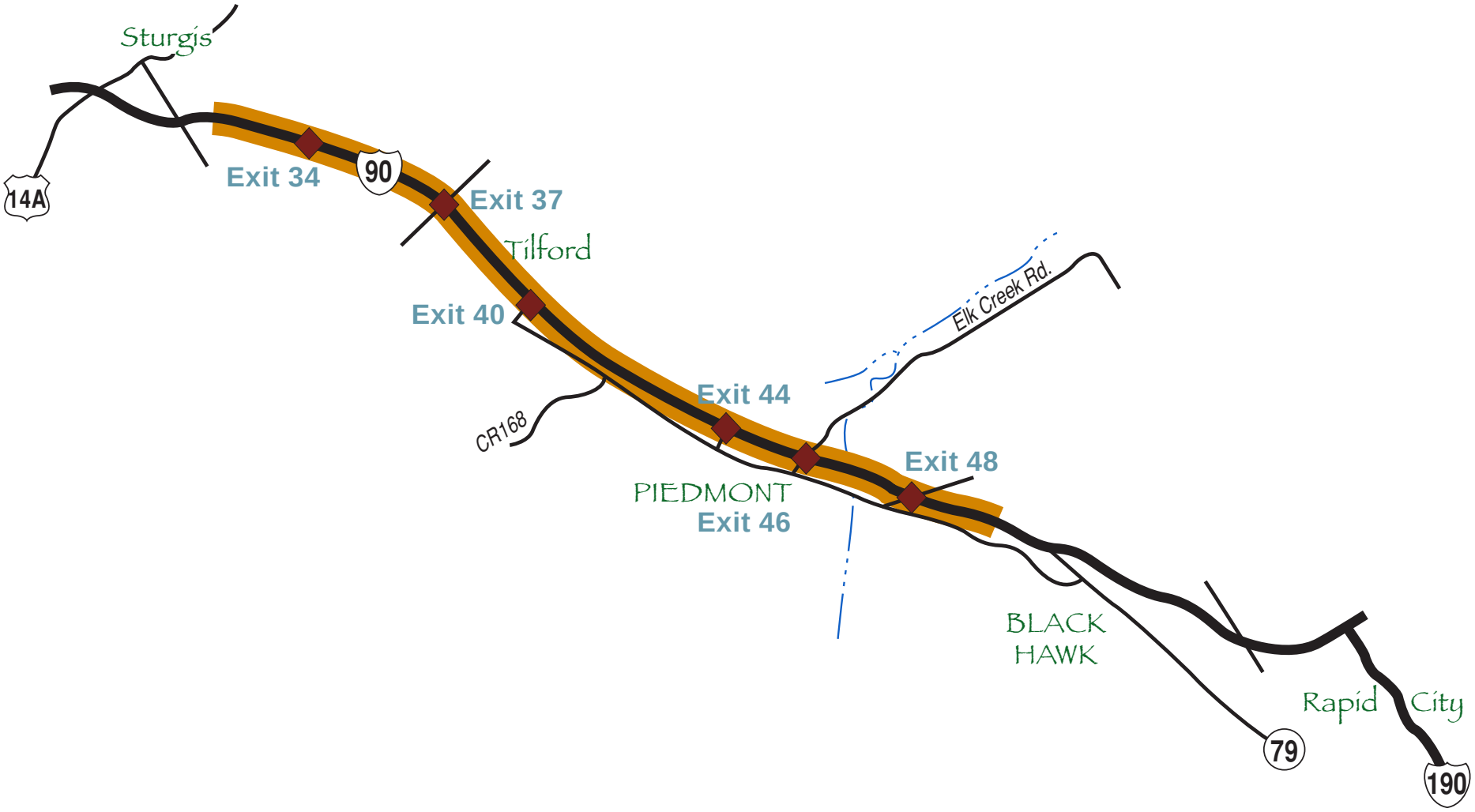

Figure 2

1.4. Project Process

Project Schedule

The project process is depicted graphically on Figure 3. The study began in December of 2003 with project initiation and data assembly. In the initial 2 months of the study process, existing traffic operations, safety, and geometric conditions were assessed based on information contained in previous studies of the corridor and on updated data gathered by the SDDOT. Future traffic volume projections were developed to assess Year 2025 traffic operations. Based on these evaluations, a set of alternatives was conceived to address needs throughout the corridor. These alternatives were initially presented to the project Steering Committee and to the public in May of 2004. Based on the input from these meetings, the alternatives were refined. This shortened list of alternatives was then evaluated comparatively to develop a recommended Most Feasible Alternative for the Corridor, which was discussed by the Steering Committee and presented to the public in August of 2004. This Final Report, developed in October of 2004, documents that selection process and provides an Implementation Plan for preserving the right of way to construct the Most Feasible Alternative.

Project Governance

A project Steering Committee was formed prior to project kickoff in September of 2003. The Committee consists of SDDOT staff, Federal Highway Administration (FHWA) staff and representatives of Meade County, the Rapid City Metropolitan Planning Organization (MPO), and other local stakeholders. The Steering Committee was responsible for coordinating public input, serving as a resource for the consultant, and reviewing consultant deliverables. This committee met 4 times throughout the planning process.

Public Involvement

The public involvement plan for the project included three public open house meetings, development of a website, and circulation of multiple newsletters to the public. A kickoff public meeting was held in February 2004 to gather input on needed corridor improvements and to make members of the public aware of corridor preservation plans. The second public meeting, held in May of 2004, presented preliminary analysis results and alternatives. The final public meeting in August of 2004 presented the recommended Most Feasible Alternative and provided the public with an opportunity to suggest changes to the Alternative.

The project website, found at http://www.i90corridor.com, provided information to visitors throughout the project.

WORK PLAN

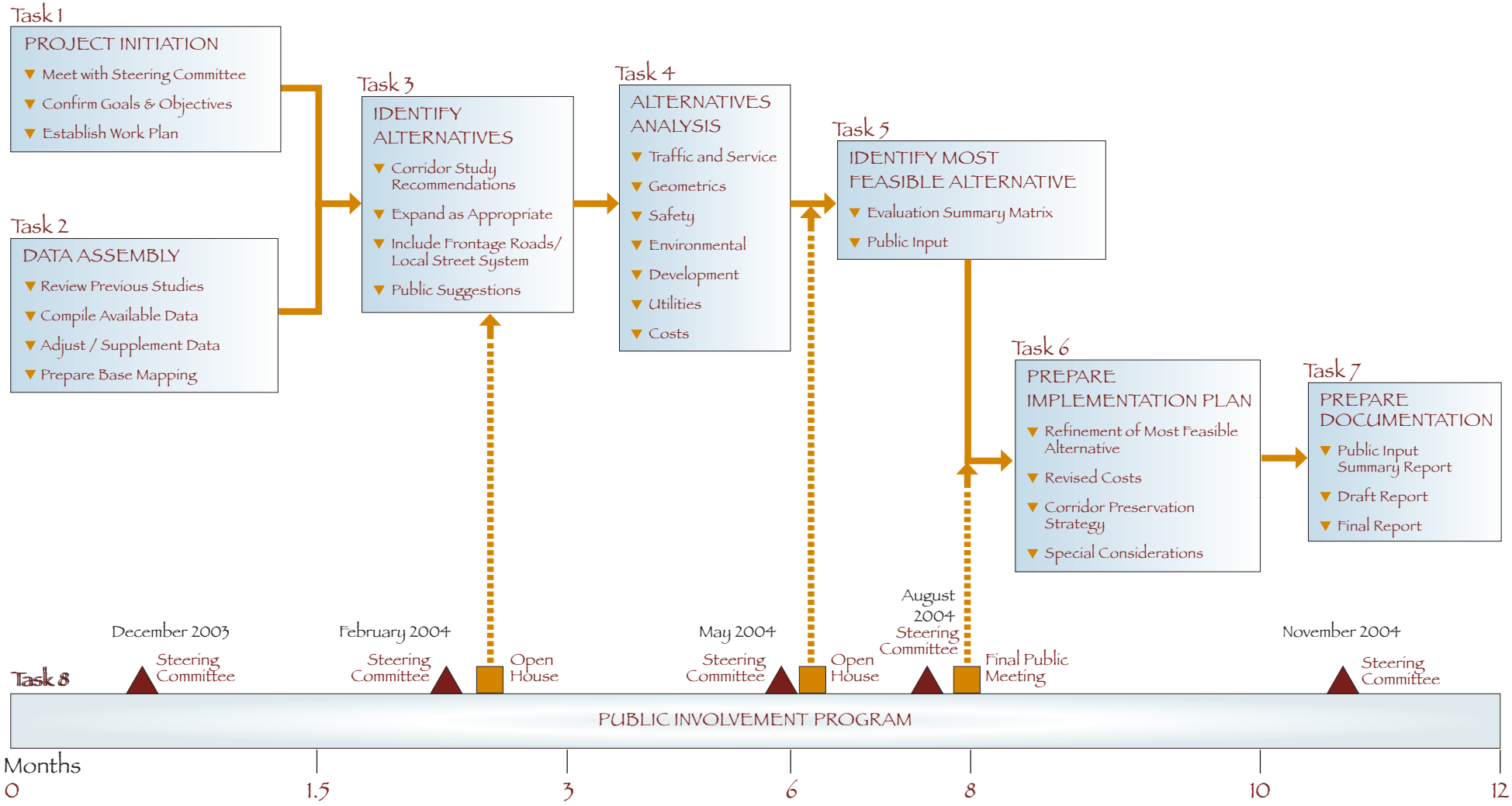

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Figure 3

1.5. Previous Corridor Study

The South Dakota Interstate Corridor Study was completed by Kirkham Michael and Felsburg Holt & Ullevig in February of 2001. This study highlighted geometric, operational and safety issues along sections of Interstates 90, 29 and 229. The section of I-90 which is the subject of this current effort was included in the Corridor Study. The information included in the Corridor Study was used as a basis for much of the information assessed in this Corridor Preservation Study.

2.0 EXISTING CONDITIONS

Existing conditions along the corridor were evaluated to identify geometric deficiencies, quantify traffic operations, and locate traffic safety problems.

2.1 Geometric Conditions

Data gathered as part of the previous Corridor Study effort were used as a foundation for this evaluation. This data were gathered from as-built interchange drawings and aerial photographs of the corridor. Standards included in the South Dakota Roadway Design Manual were used as a basis for categorizing geometric deficiencies. With this information, the following deficiencies were noted:

Exit 34

- Access intersection spacing to the South and North of the interchange is substandard (80' North/60' South).
- The stopping sight distances (the distance available to a driver to stop upon seeing a potential obstruction ahead), minimum vertical grade and k-values (the k-value represents the "sharpness" of a curve) for the cross road do not meet current design standards.

Exit 37

- The stopping sight distances, minimum vertical grade and k-values for the cross road do not meet current design standards.
- The stopping sight distances and k-values for 3 of the 4 interchange ramps do not meet current design standards.
- The descending grade on Ramp A (northeast quadrant) exceeds the standard (-5.59% versus -5.00%).

Exit 40

- The tight curves along the frontage road located in the southeast quadrant of this interchange are dangerous.
- Intersection spacing to the South and North is substandard (250' North/250' South).
- The stopping sight distances and k-values for the cross road do not meet current design standards.

Exit 44

- The cross-street underpass is very narrow.
- Recreational Vehicle facility located in southeast quadrant of the interchange necessitates wider turn-off to and from the service road. South side ramp terminal is an awkward intersection with tight turns; traffic enters from all directions.

- Intersection Spacing to the South is substandard (60').
- The stopping sight distances, k-values, minimum longitudinal grade and maximum longitudinal grade for the cross road do not meet current design standards.
- The stopping sight distances and k-values for all of the ramps do not meet current design standards.
- The entering ramp taper rates for the eastbound and westbound interchange on-ramps do not meet current design standards.
- The twin I-90 bridges over Deerview Road are scheduled for replacement in 2008 due to their structural and functional condition.

Exit 46

- Intersection spacing to the South and North is substandard (0' North/125' South).
- The stopping sight distances and k-values for two interchange ramps do not meet current design standards.
- The entering ramp taper rates for eastbound and westbound interchange on-ramps do not meet current design standards.
- The ramp intersection sight distance is extremely limited due to the crest vertical curve along Elk Creek Road.
- The frontage road connection in the northwest quadrant of the interchange is substandard.

Exit 48

- Intersection spacing to the North is substandard (50').
- The stopping sight distances, k-values, ramp intersection sight distances and minimum longitudinal grade for the cross road do not meet current design standards.
- The on-ramp and off-ramp taper rates for all ramps do not meet current design standards.
- Intersection spacing south of the interchange is substandard.
- Tight frontage road spacing northeast of the interchange.

Mainline I-90 between Exits 37 and 44

- It appears that the radii of the horizontal curves along I-90 in this area are a minimum of 2500 feet, which correlates to a design speed of 70 mph utilizing a 5.8% superelevation. The existing superelevation rates for these horizontal curves should be verified to ensure they are safe.

- The rest area located east of Exit 40 exhibits problems associated with maintenance and vandalism.

Frontage Road / Local Access

- Frontage roads along I-90 between Exits 44 and 46 lie extremely close to the mainline freeway.

- The north side frontage road connects directly to the I-90 on-ramp ramp in northwest quadrant of the Exit 46 interchange. This configuration is substandard and unsafe.

- The frontage road south and east of Exit 40 lies extremely close to the mainline freeway.

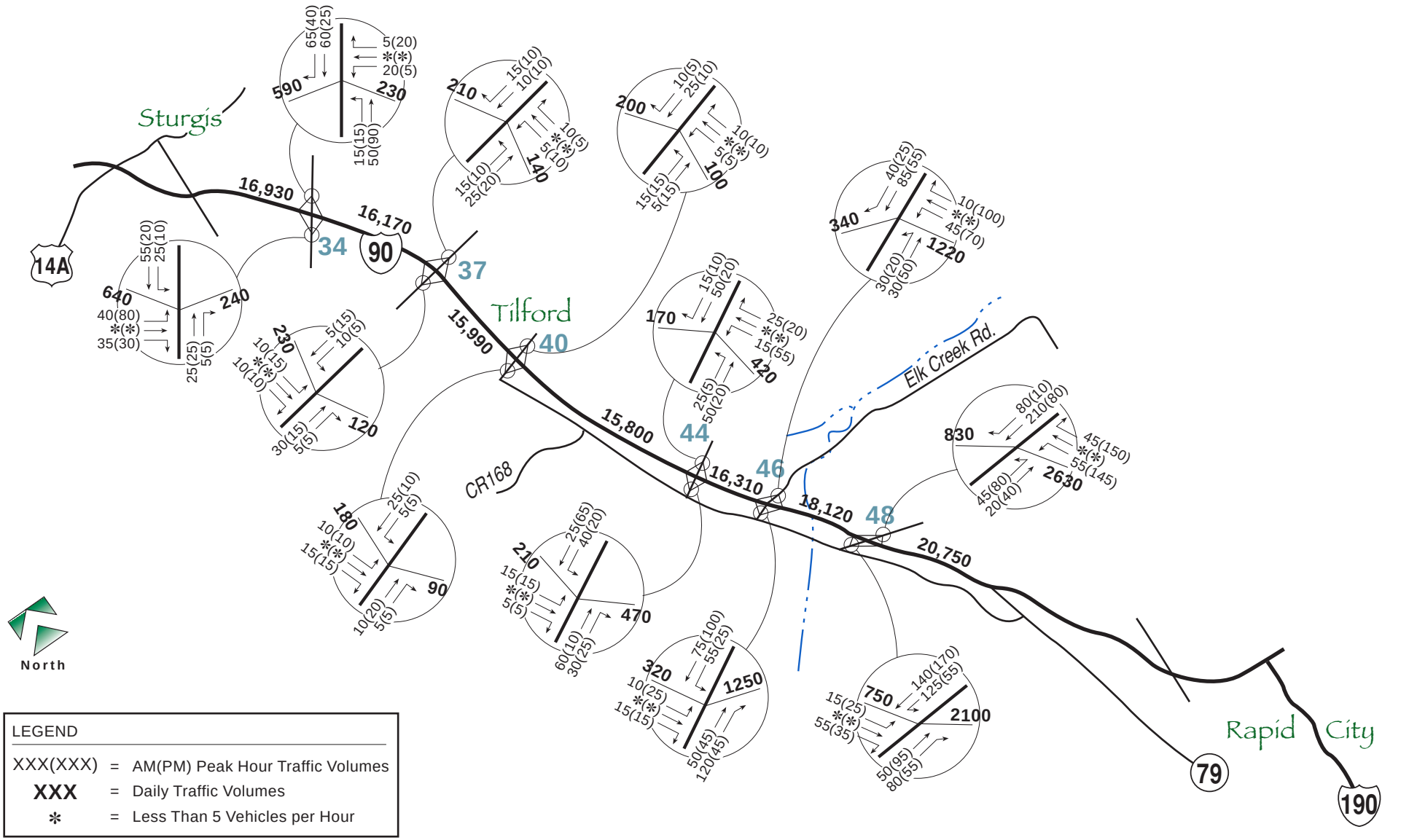
2.2 Traffic Volumes and Operations

Traffic Volumes

Traffic volume information was assembled from daily interchange traffic counts performed by the SDDOT in November of 2003 and automated westbound mainline I-90 traffic counts collected for the entire Year 2003 at MRM 43.42. Morning and afternoon peak hour turning movement counts were also conducted at the interchange ramp terminal intersections on weekdays in October and November of 2003. Year 2003 traffic volumes are shown on Figure 4.

The k-factor procedure, documented in the Traffic Engineering Handbook (Institute of Transportation Engineers, 5th Edition, 1999), was utilized to select and define appropriate hourly volumes for the purposes of this study. The k-factor procedure is a methodology for converting daily traffic volumes to hourly traffic volumes upon which capacity analyses may be based. Based on conversations with SDDOT staff, the 30th highest hour of the year was selected as the basis for hourly traffic volume estimates, and this hour was assumed to comprise 10 percent (the k-factor) of the daily traffic volume. This 10 percent factor will be referenced as k_{30} throughout this document. Traffic volume estimates resulting from the k_{30} calculation capture day-to-day variations in traffic that may not be captured by traffic counts conducted on a single day.

YEAR 2003 TRAFFIC VOLUMES



LEGEND		
XXX(XXX)	=	AM(PM) Peak Hour Traffic Volumes
XXX	=	Daily Traffic Volumes
*	=	Less Than 5 Vehicles per Hour

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Figure 4

Ramp terminal intersection turning movements for exits 34 through 48 were developed by combining the AM and PM peak hour turning movement patterns with the k_{30} hourly ramp and cross-road traffic volumes using the National Cooperative Highway Research Program (NCHRP) 255 methodology. This iterative approach was used to adjust the turning movement volumes collected on a single day in October to reflect the more general k_{30} incoming and outgoing volumes.

Mainline I-90 traffic volumes were developed based on information collected along westbound I-90 at MRM 43.42, at roughly the middle of the study corridor. The counts indicated that the Year 2003 Average Annual Daily Traffic volume (AADT) was approximately 7,850 vehicles per day. This westbound AADT was translated to a peak hour volume of 790 vehicles per hour based on a k_{30} of 10 percent and this peak hour volume was assigned to both directions (assuming a 50/50 directional distribution) for both the AM and PM peak hours. This volume was then balanced outward from the middle of the study corridor to calculate mainline volumes throughout.

Levels of Service

Methodology

Analysis of traffic operations in the study area utilized methods documented in the *Highway Capacity Manual* (HCM), Transportation Research Board (TRB), 2000 Edition. The result of such an analysis is a level-of-service (LOS) rating, which is a qualitative assessment of the traffic flow for a given roadway facility. Level of service is described by a letter designation ranging from "A" to "F", with LOS A representing essentially uninterrupted flow, and LOS F representing a breakdown of traffic flow with excessive congestion and delay. For analysis of a signalized intersection, a LOS rating is calculated for an intersection as a whole. Level of service analysis of an unsignalized intersection yields a LOS rating for each critical vehicle movement. A LOS rating may also be calculated for mainline, merge, diverge, or weaving sections along a major freeway using Highway Capacity Software. The Synchro software analysis package and methodology was utilized to calculate LOS ratings for ramp terminal intersections throughout the study corridor.

The traffic parameters shown in Table 1 were used as the basis for the operational analyses of freeway sections and ramp terminal intersections. Traffic parameters were selected based on collected data, knowledge of the corridor, and guidance provided in the Highway Capacity Manual.

Table 1. Traffic Parameters for Operational Analyses

Traffic Parameter	I-90 Freeway	Ramp Terminal Intersections
% Heavy Vehicles	14%	10%
Peak Hour Factor	0.90	0.92
Free-flow Speed	75	n/a
Terrain / Area Type	Rolling	Non-CBD
Cycle Length	n/a	100 Seconds

Ramp Terminal Intersections

As discussed earlier, each of the six interchanges within the study corridor is configured as a standard diamond interchange with unsignalized traffic control at the ramp terminal intersections. Level of service analyses were performed for each of the ramp terminal intersections and the results are shown in Table 2. As shown, all movements at the interchange ramp terminal intersections currently operate at LOS B or better. Intersection levels of service are shown on Figure 5.

Table 2. Interchange Ramp Terminal Intersection Levels of Service

Interchange	Year 2003 Ramp Terminal Intersection Levels of Service[1]			
	North Ramp Terminal		South Ramp Terminal	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Exit 34	a	a	a	a
Exit 37	a	a	a	a
Exit 40	a	a	a	a
Exit 44	a	a	a	a
Exit 46	b	b	a	a
Exit 48	b	b	b	b

[1] Levels of service shown are for the single poorest-operating movement at the intersection

Mainline I-90 Levels of Service

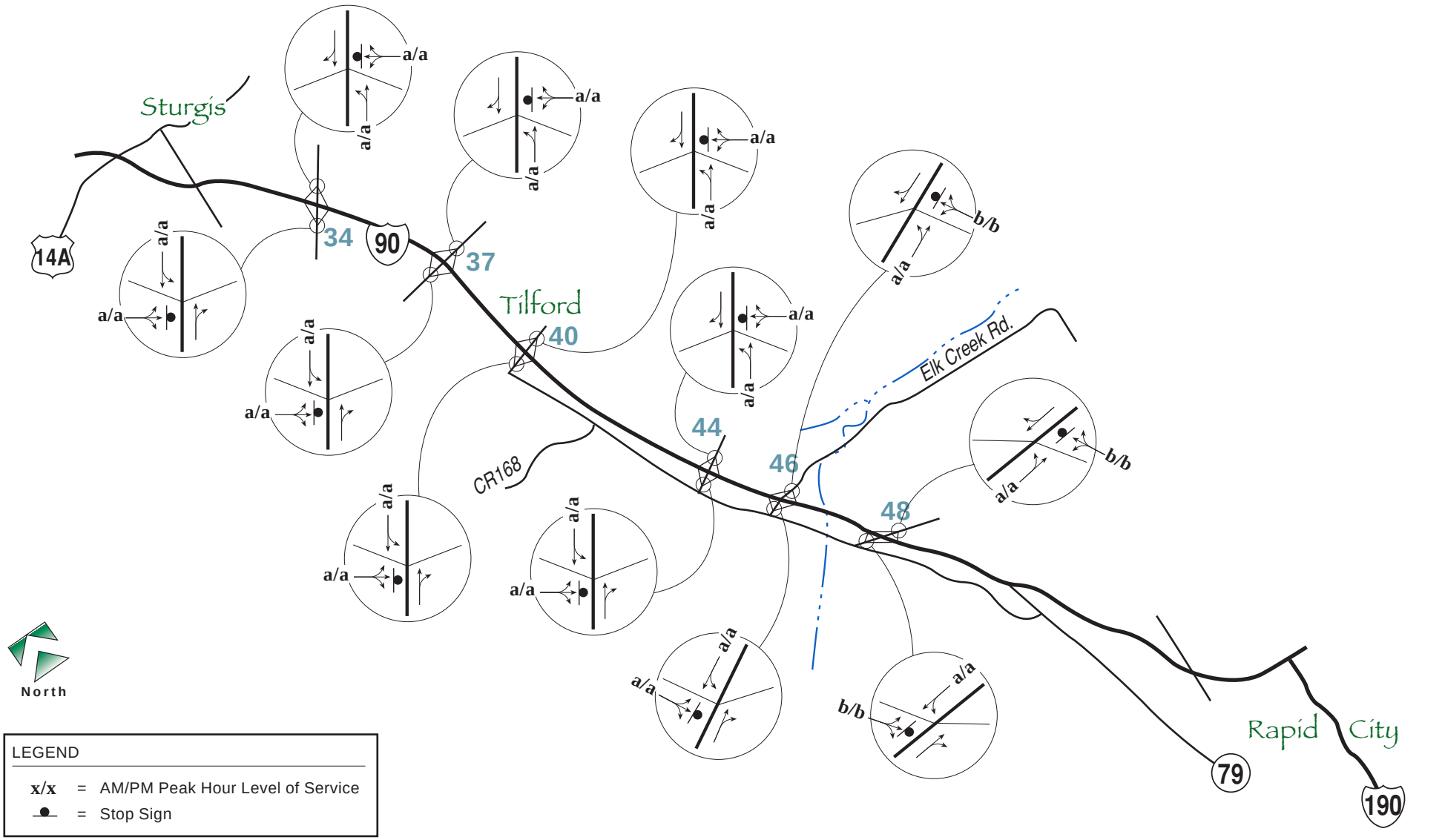
Based on the traffic parameters identified in Table 1 and LOS methodology outlined in the HCM, LOS A through LOS F AADT thresholds were established for mainline I-90. The calculated thresholds are shown in Table 3.

Table 3. Mainline I-90 LOS Criteria

Level of Service	Maximum Density for LOS	Maximum Service Volume (Vehicles per hour per lane) for LOS	Maximum AADT 2-way I-90 Volume for LOS (4-lane I-90)
A	11.0	614	24,560
B	18.0	1,001	40,040
C	26.0	1,363	54,520
D	35.0	1,616	64,640
E	45.0	1,785	71,400
F	variable	variable	Variable

Level of service results for mainline I-90 were calculated based on the thresholds in Table 3 and are shown in Table 4. Each mainline segment in the study corridor currently operates at LOS A.

YEAR 2003 INTERSECTION LEVELS OF SERVICE



LEGEND

x/x = AM/PM Peak Hour Level of Service

● = Stop Sign

Table 4. Year 2003 Mainline I-90 Traffic Operations

I-90 Segment	Existing Operating Conditions		
	AADT	LOS	v/c
West of Exit 34	16,930	A	0.24
Exit 34 – Exit 37	16,170	A	0.23
Exit 37 – Exit 40	15,990	A	0.22
Exit 40 – Exit 44	15,800	A	0.22
Exit 44 – Exit 46	16,310	A	0.23
Exit 46 – Exit 48	18,120	A	0.25
East of Exit 48	20,750	A	0.29

2.3 Accident Analysis

Consistent with the accident rate methodology developed for the Interstate Corridor Study, a weighted accident rate per million vehicles entering (MEV) the interchange was calculated for each interchange and a weighted accident rate per million freeway vehicle-miles traveled (VMT) was calculated for each 1-mile section of I-90. The interchange and freeway analyses are described in the following sections.

Interchange Accident Analysis

The methodology was used to calculate a weighted accident rate per million entering vehicles. Accident data were made available by SDDOT in the form of a three-year (2000-2002) data summary sheet for each interchange. The data summary provided a categorization of fatal, injury, and property damage traffic accidents occurring within the interchange area during the three year period. A point rating system of 12 points for a fatal crash, 3 points for an injury crash, and 1 point for a property damage crash was applied to the data. Based on this point system, a 3-year weighted accident sum was established for each interchange.

By dividing the weighted accident sum by the MEV value, a 3-year crash rate was then calculated for each interchange and for each 1-mile segment of I-90. After the calculation of each interchange crash rate, it was necessary to determine which interchanges could be considered high accident locations. The methodology identified in the *Manual of Transportation Engineering Studies*, published by the Institute of Transportation Engineers in 1994, was used to identify the significant accident locations.

That methodology states that a high accident location is defined as those locations that have a 3-year weighted accident crash rate greater than the mean rate for all locations, plus a constant times the standard deviation for all locations. At the 90% confidence level, that constant is 1.282. The Corridor Study analyzed data between the years of 1997 and 1999 for a broad base of interchanges throughout South Dakota. Therefore, data from the Corridor Study was used as a basis for average interchange accident rate calculations.

The mean rate for all locations (based on data from the Interstate Corridor Study) was calculated to be 1.23 weighted accidents per million entering vehicles (MEV), and the standard deviation for all locations was calculated to be 0.69. With these values, the corresponding crash rate that determines significant accident interchanges is 2.12 weighted accidents per million entering vehicles. Using this methodology, none of the interchanges were identified as significant accident locations. The interchange accident rates are summarized in Table 5. A full breakdown of accident totals and rates for both the interchanges and mainline I-90 is included in Appendix A.

Table 5. Interchange Accident Rates

Interchange	Total Accidents (2000-2002)	Weighted Accident Rate (Wtd. Acc / MEV)
Exit 34	8	1.14
Exit 37	6	0.43
Exit 40	5	0.72
Exit 44	17	1.25
Exit 46	11	1.00
Exit 48	13	0.76

Mainline I-90 Accident Analysis

A similar methodology was used to identify significant accident segments along mainline I-90, though accident rates within only the study corridor were used to determine the significant crash rate locations. Segments with a weighted accident rate above 2.21 accidents per Million Vehicle Miles Traveled (MVMT) were considered significant accident rate locations. Accident records were summarized into one-mile lengths and a weighted accident rate was calculated for each mile of I-90 along the study corridor. Three mainline significant accident locations were identified, as shown in Table 6.

Table 6. Mainline I-90 Significant Accident Rate Locations

Interstate Segment	Total Accidents (2000-2002)	Weighted Accident Rate (Wtd. Acc / MVMT)
MP 33-34	35	3.07
MP 50-51	30	2.24

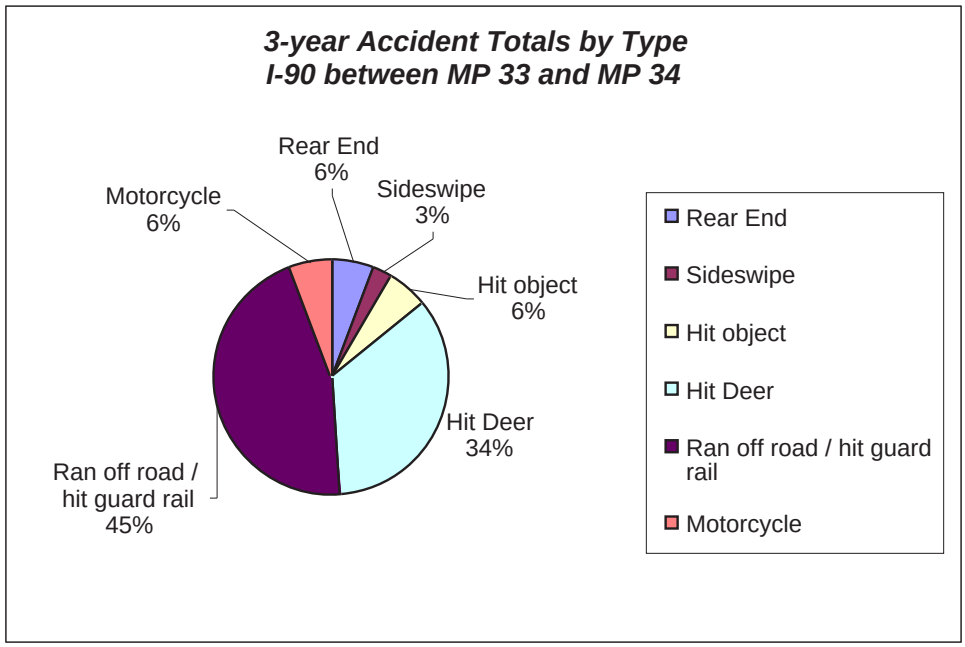
The interstate segment between MRMs 50 and 51 will be reconstructed as a part of the Exit 51 interchange reconstruction project, programmed in the Statewide Transportation Improvement Plan (STIP) for the Year 2006. Since this segment will be rebuilt in the near future, a detailed analysis of accident causes was not performed. Analysis of the 1-mile section of I-90 between MRM 33 and MRM 34 was performed to identify reasons for the elevated crash rate.

Mileage Reference Marker 33 to 34

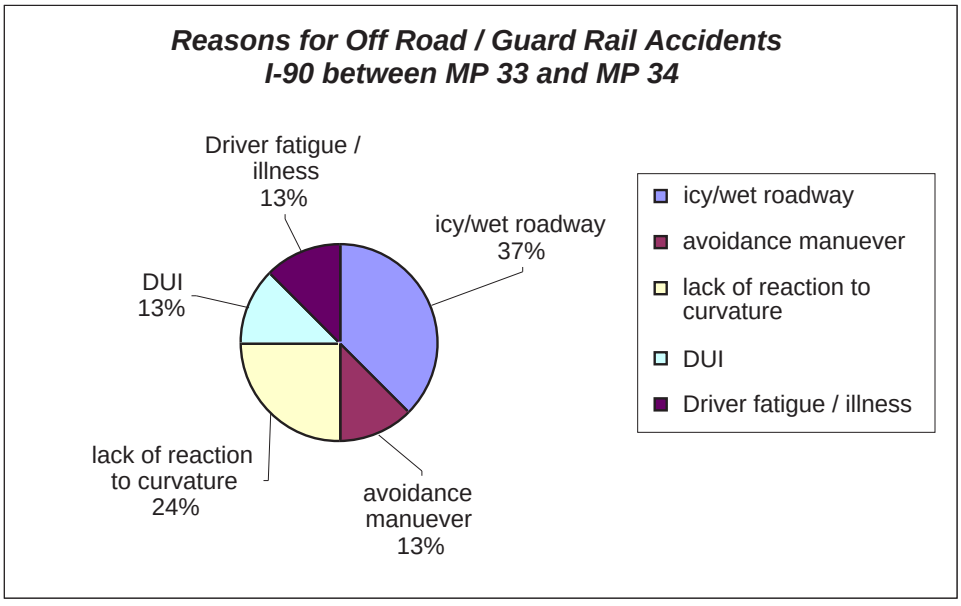
There were a total of 35 crashes along this 1-mile section of I-90 between 2000 and 2002. Sixteen of these crashes involved vehicles running off the roadway, and twelve crashes involved collisions with wildlife. According to the breakdown shown on Figure 6, six of these crashes (approximately 37 percent) occurred during icy or wet roadway conditions and four (approximately 24 percent) occurred due to the driver's failure to react to the horizontal curvature of the dry roadway. Based on the accident statistics, it is apparent that the horizontal curvature along this section of I-90 contributed in part to the heightened accident rate. Icy and wet roadway conditions, however, were the leading contributor to off-road crashes rather than the failure of the driver to react to the curvature. Several accident countermeasures could be implemented to address conditions along the curve, including static advisory signs or Variable Message Signs (VMS) warning drivers of hazardous conditions.

I-90 ACCIDENT CAUSES - MILEAGE REFERENCE MARKER 33 TO 34

Accident Types	# of Accidents
Rear End	2
Sideswipe	1
Hit Object	2
Hit Deer	12
Ran off road / hit guard rail	16
Motorcycle	2
3-YEAR TOTAL	35



Reasons for off-road collisions	# of Accidents
Icy/wet roadway	6
Avoidance Manuever	2
Lack of reaction to curvature	4
DUI	2
Driver fatigue / illness	2
3-YEAR TOTAL	16



3.0 YEAR 2025 TRAFFIC CONDITIONS

3.1 Future Roadway Network Enhancements

An extension of South Dakota Highway 79 to connect to I-90 has been proposed and is currently being studied. This extension would provide vehicles seeking to reach I-90 from locations east of Sturgis with an alternative to traveling through the City. The alternatives in this Corridor Preservation Study have been developed to accommodate the connection to I-90 of such an extension. If constructed, the extension would likely connect to I-90 at Exit 34 or Exit 37. Alternatively, it could connect to a new I-90 interchange somewhere between Exits 34 and 37.

3.2 Growth Projections

Corridor growth projections were developed based on historical growth patterns and anticipated future growth. Historic growth rates were calculated by comparing the sum of Year 2003 interchange ramp daily traffic volumes with the sum of comparable traffic counts conducted in the Year 1998. The use of historic growth rates as a baseline for future growth reflected the differences between interchanges. Historic rates were found to range between approximately 3 percent and 9 percent.

Because the pace and nature of development currently varies and will continue to vary throughout the corridor, growth rates specific to each interchange were developed. In addition, growth north of the interchanges is likely to differ from growth south due to topography and existing development. An average of the north and south growth rates was applied to eastbound and westbound traffic volumes at the interchanges. Table 7 summarizes the future growth rate assumptions used for Year 2025 traffic volume projections.

Table 7. Future Interchange Growth Rates

Interchange	North Growth Rate	South Growth Rate	Future Growth Considerations
#34 Black Hills National Cemetery	2.00%	2.00%	Area surrounding interchange largely built out. If SD 79 extension connects here, growth rate would increase.
#37 Pleasant Valley Road	3.00%	3.00%	Future growth likely to be consistent with recent history. If SD 79 extension connects here, growth rate would increase.
#40 Tilford Road	3.00%	3.00%	Area surrounding Exit 40 similar to Exit 37.
#44 Deerview Road	2.00%	4.00%	Increased development anticipated south of interchange.
#46 Elk Creek Road	6.00%	3.00%	Significant residential growth proposed north of interchange. Area south of interchange limited by topography.
#48 Stage Stop Road	3.00%	6.00%	Summerset development south of interchange.

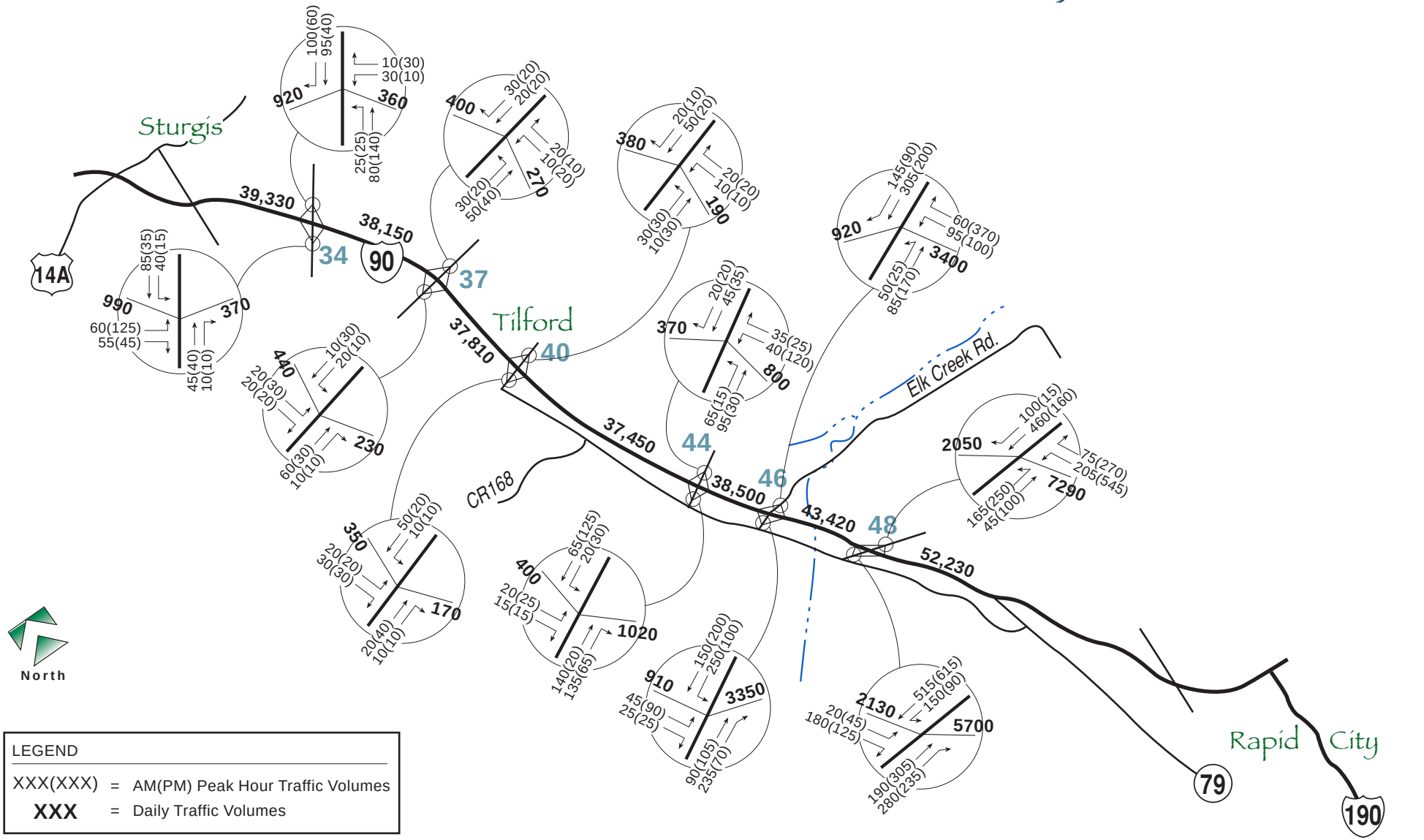
Based on historical traffic growth along I-90 and conversations with SDDOT staff, mainline I-90 was assigned an annual growth rate of 4 percent. Traffic counts gathered from two Automated Traffic Recording (ATR) stations along I-90 within Rapid City indicated that traffic volumes grew annually by approximately 3 percent between 1989 and 2003.

3.3 Projected Traffic Conditions

Traffic Volumes

The interchange and mainline I-90 growth rates discussed above were applied to the Year 2003 traffic volumes to calculate projected Year 2025 traffic volumes across the corridor. The NCHRP 255 method was applied to Year 2003 intersection turning movements to account for varying north and south growth rates. East-west growth at the interchanges was assumed to be an average of the north and south rates. The projected Year 2025 mainline I-90 and interchange traffic volumes are shown on Figure 7. As shown, mainline I-90 daily traffic volumes are expected to vary between approximately 37,450 vpd between Exits 40 and 44 to 52,230 vpd east of Exit 48. As is the case currently, Year 2025 traffic volumes are anticipated to generally increase from west to east, as development intensifies closer to Rapid City.

PROJECTED YEAR 2025 TRAFFIC VOLUMES



LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

XXX = Daily Traffic Volumes

Levels of Service

To test the operational performance of the existing configuration into the future, Year 2025 LOS calculations were performed based on the existing roadway configuration and traffic control. The interchange ramp terminal intersections were all analyzed assuming STOP sign control and I-90 analyses assumed 4 lanes of width, 2 in each direction. The results of the ramp terminal intersection analyses are summarized in Table 8 below in comparison with the existing operational conditions. As shown, the Exit 34, 37, 40 and 44 interchange ramp terminal intersections are expected to operate at LOS B or better by the Year 2025. At Exits 46 and 48, unsignalized intersection operations are expected to reach LOS C and LOS F, respectively.

The SDDOT seeks to maintain LOS C or better operations. Traffic signals are expected to be necessary to achieve this operational condition at Exit 48. The Exit 46 ramp terminal intersections may remain unsignalized by the Year 2025, but operations of LOS C are anticipated. Level of Service results for intersections are shown on Figure 8.

Table 8. Existing and Projected 2025 Ramp Intersection LOS

Interchange	Existing / Year 2025 Unsignalized Ramp Terminal Intersection Levels of Service[1]			
	North Ramp Terminal		South Ramp Terminal	
	AM Peak Hour	PM Peak Hour	AM Peak Hour	PM Peak Hour
Exit 34	a/a	a/a	a/b	a/b
Exit 37	a/a	a/a	a/a	a/a
Exit 40	a/a	a/a	a/a	a/a
Exit 44	a/b	a/b	a/b	a/b
Exit 46	b/c	b/c	a/c	a/c
Exit 48	b/f	b/f	b/d	b/f

[1] Levels of service shown are for the single poorest-operating movement at the intersection

Projected Year 2025 mainline traffic operations are depicted in Table 9. Traffic volumes are expected to peak at more than 50,000 vehicles per day along I-90 east of Exit 48, which translates to LOS C peak hour operating conditions. When I-90 AADT east of Exit 48 increases to approximately 54,520 vpd, a 4-lane section would deteriorate below LOS C.

PROJECTED YEAR 2025 INTERSECTION LEVELS OF SERVICE

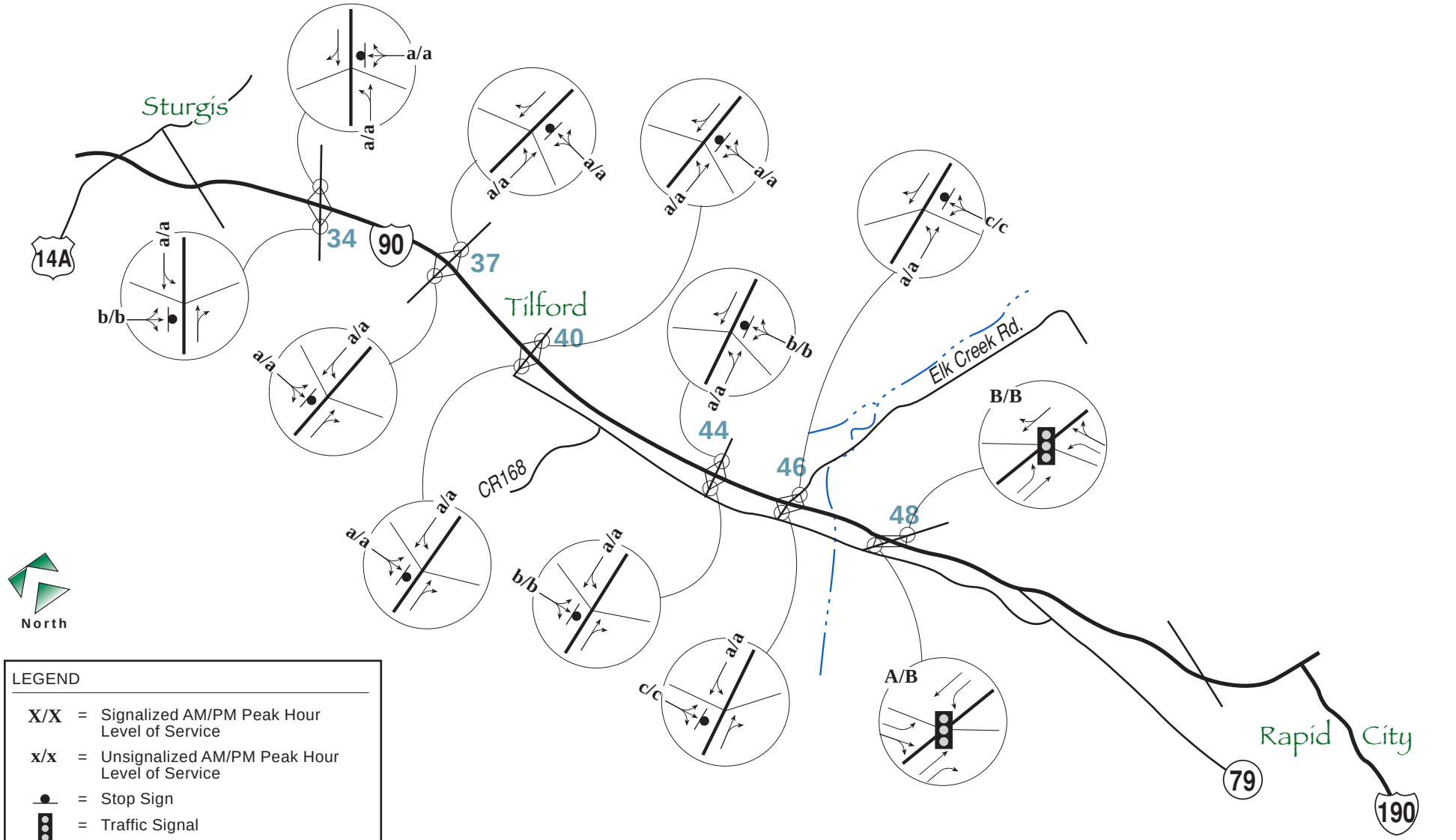


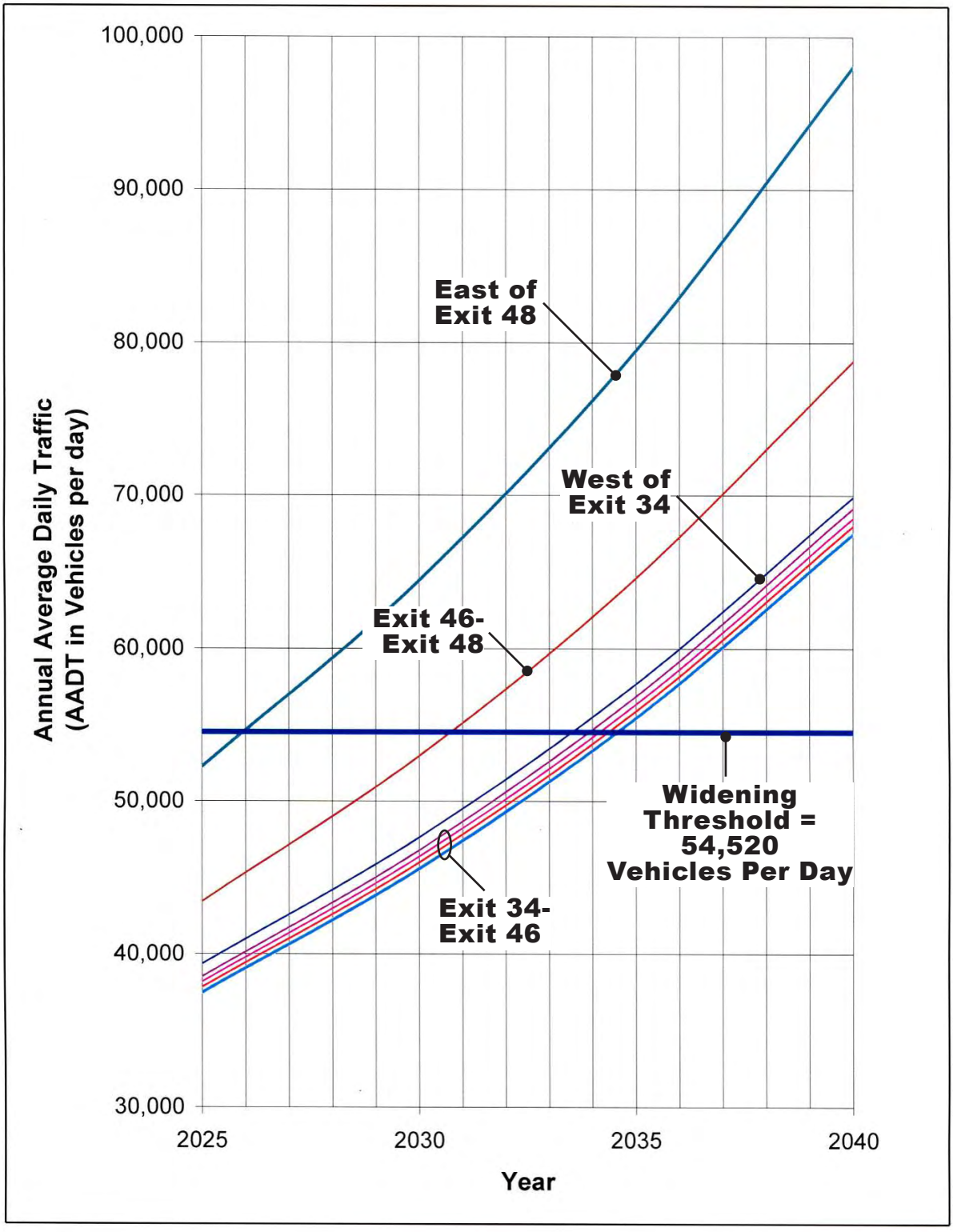
Table 9. Existing and Projected Year 2025 I-90 Mainline Operating Conditions

I-90 Segment	Existing Operating Conditions			Year 2025 Operating Conditions		
	AADT	LOS	V/C	AADT	LOS	V/C
West of Exit 34	16,930	A	0.24	39,330	B	0.55
Exit 34 – Exit 37	16,170	A	0.23	38,150	B	0.53
Exit 37 – Exit 40	15,990	A	0.22	37,810	B	0.53
Exit 40 – Exit 44	15,800	A	0.22	37,450	B	0.52
Exit 44 – Exit 46	16,310	A	0.23	38,500	B	0.53
Exit 46 – Exit 48	18,120	A	0.25	43,420	C	0.61
East of Exit 48	20,750	A	0.29	52,230	C	0.73

Mainline I-90 Widening

Projected Year 2025 demand for travel along I-90 is projected to reach a level near that requiring a widening from 4 to 6 lanes, particularly at the east end of the study corridor. Figure 9 illustrates the anticipated growth in mainline traffic volumes for each interchange-to-interchange segment. As shown, widening of I-90 through the study corridor is anticipated to be necessary between the Years 2026 and 2035. To address the anticipated need for widening, a mainline I-90 alternative was developed to examine the impacts of widening the Interstate from 4 to 6 lanes throughout the study corridor.

ANTICIPATED I-90 TRAFFIC GROWTH



4.0 ALTERNATIVES

4.1 Description of Alternatives

A set of corridor alternatives was developed to address existing geometric and safety issues and existing and future traffic needs. Based on the assessment of existing conditions, a primary concern within the corridor is geometric deficiencies. The existence of multiple geometric deficiencies throughout the study corridor, however, was not found to be a specific cause of elevated accident rates. Traffic operations are a secondary concern within the study corridor, as the majority of intersections and mainline I-90 through the study corridor are anticipated to operate satisfactorily to the Year 2025. The Exit 46 and Exit 48 interchanges and mainline I-90 in the vicinity of Exits 46 and 48, however, show a more urgent need for improvements to ensure acceptable future operations. Traffic volume growth beyond the Year 2025 is also likely to accelerate the need for operational improvements throughout the corridor.

A collection of interchange, frontage / local road, and mainline I-90 alternatives was developed to address the identified geometric, operational and safety concerns. These alternatives were refined based on input from the project Steering Committee and the public at a series of three Open Houses. The alternatives are described below by interchange and are depicted graphically on Figures 10 through 25.

Exit 34 – Black Hills National Cemetery (Figures 10-11)

The three alternatives developed for Exit 34 examined improvements that would essentially leave the interchange in its current location (two alternatives), or the possibility of shifting the interchange location west of its current alignment (one alternative). Existing issues in need of remedies include the close proximity of the railroad tracks and adjacent access to the interchange ramp termini.

Table 10. Exit 34 Alternatives

Exit 34 Interchange Alternative	Description / Key Issues Addressed
Alternative 1	Diamond Interchange in current location. Would improve sight distances and k-values, but would not address tight railroad and access spacing.
Alternative 1a	Single-Point Urban Interchange in current location. Would improve sight distances and k-values along with tight railroad and access spacing.
Alternative 2	Diamond Interchange shifted west. Would improve tight spacing and accommodate a SD 79 extension.

Exit 37 – Pleasant Valley Drive (Figure 12)

A single alternative was developed for Exit 37. This alternative would increase spacing between the ramp terminal intersections and would also address the geometric deficiencies identified in Section 2.

Exit 40 – Tilford Road (Figure 13)

A single alternative was developed for Exit 40. This alternative would increase spacing between intersections along Tilford Road by spreading the ramp termini farther apart and realigning the frontage / access roads both north and south of I-90.

Exit 44 – Deerview Road (Figures 14-16)

Interstate 90 currently crosses over Deerview Road with twin bridges. These twin bridges are scheduled for replacement in the near future, a project included in the 2005 – 2009 Statewide Transportation Improvement Plan (STIP). There are multiple sight distance and k-value deficiencies along the ramps and along Piedmont Road which would be corrected with the implementation of any of the alternatives.

Table 11. Exit 44 Alternatives

Exit 44 Interchange Alternative	Description / Key Issues Addressed
Alternative 1	Diamond Interchange in current location with I-90 over Deerview Road. Would improve sight distances and k-values and access spacing south.
Alternative 1a	Diamond Interchange in current location with Deerview Road over I-90. Would improve sight distances and k-values and access spacing south.
Alternative 1b	Diamond Interchange in current location with I-90 over Deerview Road. Would address geometric deficiencies and south roundabout would accommodate tight access spacing.

Exit 46 – Elk Creek Road (Figures 17-18)

Exit 46 represents a location within the corridor where development is more dense and the pace of development is anticipated to continue into the future. Commercial accesses are located in close proximity to the interchange ramp termini, inhibiting circulation. The Exit 46 interchange alternatives were developed with access management as a priority in an attempt to improve the quality of access for existing and future development. In addition, the Elk Creek Road bridge over I-90 has a severe crest vertical curve and a significant skew angle relative to mainline I-90, inhibiting proper sight distance. There are multiple geometric deficiencies throughout the interchange.

Table 12. Exit 46 Alternatives

Exit 46 Interchange Alternative	Description / Key Issues Addressed
Alternative 1	Diamond Interchange in current location. Would shift south commercial access farther south and introduce north grade-separated railroad crossing.
Alternative 2	Diamond Interchange shifted east of current location would significantly reduce the existing bridge skew and open access options.
Alternative 3	Single-Point Urban interchange shifted east of current location would significantly reduce the existing bridge skew.

Exit 48 – Stagestop Road (Figures 19-21)

The area surrounding Exit 48 exhibits the most dense development of any interchange area within the study corridor, particularly south of the interchange. Access spacing along Stagestop Road is substandard, and similar to Exit 46, the Stagestop Road bridge over I-90 has a severe skew angle relative to mainline I-90. Interchange, north access, and south access alternatives were developed to address this skew and improve access spacing.

Table 13. Exit 48 Alternatives

Exit 48 Interchange Alternative	Description / Key Issues Addressed
Alternative 1	Diamond Interchange in current location. Would replace existing bridge and address sight distance and k-value deficiencies.
Alternative 2	Single-Point Urban Interchange in current location. Would replace existing bridge and address sight distance and k-value deficiencies.
Alternative 3	Diamond Interchange shifted west would address bridge skew and create space north of the interchange for local access. Grade-separated railroad crossing.
Alternative 3a	Diamond Interchange shifted farther west than Alternative 3 would address bridge skew and create space both north and south of the interchange for local access.

Alternatives were also developed to address local access spacing issues without reconstructing the interchange. The three north access alternatives would realign J.B. Road to varying degrees to eliminate its current close proximity to the north ramp terminal intersection. The two south access alternatives would relocate the access road closest to the interchange farther south away from the south ramp terminal. The Exit 48 access alternatives are depicted graphically on Figures 22 – 24.

4.2 I-90 / Frontage Road Alternatives

Mainline I-90 (Figure 25)

As discussed in section 4, Year 2025 demand for travel along I-90 is projected to reach a level near that requiring a widening from 4 to 6 lanes, particularly at the east end of the study corridor. East of Exit 48, mainline I-90 would be realigned south of its current alignment to increase distance to the adjacent access roads. To address the anticipated need for widening, a mainline I-90 alternative was developed to examine the impacts of widening the Interstate from 4 to 6 lanes throughout the study corridor.

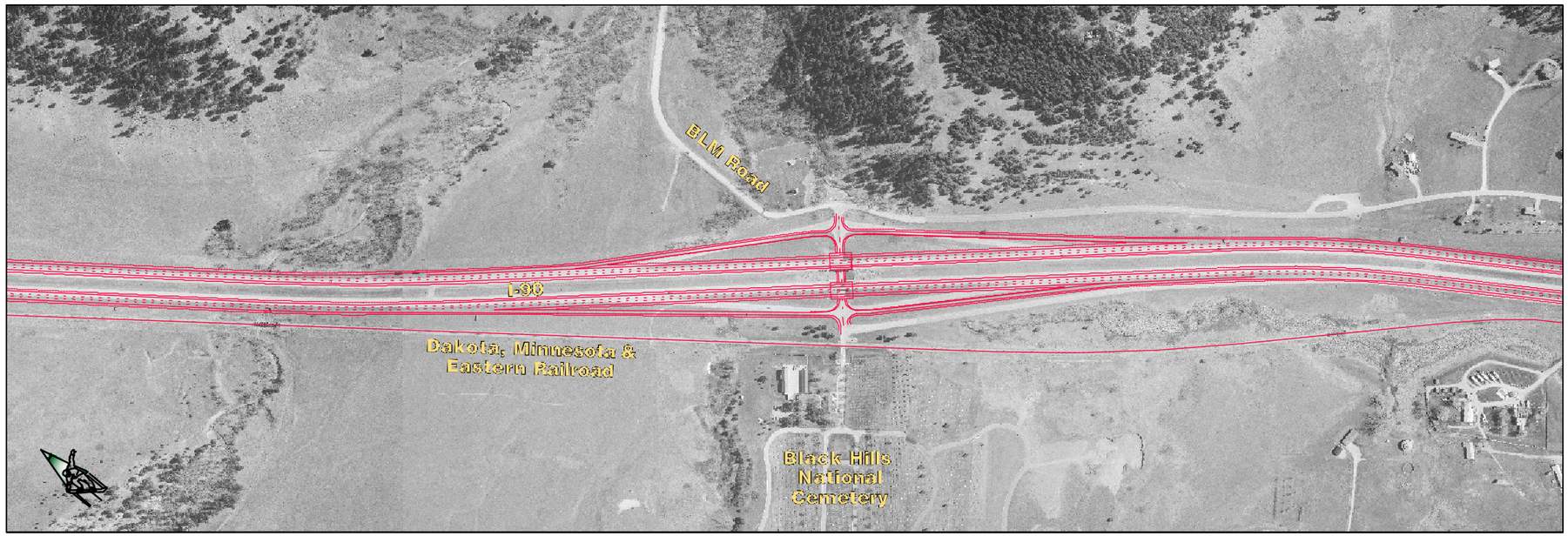
Exit 40 to 44 Corridor Segment (Figure 26)

As depicted graphically, the full length of the south frontage road between Exits 40 and 44 would need to be realigned to accommodate a six-lane I-90.

Exit 44 to 46 Corridor Segment (Figure 27)

An alternative was developed to address the I-90 corridor continuously between Exits 44 and 46, where the frontage roads lie immediately adjacent to both sides of the Interstate. The frontage roads would be difficult to relocate farther away from the Interstate because the town of Piedmont lies immediately south of the south frontage road and the DM&E Railroad lies immediately north of the north frontage road. The potential widening of I-90 from 4 to 6 lanes would further constrict options in the area. The alternative developed would realign mainline I-90 slightly north and would relocate the north frontage road to one of several alignment options north of I-90.

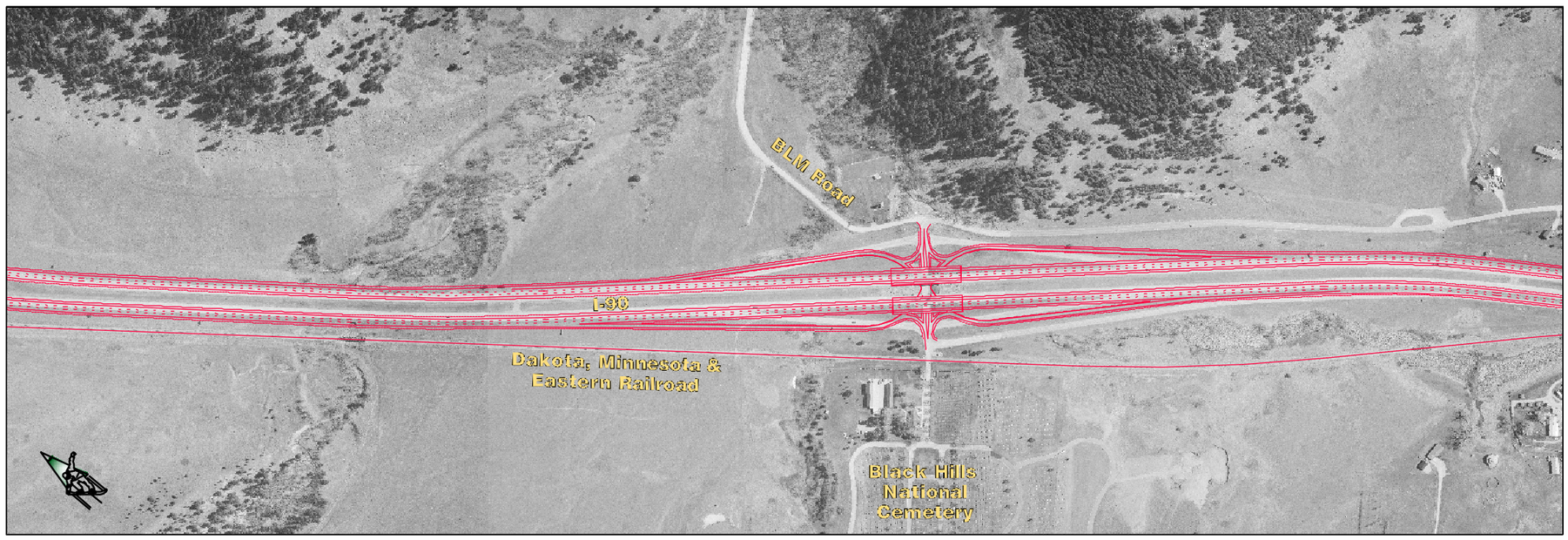
I-90 Exit 34 - Black Hills National Cemetery



Interchange Alternative 1
Diamond Interchange

★ MOST FEASIBLE ALTERNATIVE

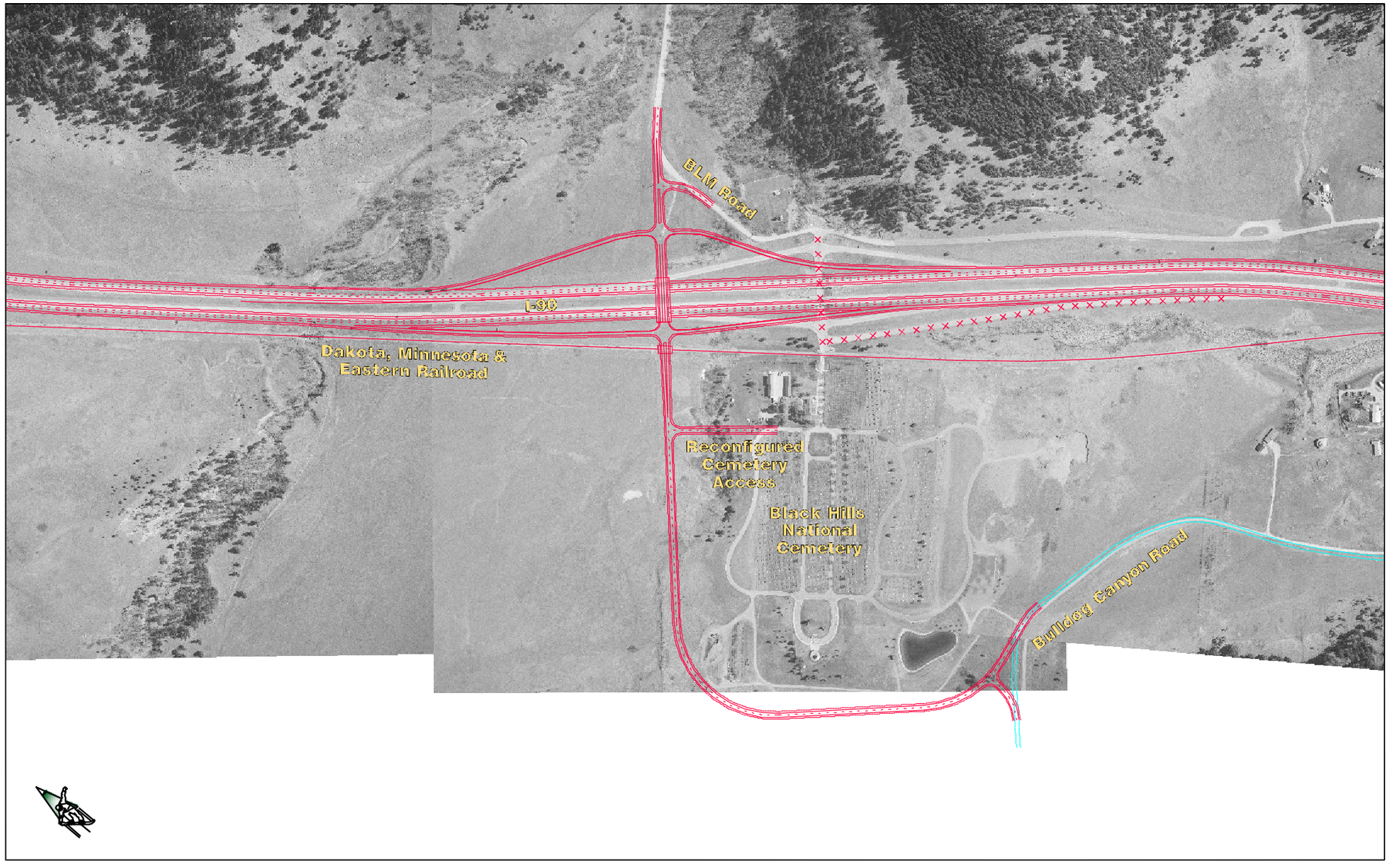
Estimated Construction Costs
$8.0 Million
Estimated Right-of-Way Requirements
4.7 Acres



Interchange Alternative 1a
Single Point Urban Interchange

Figure 10.
Exit 34 Alternatives 1 and 1a

I-90 Exit 34 - Black Hills National Cemetery



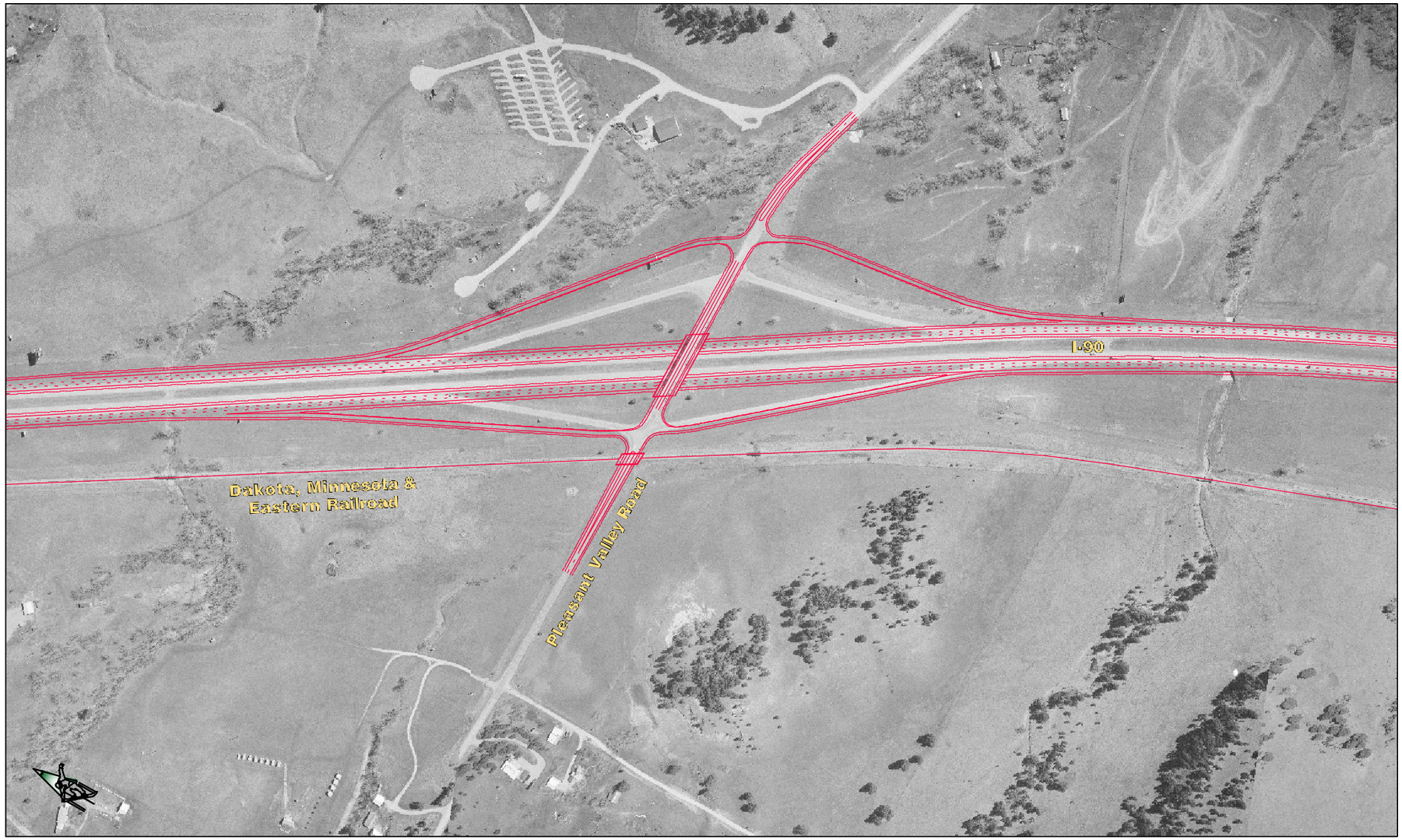
Interchange Alternative 2
Realigned Diamond Interchange

★ MOST FEASIBLE ALTERNATIVE

Estimated Construction Costs
$8.1 Million
Estimated Right-of-Way Requirements
15.3 Acres

Figure 11.
Exit 34 Alternative 2

I-90 Exit 37 - Pleasant Valley Road



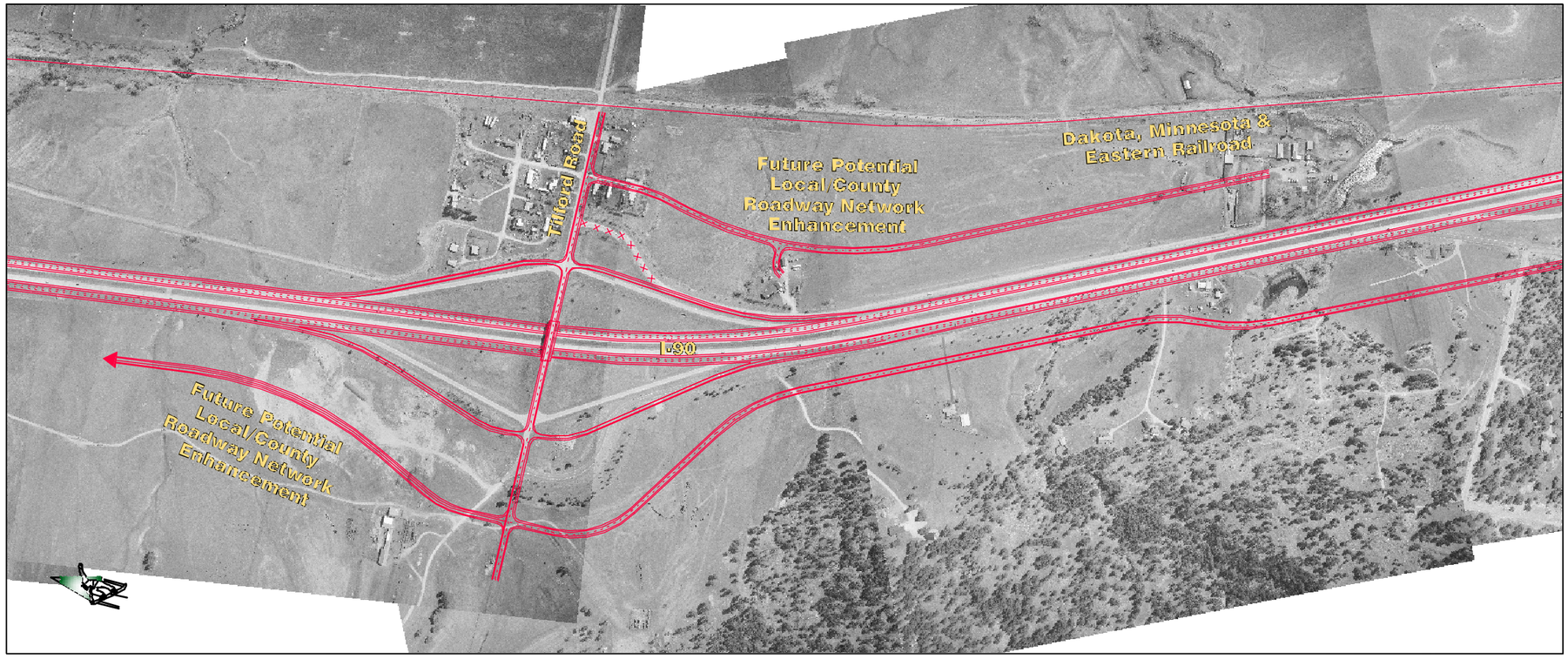
Interchange Alternative 1
Diamond with Realigned North Ramps

★ MOST FEASIBLE ALTERNATIVE

Estimated Construction Costs
$5.6 Million
Estimated Right-of-Way Requirements
5.3 Acres

Figure 12.
Exit 37 Alternative 1

I-90 Exit 40 - Tilford Road



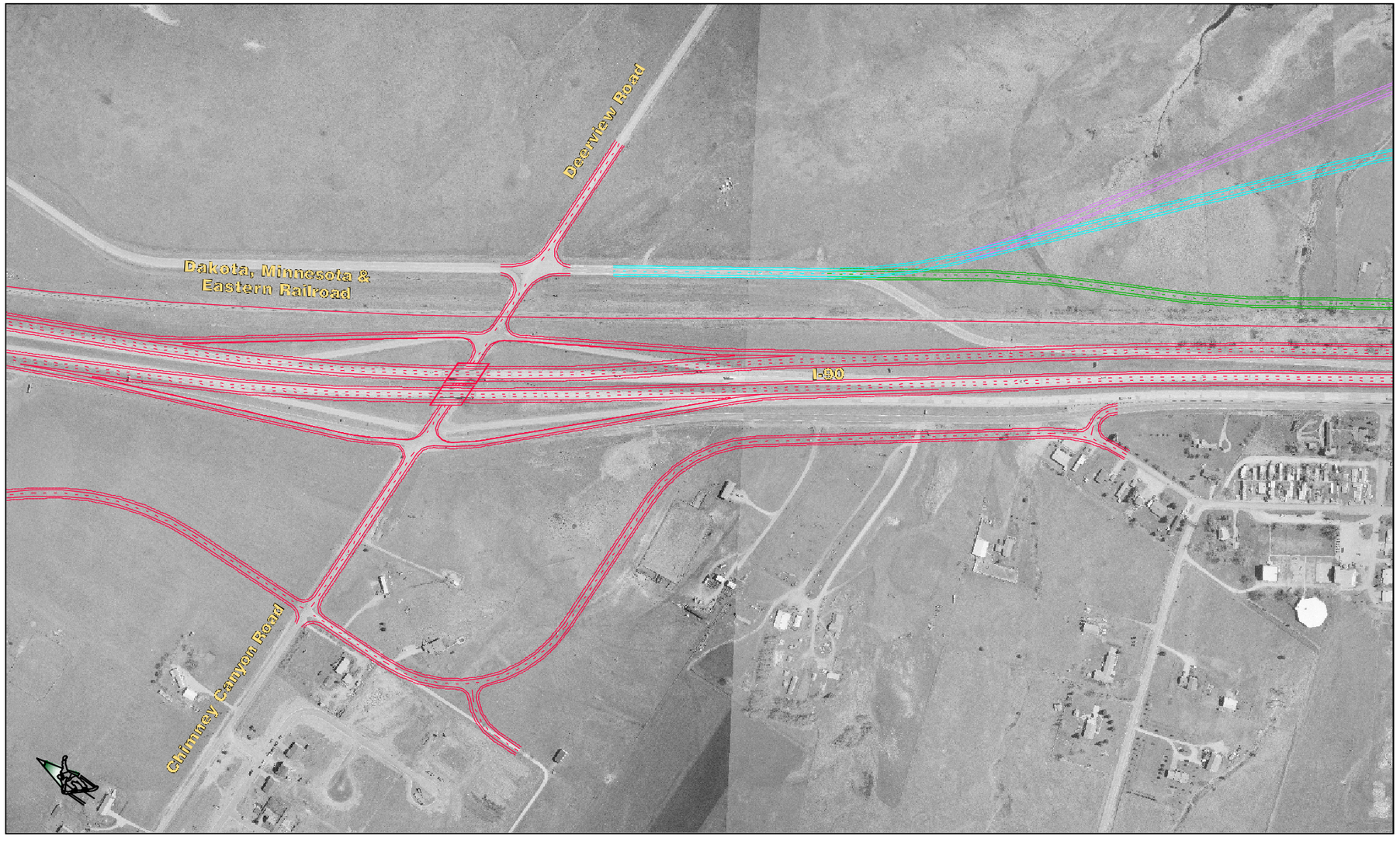
Interchange Alternative 1
Diamond with Realigned Frontage Roads

★ MOST FEASIBLE ALTERNATIVE

Estimated Construction Costs
$5.9 Million
Estimated Right-of-Way Requirements
6.0 Acres

Figure 13.
Exit 40 Alternative 1

I-90 Exit 44 - Deerview Road



Interchange Alternative 1
Diamond with Realigned South Frontage Road

MOST FEASIBLE ALTERNATIVE

Estimated Construction Costs
$7.7 Million
Estimated Right-of-Way Requirements
0.3 Acres

Figure 14.
Exit 44 Alternative 1

I-90 Exit 44 - Deerview Road

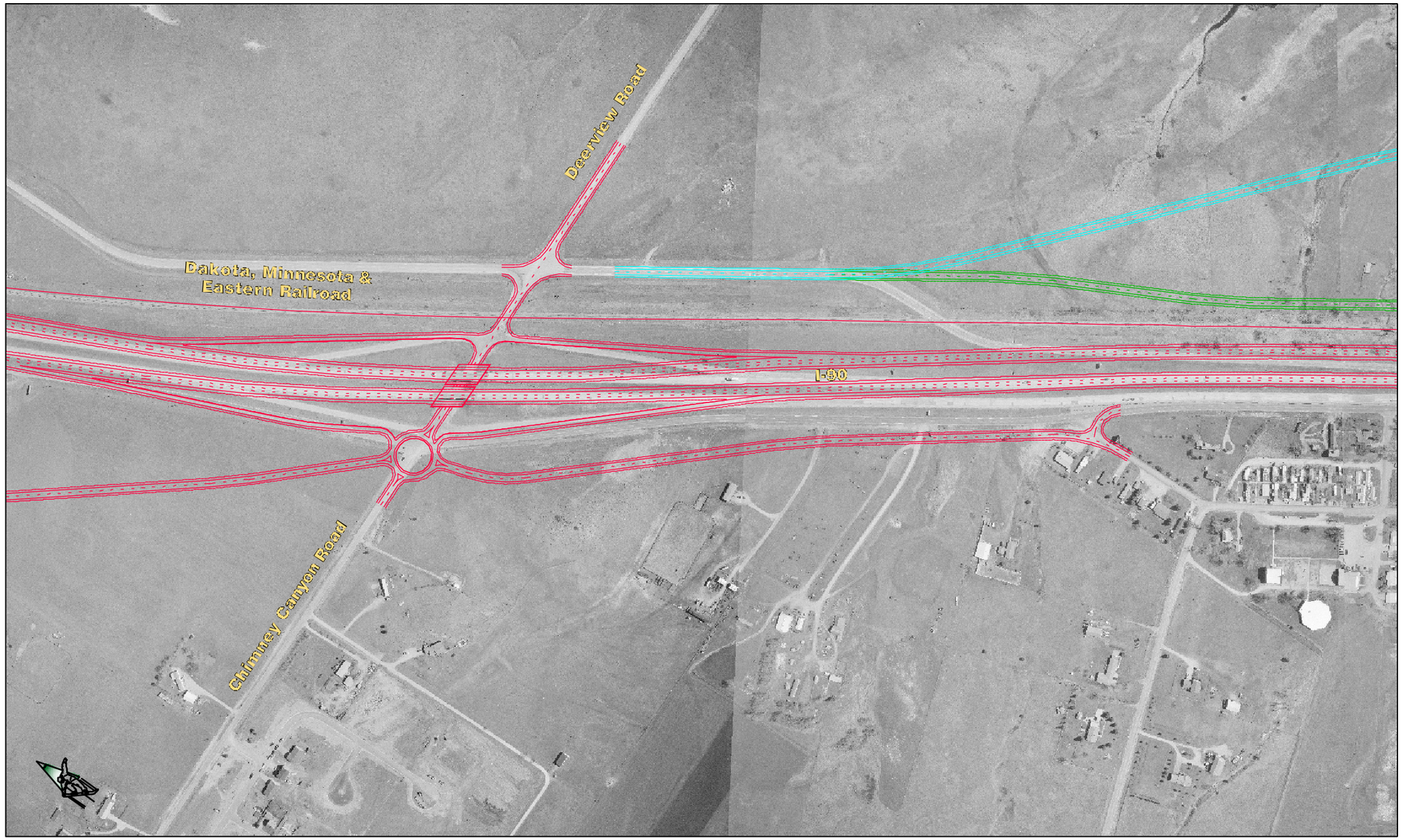
Interchange Alternative 1a
Diamond with Realigned South Frontage Road
Deerview Road over I-90

★ MOST FEASIBLE ALTERNATIVE

Estimated Construction Costs
$7.4 Million
Estimated Right-of-Way Requirements
3.3 Acres

Figure 15.
Exit 44 Alternative 1a

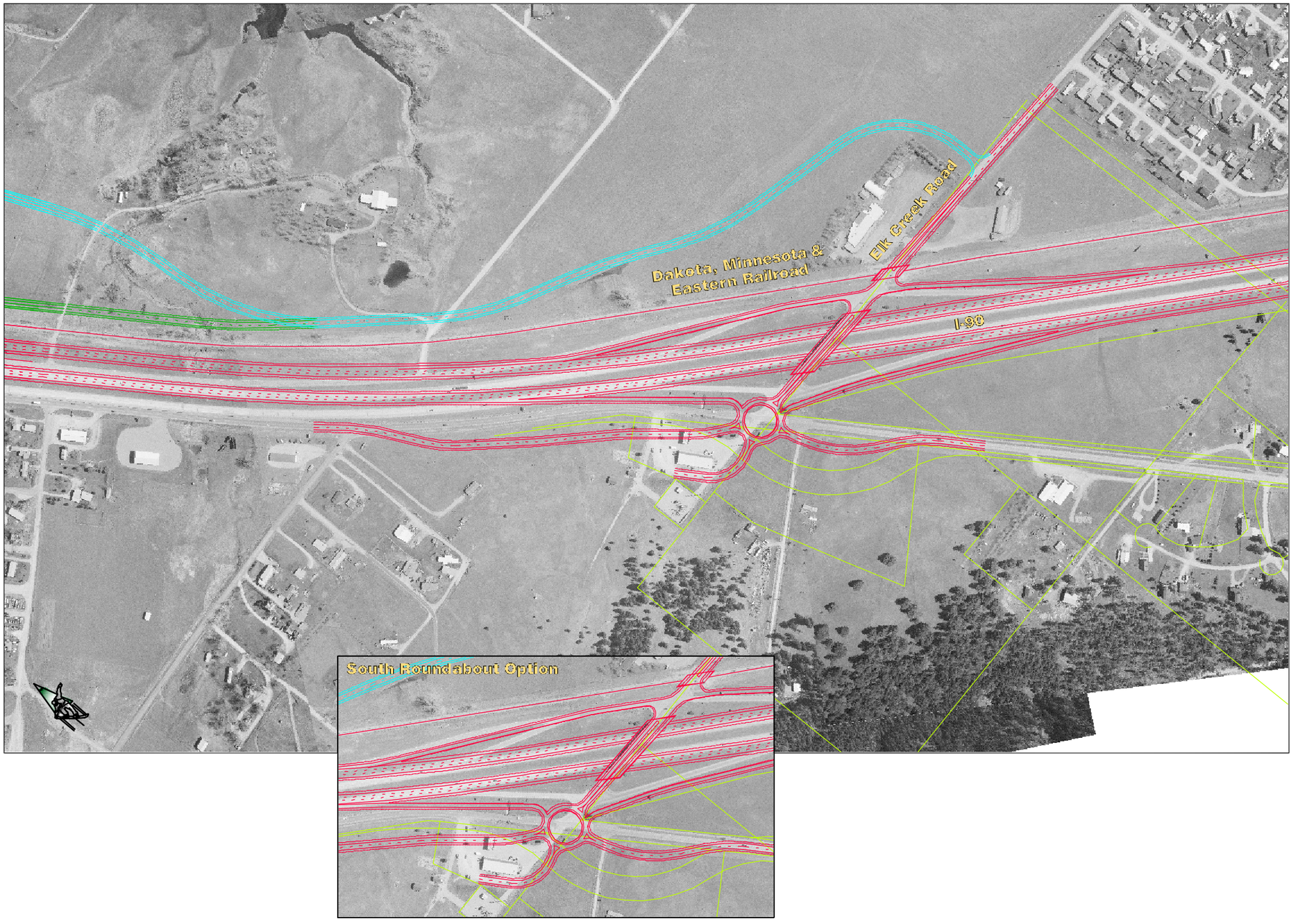
I-90 Exit 44 - Deerview Road



Interchange Alternative 1b
Diamond with South Roundabout

Figure 16.
Exit 44 Alternative 1b

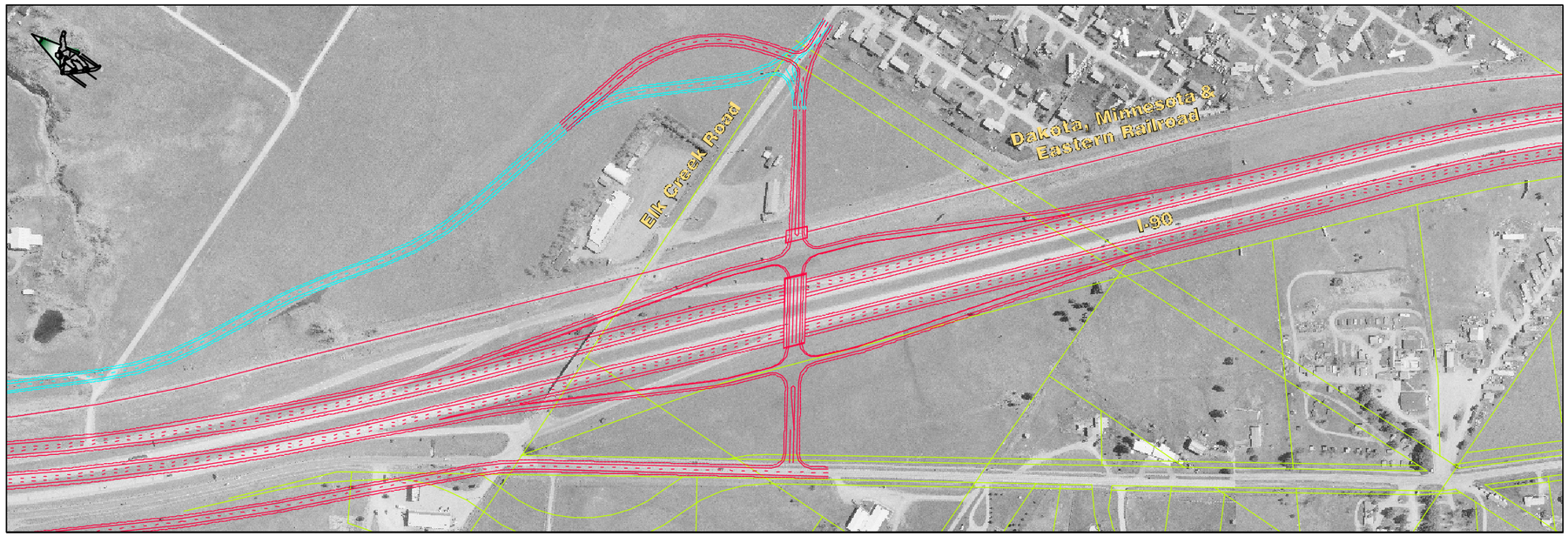
I-90 Exit 46 - Elk Creek Road



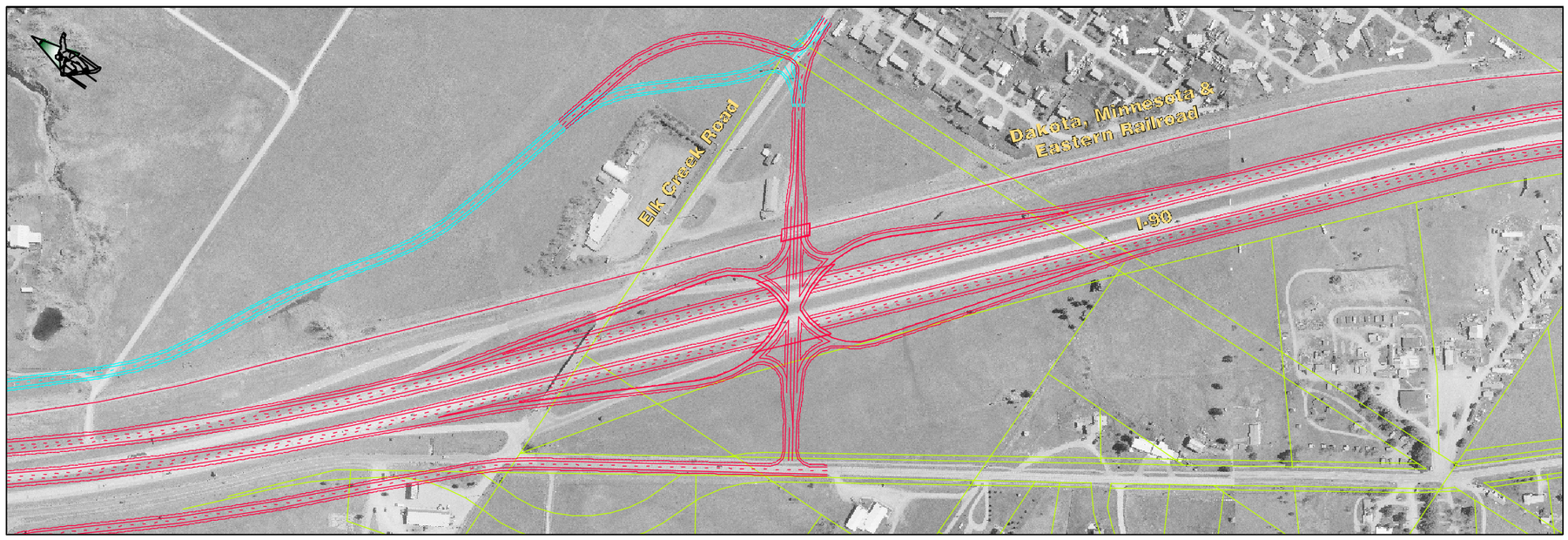
Interchange Alternative 1
Diamond Interchange with Realigned Frontage Roads

Figure 17.
Exit 46 Alternative 1

I-90 Exit 46 - Elk Creek Road



Interchange Alternative 2
Relocated Diamond with Realigned North Frontage Road



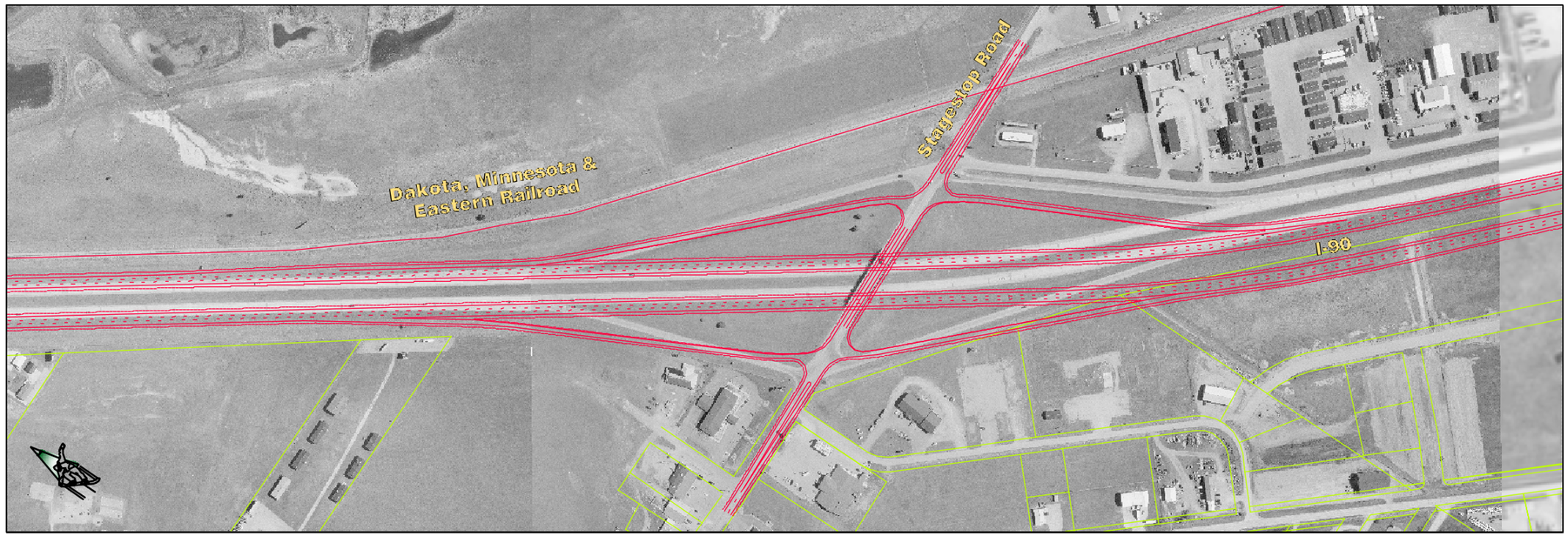
Interchange Alternative 3
Single Point Urban Interchange with North Frontage Road Connection

★ MOST FEASIBLE ALTERNATIVE

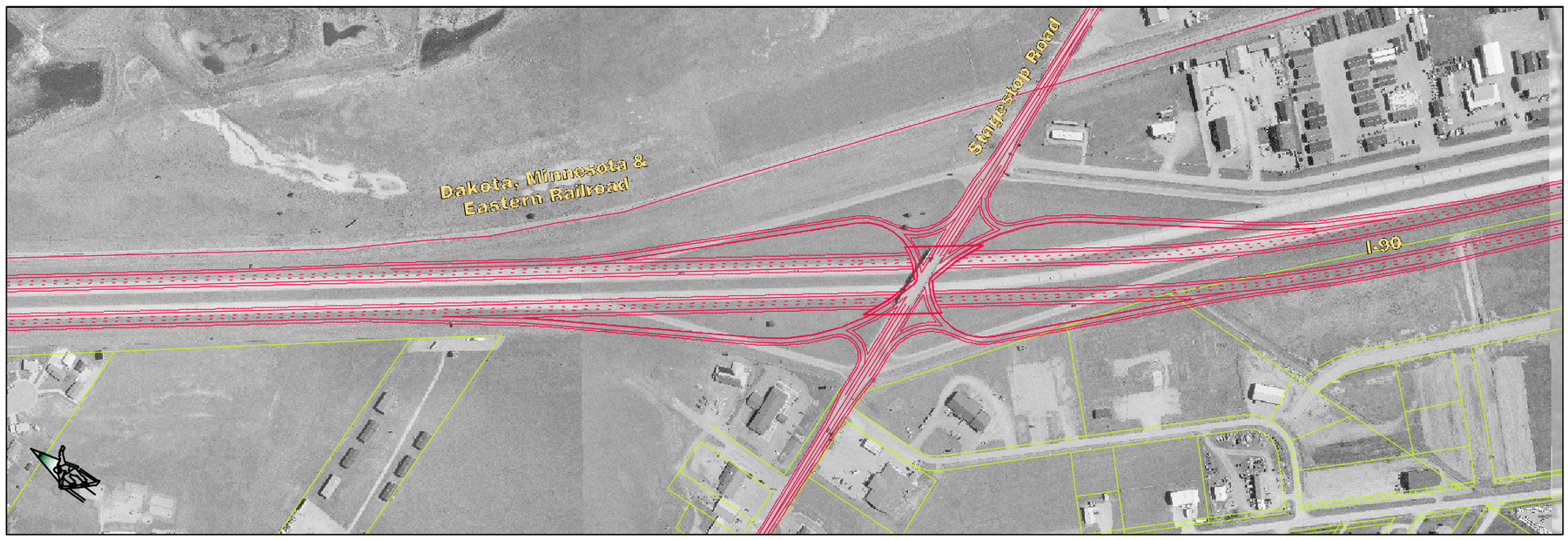
Estimated Construction Costs
$5.4 Million
Estimated Right-of-Way Requirements
2.5 Acres

Figure 18.
Exit 46 Alternatives 2 and 3

I-90 Exit 48 - Stagestop Road



Interchange Alternative 1
Diamond Interchange



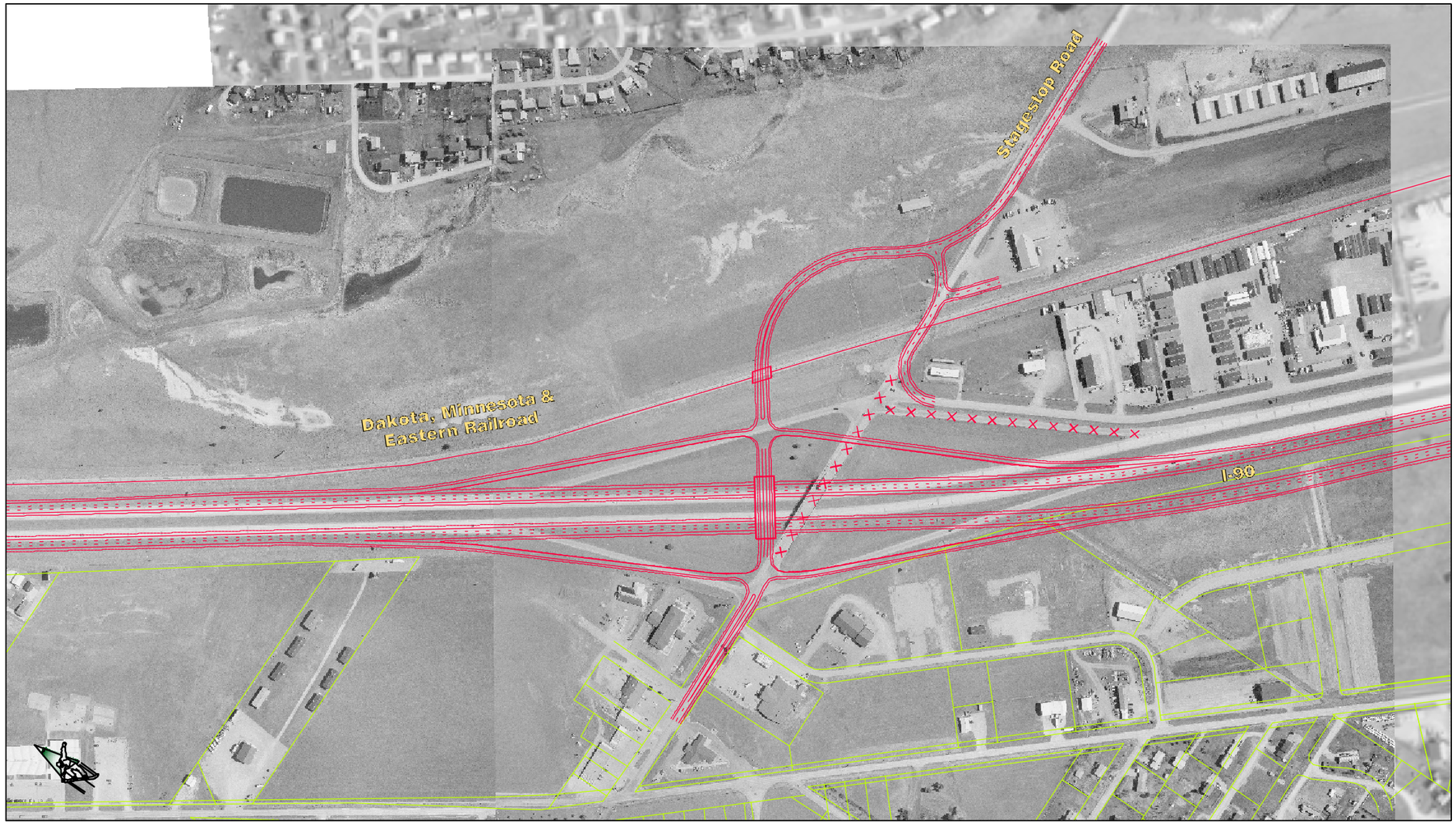
Interchange Alternative 2
Single Point Urban Interchange

★ MOST FEASIBLE ALTERNATIVE

Estimated Construction Costs
$4.9 Million
Estimated Right-of-Way Requirements
5.7 Acres

Figure 19.
Exit 48 Alternatives 1 and 2

I-90 Exit 48 - Stagestop Road



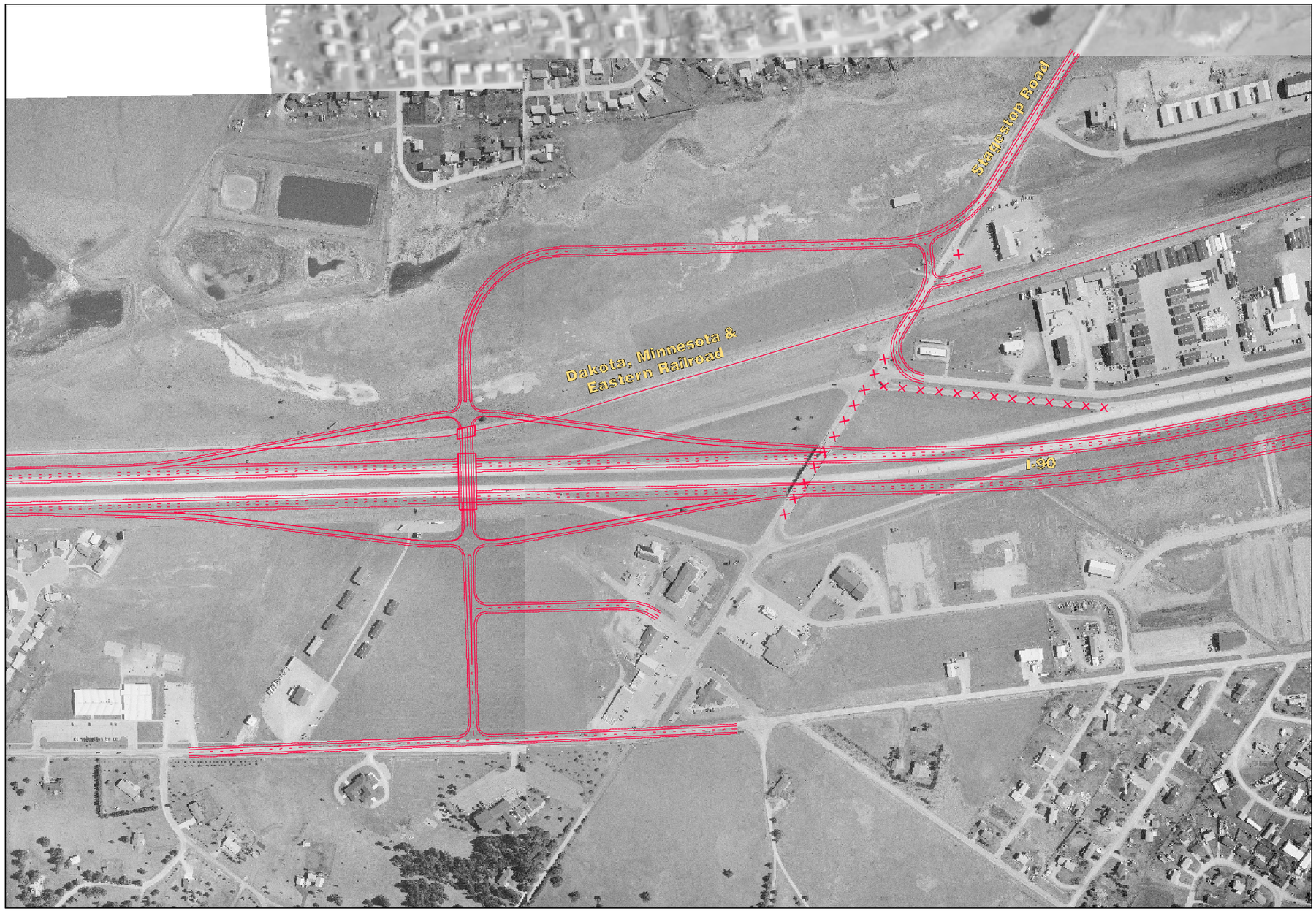
Interchange Alternative 3
Shifted Diamond Interchange

★ MOST FEASIBLE ALTERNATIVE

Estimated Construction Costs
$6.4 Million
Estimated Right-of-Way Requirements
9.4 Acres

Figure 20.
Exit 48 Alternative 3

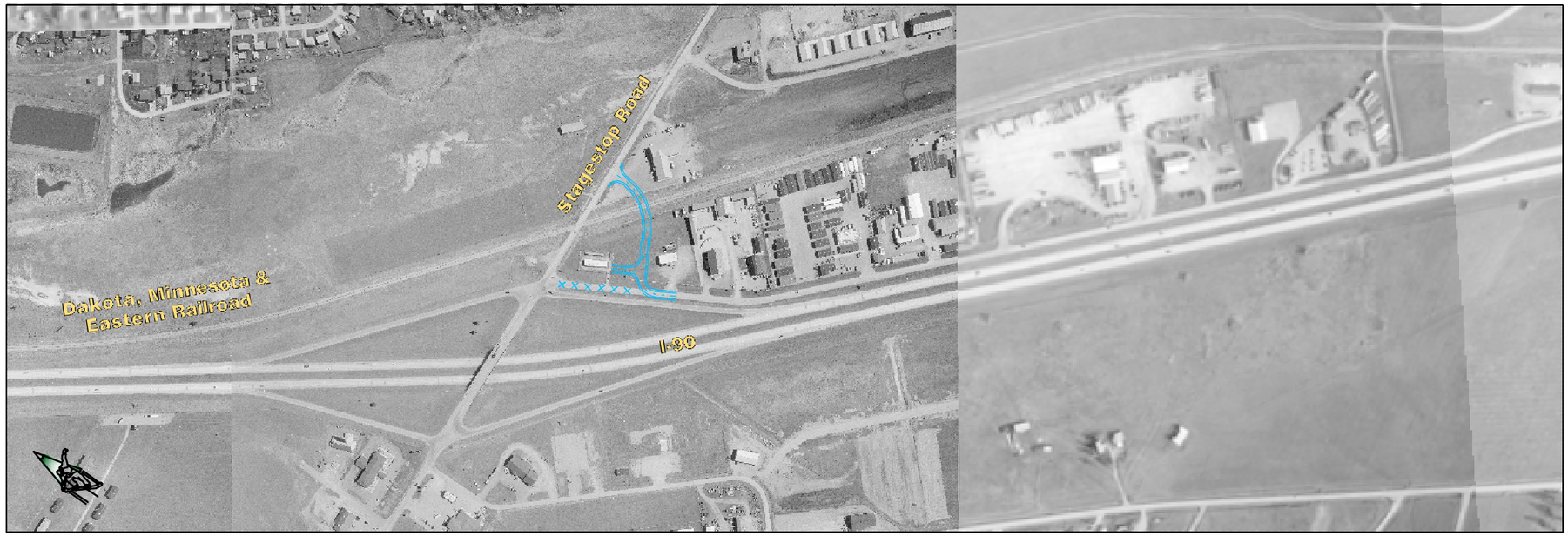
I-90 Exit 48 - Stagestop Road



Interchange Alternative 3a
Relocated Diamond Interchange

Figure 21.
Exit 48 Alternative 3a

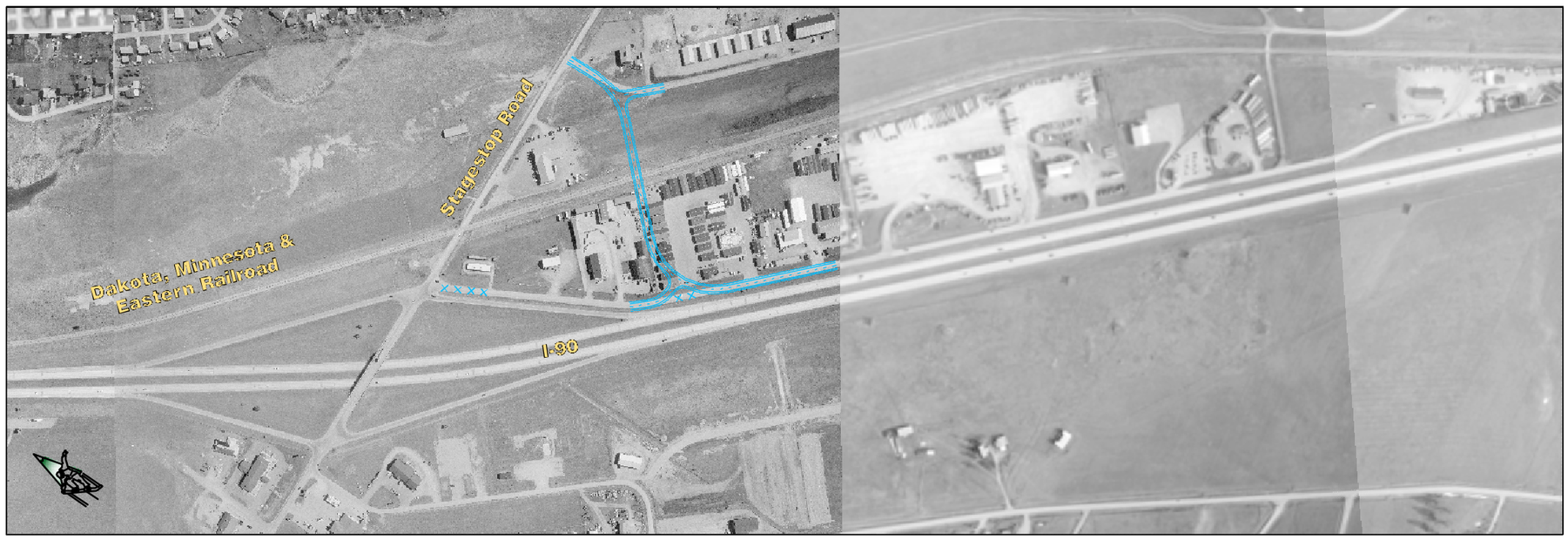
I-90 Exit 48 - Stagestop Road



North Access Alternative 1
South J.B. Road Connection

★ MOST FEASIBLE ALTERNATIVE

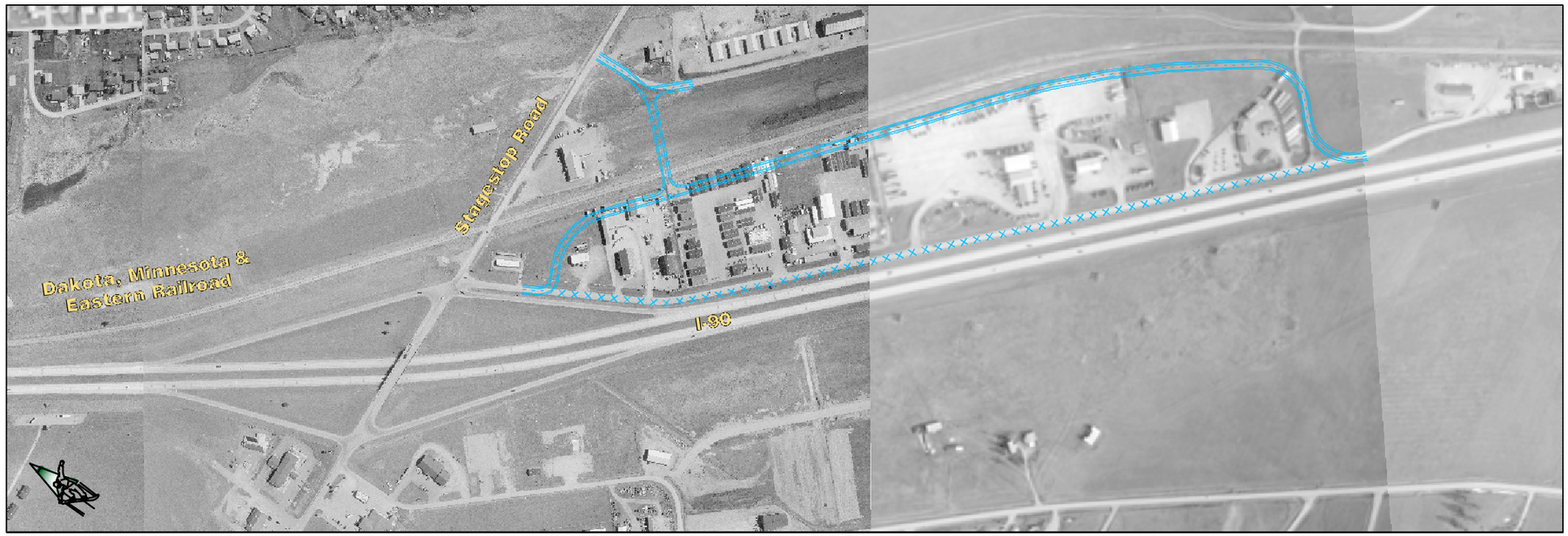
Estimated Construction Costs
$300,000
Estimated Right-of-Way Requirements
1.0 Acres



North Access Alternative 2
North J.B. Road Connection

Figure 22.
Exit 48 North Access
Alternatives 1 and 2

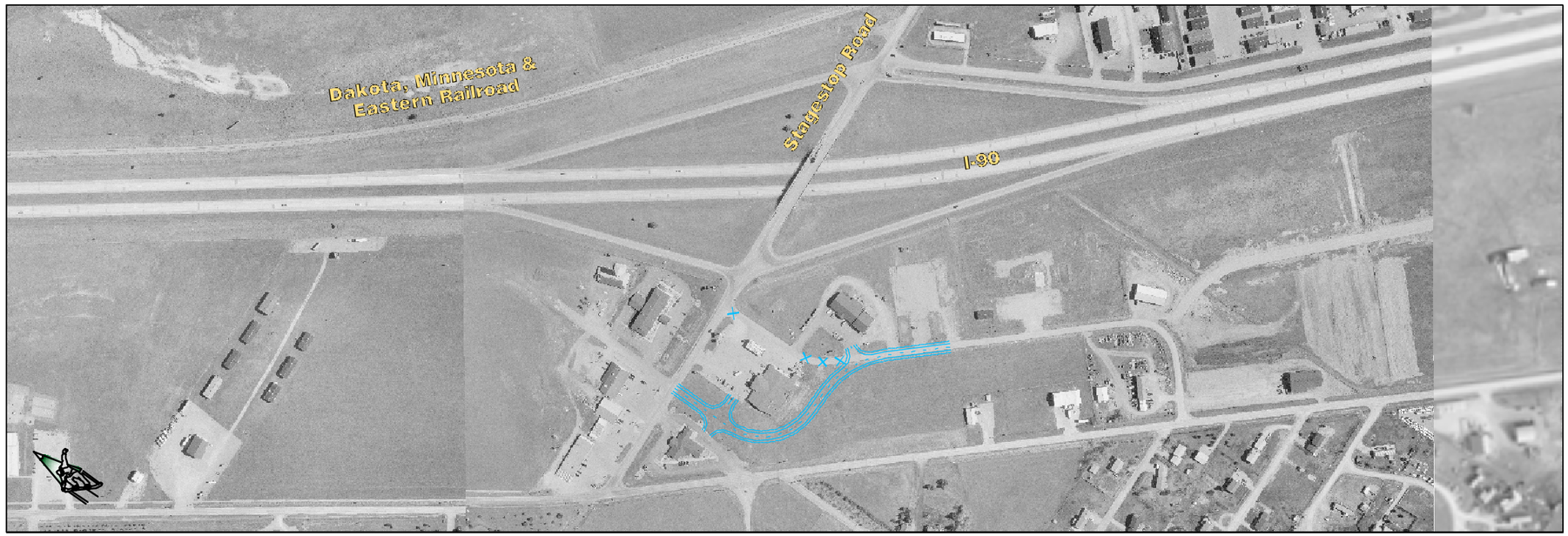
I-90 Exit 48 - Stagestop Road



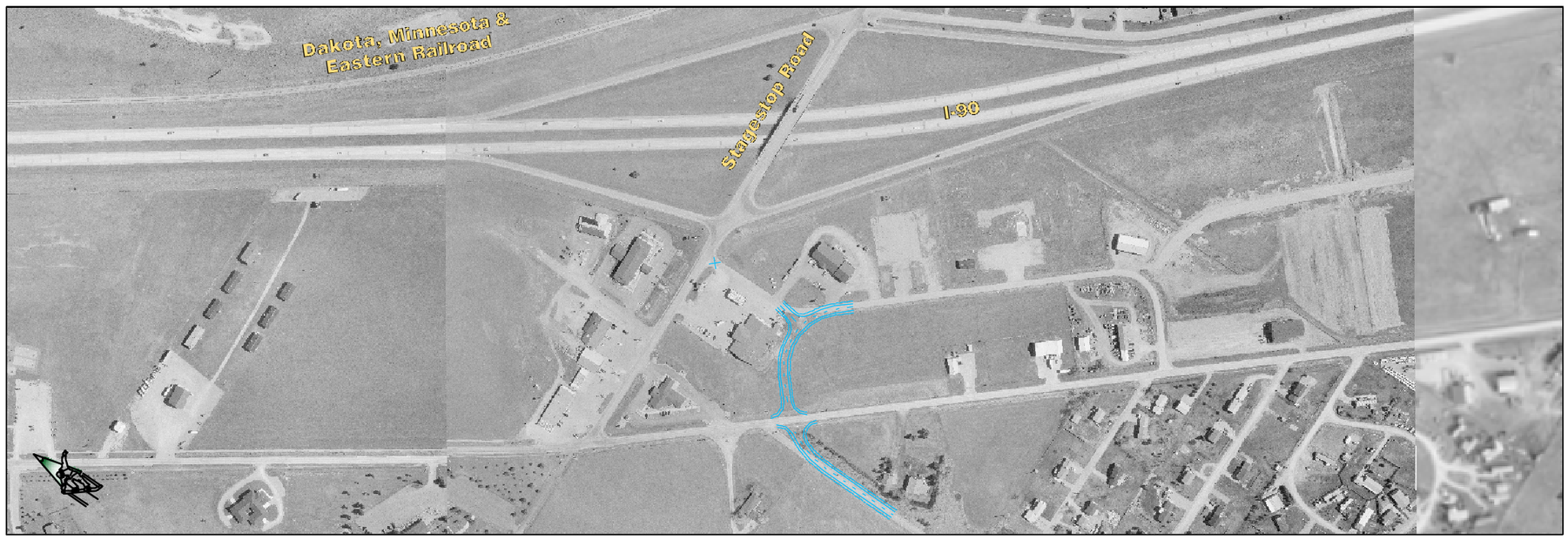
North Access Alternative 3
Frontage Road Relocation

Figure 23.
Exit 48 North Access
Alternative 3

I-90 Exit 48 - Stagestop Road



South Access Alternative 1
Realigned Access Road



South Access Alternative 2
New SD 79 Access

★ MOST FEASIBLE ALTERNATIVE

Estimated Construction Costs
$500,000
Estimated Right-of-Way Requirements
1.4 Acres

Figure 24.
Exit 48 South Access
Alternatives 1 and 2

I-90 East of Exit 48

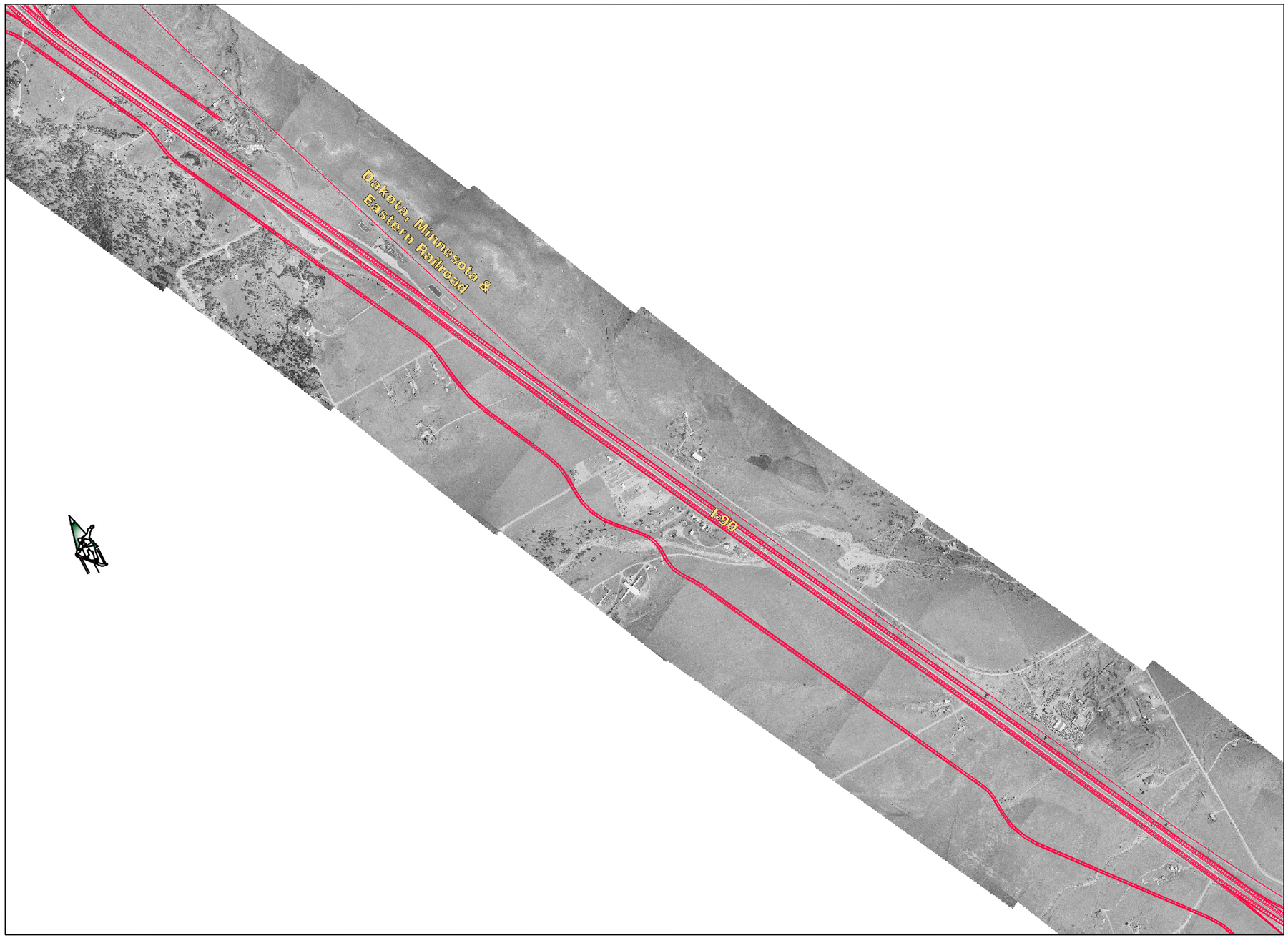
Interchange Alternative 1
Realigned I-90 as it ties into existing I-90 east of Exit 48

MOST FEASIBLE ALTERNATIVE

Estimated Construction Costs
$13.6 Million
Estimated Right-of-Way Requirements
23.7 Acres

Figure 25.
East of Exit 48 Alternative 1

Exit 40 to Exit 44 Frontage / Local Roads

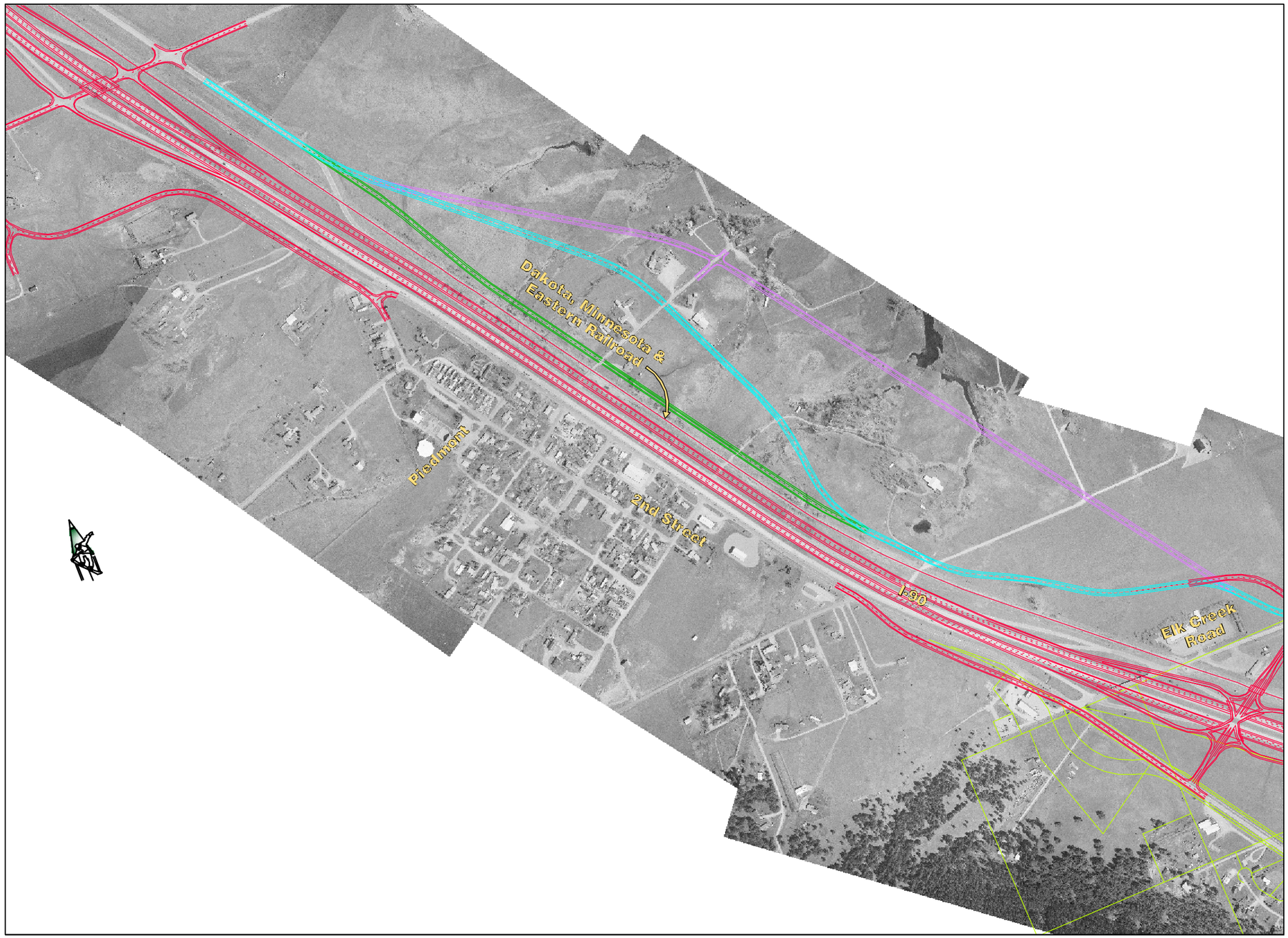


Frontage / Local Road Alternative 1 - Realigned South Frontage / North Access Roads

Estimated Construction Costs
(South Frontage Road Only)
$4.9 Million
Estimated Right-of-Way Requirements
(South Frontage Road Only)
43.5 Acres
Estimated Construction Costs
(North Access Road Only)
$1.2 Million
Estimated Right-of-Way Requirements
(North Access Road Only)
7.5 Acres

Figure 26.
Exit 40 to 44 Alternative 1

Exit 44 to Exit 46 Frontage / Local Roads



Frontage / Local Road Alternative 1
Realigned I-90 and Frontage Roads

★ MOST FEASIBLE ALTERNATIVE

Estimated Construction Costs
(North Frontage Road Only)
$2.0 Million
Estimated Right-of-Way Requirements
(North Frontage Road Only)
15.2 Acres
Estimated Construction Costs
(South Frontage Road Only)
$1.8 Million
Estimated Right-of-Way Requirements
(South Frontage Road Only)
10.9 Acres

Figure 27.
Exit 44 to 46 Alternative 1

4.3 Evaluation of Alternatives

To identify a Most Feasible Alternative, the alternatives described above were evaluated in ten categories. The evaluation categories are listed in Table 14, along with the criteria considered in evaluating each.

Table 14. Alternative Evaluation Categories and Criteria

Category	Criteria
Traffic and Service	Level of Service enhancement, need for signalization, impacts on local access
Geometrics	Improvement of existing geometric deficiencies
Right of way	Estimate of necessary acquisitions
Safety	Improvement of existing hazardous conditions
Environmental	Potential for wetland area, noise, water quality, wildlife, and 4(f) / 6(f) impacts
Development	Required relocations, impacts on businesses / residences which will remain
Utilities	Impacts to existing utilities (water, gas, electrical)
Costs	Preliminary opinion of probable construction cost
Flexibility	Ease of construction in phases
Constructability	Ease or difficulty associated with construction of the alternative

The performance of each alternative was evaluated according to these criteria and assigned a rating of good, fair, or poor in each category. The ratings were compiled to provide SDDOT decision makers with a tool for comparing the alternatives and selecting a Most Feasible Alternative for each location for which multiple alternatives were developed. Included in this list were the Exit 34, 44, 46, and 48 interchanges and the Exit 48 north and south access alternatives. Improvements necessary at the other locations were captured with a single alternative.

4.4 Selection of Most Feasible Alternative

The results of the evaluation of the alternatives were compiled in the form of evaluation matrices to facilitate comparison between the alternatives. The full matrices are included in tabular form in Appendix B. The Most Feasible Alternatives for each location are listed in Table 15 along with the basic reason for their selection. The selections made at each interchange were combined to form the Most Feasible Alternative for the corridor. In some cases, more than one Most Feasible Alternative was selected to provide additional flexibility in future implementation.

Table 15. Summary of Most Feasible Alternative

Location	Most Feasible Alternative(s)	Principal Reasons for Selection	Figure Number
Exit 34	1	Minimal right of way needs, good constructability, lesser impacts to Black Hills National Cemetery.	10
	2	Would be adaptable to potential future SD 79 extension and would provide grade-separated railroad crossing.	11
Exit 37	1	Would address geometric deficiencies.	12
Exit 40	1	Would address geometric deficiencies.	13
Exit 44	1	Would address geometric deficiencies.	14
	1a	Would address geometric deficiencies and add grade-separated railroad crossing.	15
Exit 46	3	Would address severe bridge skew and grade-separate the railroad crossing, would maximize separation between potential future signalized intersections.	18
Exit 48	2	Would address geometric deficiencies and minimize need for right of way acquisition.	19
	3	Would provide additional flexibility in phasing of construction, would address bridge skew angle, would address tight access condition north of interchange.	20
Exit 40 to 44 south frontage road	1	Would realign frontage road to accommodate six-lane I-90 and provide separation from mainline.	26
Exit 40 north access road	1	Would realign north access road to provide separation from I-90.	26
Exit 44 south frontage road	1	Would realign south frontage road to connect with County Road.	27
Exit 46 south frontage road	1	Would realign south frontage road to connect with County Road.	27
Exit 44 to 46 north frontage road	1	Would realign frontage roads to provide separation from I-90 and additional space for main Piedmont access road south of I-90. Removes multiple at-grade railroad crossings.	27
Exit 48 north access	1	Would be relatively inexpensive to construct while improving access spacing, lesser right of way impacts.	22
Exit 48 south access	2	Would be flexible to accommodate a variety of future development plans and would enhance access control along the service road.	24

4.5 Description of Most Feasible Alternative

It is clear from the alternative evaluation process that the driving factors behind the selection of the Most Feasible Alternative were geometric conditions, access control, flexibility, and projected traffic conditions. The Most Feasible Alternative would introduce two Single-Point Urban interchanges (Exits 46 and 48), while the remaining interchanges would be configured as standard diamond interchanges. The widening of I-90 to 6 lanes throughout the project corridor could not occur without realignment of frontage roads in several locations, most notably between Exits 44 and 46.

Railroad Crossings

The Most Feasible Alternative would eliminate several at-grade railroad crossings, while adding a number of grade-separated crossings of the DM&E Railroad. Table 16 highlights the balance of railroad crossings within the corridor. The DM&E typically requires that the addition of an at-grade crossing be balanced by the removal of two. Analysis shows that the addition of an at-grade crossing with Exit 48 north access Alternative 1 would be more than balanced by the 6 to 8 at-grade crossings that would be removed with implementation of the Most Feasible Alternative.

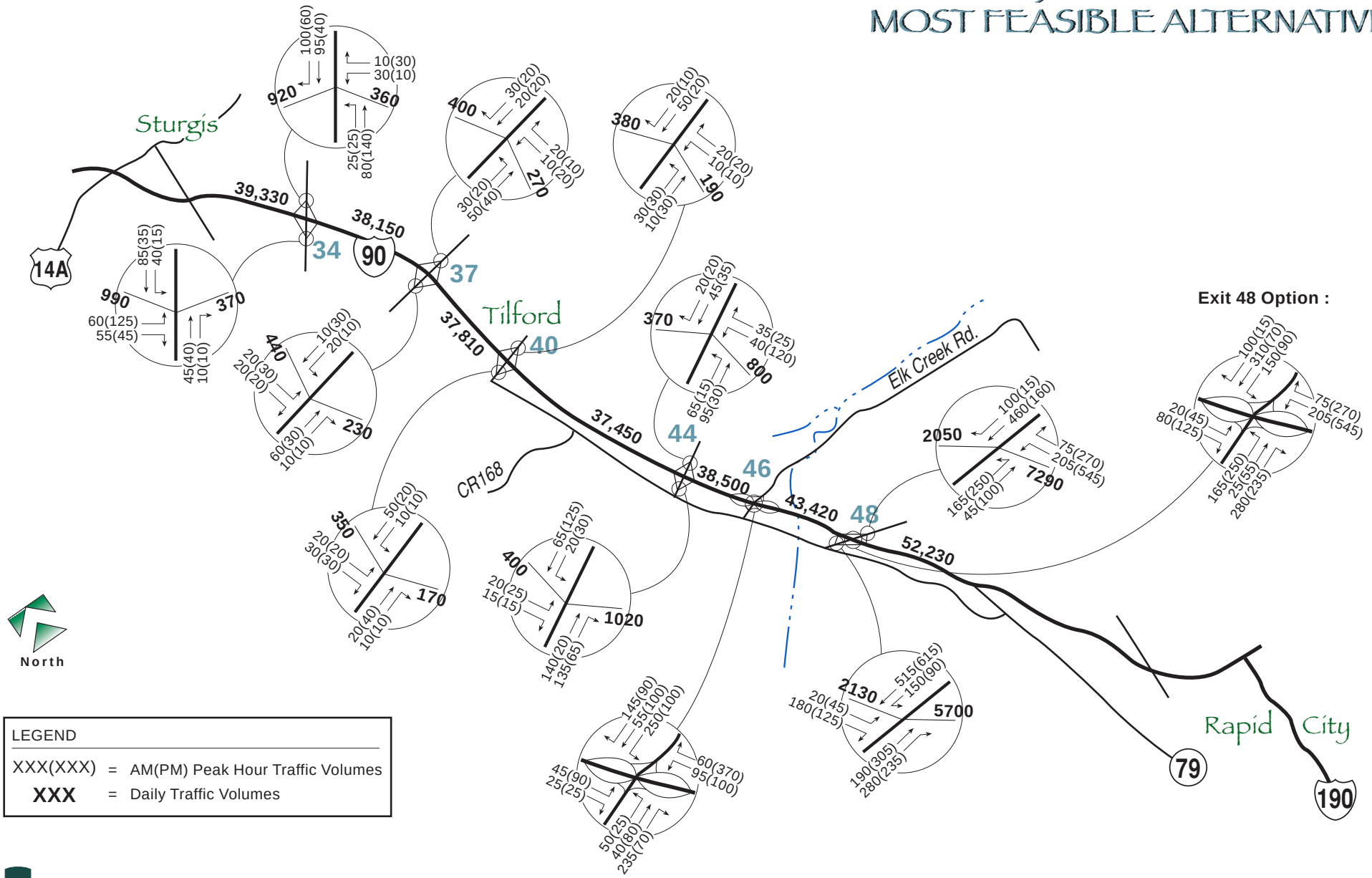
Table 16. Railroad Grade Crossing Balance – Most Feasible Alternative

Location	Alternative	At-grade Crossings Added	At-grade Crossings Removed
Exit 34	Alternative 1	0	0
	Alternative 2	0	1
Exit 37	Alternative 1	0	1
Exit 44	Alternative 1	0	0
	Alternative 1a	0	1
Exit 46	Alternative 3	0	1
Exit 48	Alternative 2	0	0
	Alternative 3	0	0
Exit 48 North Access	Alternative 1	1	0
Exit 44 to 46	Alternative 1	0	4
Total		**1**	**6 to 8**

Traffic Operations

Projected Year 2025 traffic volumes with the Most Feasible Alternative constructed are depicted on Figure 28, and traffic operations are depicted on Figure 29. As shown, all interchange ramp terminal intersections would operate at LOS B or better with implementation of the Most Feasible Alternative. All segments of mainline I-90 would operate at LOS B.

PROJECTED YEAR 2025 TRAFFIC VOLUMES
MOST FEASIBLE ALTERNATIVE

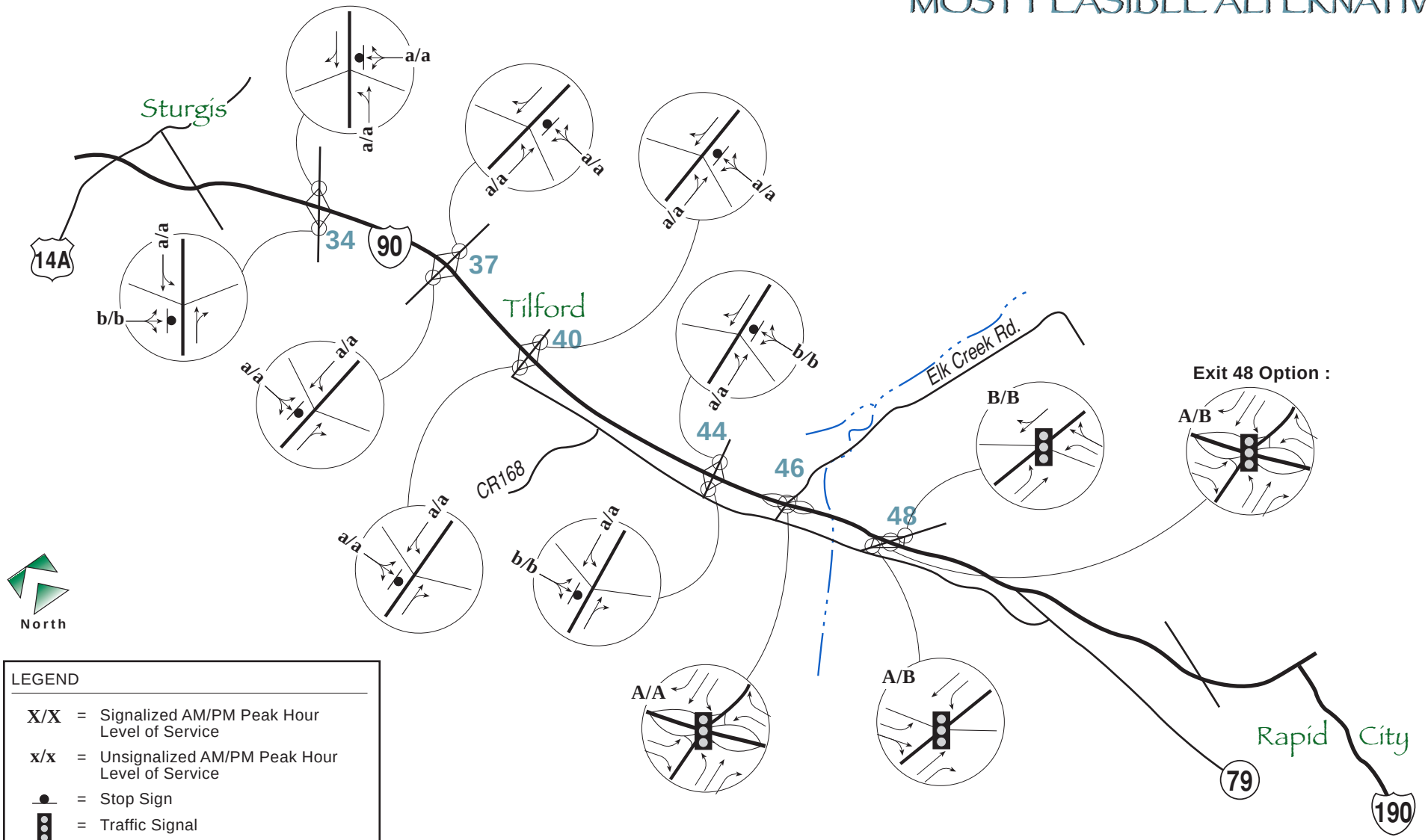


LEGEND

XXX(XXX) = AM(PM) Peak Hour Traffic Volumes

XXX = Daily Traffic Volumes

PROJECTED YEAR 2025 INTERSECTION LEVELS OF SERVICE
MOST FEASIBLE ALTERNATIVE



LEGEND

X/X	=	Signalized AM/PM Peak Hour Level of Service
x/x	=	Unsignalized AM/PM Peak Hour Level of Service
	=	Stop Sign
	=	Traffic Signal

5.0 IMPLEMENTATION PLAN

5.1 Corridor Preservation Strategy

A Corridor Preservation Strategy is necessary to protect the opportunity to implement the Most Feasible Alternative within the study corridor. As discussed in the Introduction, the goal of this project is to preserve the needed right of way in this corridor for the project improvements that are found to be most feasible by this study. The selection of a Most Feasible Alternative serves to identify needed improvements within the study corridor, and a corridor preservation strategy outlines the steps necessary to preserve needed right of way. It should include the following elements:

- Develop listing of projects within the Most Feasible Alternative for the corridor
- Prioritize those projects based on relative benefits and costs
- Identify upcoming steps in the project implementation process
- Establish immediate next steps

Project Listing

A project-by-project listing of the elements included in the Most Feasible Alternative is shown in Table 17. The projects are categorized as one of three project types: Interchange Reconstruction (ICR), Interstate Widening (W), or Frontage Road / Local Road improvement (F/L).

Table 17. Most Feasible Alternative Projects

Project Location	Project Type*	Alternative	Project Description	Figure Number
Exit 34	ICR	1	Diamond Interchange	10
		2	Shifted Diamond Interchange	11
Exit 37	ICR	1	Diamond Interchange	12
Exit 40	ICR	1	Diamond Interchange	13
Exit 44	ICR	1	Diamond Interchange (I-90 over)	14
		1a	Diamond Interchange (I-90 under)	15
Exit 46	ICR	3	Shifted Single-Point Urban Interchange	18
Exit 48	ICR	2	Single-Point Urban Interchange	19
		3	Shifted Single-Point Urban Interchange	20
East of Exit 48	W	1	4 to 6 lane widening	25
Exit 48 to Exit 46	W	1	4 to 6 lane widening	n/a
Exit 46 to 44	W	1	4 to 6 lane widening	n/a
Exit 44 to 40	W	1	4 to 6 lane widening	n/a
Exit 40 to 37	W	1	4 to 6 lane widening	n/a
Exit 37 to 34	W	1	4 to 6 lane widening	n/a
West of Exit 34	W	1	4 to 6 lane widening	n/a
Exit 40 to 44 south frontage road	F/L	1	Realign south frontage road to provide distance from mainline I-90.	26
Exit 40 north access road	F/L	1	Realign north access road to provide distance from mainline I-90.	26
Exit 44 south frontage road	F/L	1	Realign south frontage road to connect with County Road.	27
Exit 46 south frontage road	F/L	1	Realign south frontage road to connect with County Road.	27
Exit 44 to 46 north frontage road	F/L	1	Realign north frontage road north of railroad tracks.	27
Exit 48-North Access	F/L	1	Realign north frontage road to intersect with cross road north of RR tracks.	22
Exit 48-South Access	F/L	2	Reconstruct south frontage road to connect with service road.	24

* W = Interstate Widening
F/L = Frontage / Local Road Improvement
ICR = Interchange Reconstruction

Project Prioritization

Prioritization Methodology

A project prioritization methodology was developed to rank the projects identified in Table 17 based on relative costs and benefits.

Construction costs were estimated using the basic methodology used for the previous Corridor Study, and right of way costs were developed based on an estimate of the square footage

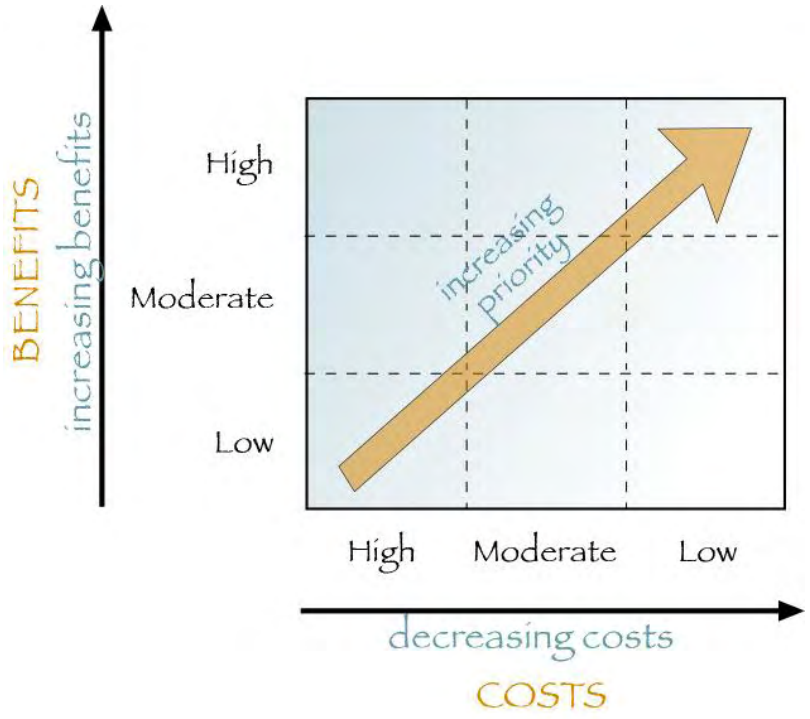
needed to accommodate each project. The sum of estimated construction and right of way costs comprised the total project cost.

Project benefits were assessed in four categories:

1. Traffic operations
2. Traffic safety
3. Improvements to structural and / or geometric deficiencies, and
4. Ability to implement improvements.

Information used in the initial alternatives evaluation process was used to comparatively assess benefits in the four categories listed above. Locations showing greater existing or projected traffic congestion translated to higher operational benefits to be delivered by implementation of the project. Similarly, improvements to locations with higher accident rates were ranked highly in the traffic safety category. Improvements to structural and / or geometric deficiencies were highlighted based on the year of construction and structural rating (where available) and corrected geometric deficiencies. The ability to implement improvements was rated based on the flexibility and constructability measures included in the evaluation of alternatives. Also considered in the ability to implement category was the likelihood of obstacles to project completion, such as neighborhood resistance. Projects currently listed in the Statewide Transportation Improvement Program (STIP) were highly rated in the ability to implement.

The relative costs and benefits of each project were ranked as High, Moderate, or Low, and then charted using the prioritization grid below. The higher priority projects were those showing relatively high benefits for low costs (upper right portion of chart) and, conversely, lower priority projects were those showing relatively low benefits for high costs (lower left).



Prioritization Results

The estimated construction costs are shown in Table 18 along with the estimated right of way required to implement each. Construction costs range between $300,000 for the north access realignment at Exit 48 to $17.8 Million for the widening of I-90 between Exits 44 and 40. Implementation of the Most Feasible Alternative would require the acquisition of a significant amount of right of way. Estimated right of way needs peak at 43.5 Acres for the realignment of the south frontage road between Exits 40 and 44.

Table 18. Estimated Construction Costs and Right of Way

Project Location	Alternative	Construction Costs	Right of Way (Acres)
Interchange Reconstruction Projects			
Exit 34 Reconstruction	1	$6.0 Million	4.7
	2	$8.1 Million	15.6
Exit 37 Reconstruction	1	$5.6 Million	5.6
Exit 40 Reconstruction	1	$5.9 Million	6.0
Exit 44 Reconstruction	1	$7.7 Million	0.3
	1a	$7.4 Million	3.3
Exit 46 Reconstruction	3	$5.4 Million	2.5
Exit 48 Reconstruction	2	$4.9 Million	5.7
	3	$6.4 Million	9.4
I-90 Widening Projects			
East of Exit 48	1	$13.6 Million	23.7
Exit 48 to Exit 46	1	$9.2 Million	10.4
Exit 46 to 44	1	$6.0 Million	0.0
Exit 44 to 40	1	$17.8 Million	0.0
Exit 40 to 37	1	$12.8 Million	0.0
Exit 37 to 34	1	$8.8 Million	0.0
West of Exit 34	1	$9.6 Million	0.0
Frontage / Local Road Projects			
Exit 40 to 44 south frontage road	1	$4.9 Million	43.5
Exit 40 north access road	1	$1.2 Million	7.5
Exit 44 south frontage road	1	$1.2 Million	7.4
Exit 46 south frontage road	1	$600,000	3.5
Exit 44 to 46 north frontage road	1	$2.0 Million	15.2
Exit 48-north access realign	1	$300,000	1.0
Exit 48-south access realign	2	$500,000	1.4

Relative project benefits are shown in Table 19. The project benefits were rated in each category to develop an overall benefit rating for each project.

Table 19. Relative Project Benefits

Project Location	Alternative	Operational Benefits	Safety Benefits	Structural / Geometric Condition Benefits	Ability to Implement
Interchange Reconstruction Projects					
Exit 34 Reconstruction	1	L	H	M	M
	2	L	H	H	L
Exit 37 Reconstruction	1	L	L	H	M
Exit 40 Reconstruction	1	L	M	M	M
Exit 44 Reconstruction	1	L	H	H	H
	1a	L	H	H	H
Exit 46 Reconstruction	3	M	M	H	M
Exit 48 Reconstruction	2	H	M	M	M
	3	H	M	H	M
I-90 Widening Projects					
East of Exit 48	1	H	M	M	M
Exit 48 to Exit 46	1	M	M	M	M
Exit 46 to 44	1	L	M	M	L
Exit 44 to 40	1	L	M	M	M
Exit 40 to 37	1	L	M	M	M
Exit 37 to 34	1	L	M	M	M
West of Exit 34	1	L	M	M	M
Frontage / Local Road Projects					
Exit 40 to 44 south frontage road	1	L	H	M	L
Exit 40 North access road	1	L	H	M	L
Exit 44 south frontage road	1	L	H	H	L
Exit 46 south frontage road	1	L	H	H	L
Exit 44 to 46 north frontage road	1	L	H	H	L
Exit 48-north access realign	1	M	H	L	H
Exit 48-south access realign	2	M	M	L	M

H = High Benefits, M = Moderate Benefits, L = Low Benefits

The results of the prioritization process are shown in Table 20. The projects were categorized as High, Moderate or Low priorities based on the relative costs and benefits of each.

Table 20. Prioritized List of Projects

Project Location	Project Type*	Alternative	Project Description
High Priority Projects			
Exit 48-north access	F/L	1	Realign north frontage road to intersect with cross road north of RR tracks.
Exit 48-south access	F/L	2	Reconstruct south frontage road to connect with service road.
Exit 44 to 46 north frontage road	F/L	1	Realign north frontage road north of railroad tracks.
Exit 46 south frontage road	F/L	1	Realign south frontage road to connect with County Road.
Exit 44 south frontage road	F/L	1	Realign south frontage road to connect with County Road.
Exit 46	ICR	3	Shifted Single-Point Urban Interchange
Exit 44	ICR	1	Diamond Interchange (I-90 over)
		1a	Diamond Interchange (I-90 under)
Moderate Priority Projects			
Exit 48	ICR	2	Single-Point Urban Interchange
		3	Shifted Single-Point Urban Interchange
Exit 34	ICR	1	Diamond Interchange
		2	Shifted Diamond Interchange
Exit 40 to 44 south frontage road	F/L	1	Realign south frontage road to provide distance from mainline I-90.
East of Exit 48	W	1	4 to 6 lane widening
Exit 48 to 46	W	1	4 to 6 lane widening
Exit 46 to 44	W	1	4 to 6 lane widening
Low Priority Projects			
West of Exit 34	W	1	4 to 6 lane widening
Exit 37 to 34	W	1	4 to 6 lane widening
Exit 40 to 37	W	1	4 to 6 lane widening
Exit 44 to 40	W	1	4 to 6 lane widening
Exit 40 north access road	F/L	1	Realign north access road to provide distance from mainline I-90.
Exit 37	ICR	1	Diamond Interchange
Exit 40	ICR	1	Diamond Interchange

* W = Interstate Widening
F/L = Frontage / Local Road Improvement
ICR = Interchange Reconstruction

As shown in Table 20, the projects are split nearly evenly into High, Moderate, and Low priority categories. The High priority projects include interchange reconstruction and access enhancements to Exit 48 and interchange reconstruction of Exits 46 and 44. The Moderate category includes the realignment of the south frontage road between Exits 40 and 44, along with widening of I-90 between Exit 44 and east of Exit 48. The majority of corridor widening projects are included in the Low priority category, along with interchange reconstruction at Exits

37 and 40. Reconstruction of Exits 37 and 40 is not planned to include major changes to the existing configurations, so those projects may be completed when the physical condition (pavement, structures) so requires.

The project prioritization shown in Table 20 provides a basis for initiating the process of planning and constructing the improvements included in the Most Feasible Alternative.

5.2 Project Implementation Steps

The project implementation process is depicted graphically on Figure 30. This diagram depicts the steps necessary to progress from the Corridor Preservation Study / Strategy to eventual construction. The implementation process includes the development of an agreement between the SDDOT and Meade County to accept the Corridor Preservation Plan and to establish guidelines for preservation of right of way for future improvements; inclusion of projects in the Regional Transportation Plan and STIP; completion of appropriate environmental clearance documents; and final design / construction.

As shown on Figure 30, responsibilities for various elements of the implementation process would be distributed among several entities. The SDDOT would bear primary responsibility for the majority of tasks, while the Federal Highway Administration would serve as the Lead Agency for the NEPA documentation and the Rapid City Metropolitan Planning Organization (MPO) would include Corridor Preservation projects in the regional plan.

Immediate Next Steps

SDDOT / Meade County Agreement

It is important to secure an agreement between the SDDOT and Meade County to facilitate the process of reserving and / or acquiring the right of way necessary to construct the Most Feasible Alternative. An intergovernmental agreement or Memorandum of Understanding may serve this purpose. The signed agreement should state that SDDOT and Meade County will, to the best of their ability, adhere to the recommendations of this Corridor Preservation Study.

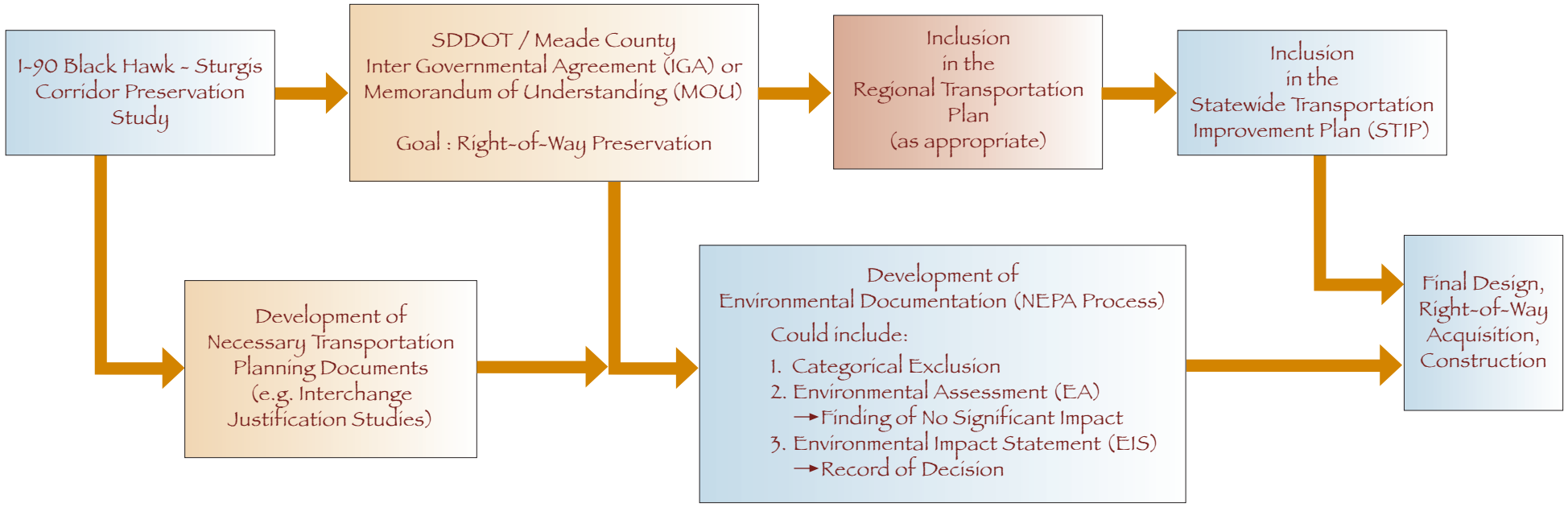
Right of Way Strategic Plan

Detailed right of way information was not available for this study. However, it is important that additional research will be performed to better identify existing right of way limits and to better define specific portions of right of way (plats, etc.) to be preserved / acquired.

As a central goal of the project, the process of preserving the right of way necessary to construct the Most Feasible Alternative is considered an immediate next step. At the discretion of the SDDOT, this process could be pursued in one of two ways:

- Right of way preservation could be performed corridor wide before any further steps in the implementation process, or
- Right of way preservation / acquisition could occur on a project-by-project basis in the midst of the implementation process.

PROJECT IMPLEMENTATION PROCESS



LEGEND

= Primary Responsibility = SDDOT

= Primary Responsibility = Rapid City Metropolitan Planning Organization (MPO)

= Joint SDDOT / Meade County Responsiblity

Identification of Project Limits

There are multiple options available to SDDOT decision makers in identifying project limits for the purpose of implementing the Most Feasible Alternative, including the following:

- The projects may be implemented together as a corridor wide improvement.
- Projects may be implemented individually.
- Projects may be linked together in logical packages.

As an example of the last option, the widening of I-90 between Exits 44 and 46 could be constructed in tandem with the realignment of frontage roads within this segment. Improvements to Exit 48, including access road realignments and interchange reconstruction, are all rated as high priority projects that could be packaged together.

An immediate next step would be for the SDDOT to make a determination on the appropriate approach to identifying project limits.

Subsequent Steps

Following these immediate next steps, when decisions regarding the right of way strategy and project limits have been made, the remainder of the implementation process can proceed. Specific needs for planning and environmental documentation will be apparent. Interchange Justification Studies may be conducted as needed, the NEPA process may be initiated for an individual project or collection of projects, and the necessary institutional actions (local, MPO, State) can be undertaken.

APPENDIX A ACCIDENT DATA

Table 1.
Mainline I-90 Accident Rates

Beginning Mile Post	End Mile Post	Average Daily Traffic Per Segment (Vehicles Per Day)	Average Annual Traffic Per Segment (Vehicles Per Year)	Number of Accidents by type 2002 Fatal	Injury	Prop.	2000-2002 Total	Weighted 3-year Accidents	Crash Rate 3-year (Wtd. Acc. / MVMT)
32.00	32.99	16,930	6,179,450	1	5	9	15	36	1.94
33	***33.99***	***16,930***	***6,179,450***	***0***	***11***	***24***	***35***	***57***	***3.07***
34.00	34.99	16,170	5,902,050	0	4	19	23	*31*	1.75
35	35.99	16,170	5,902,050	0	4	6	10	*18*	1.02
36.00	36.99	16,170	5,902,050	1	5	8	14	*35*	1.98
37	37.99	15,990	5,836,350	0	3	8	11	*17*	0.97
38.00	38.99	15,990	5,836,350	1	4	14	19	38	2.17
39	39.99	15,990	5,836,350	0	4	7	11	*19*	1.09
40.00	40.99	15,800	5,767,000	0	1	9	10	*12*	0.69
41	41.99	15,800	5,767,000	1	1	8	10	*23*	1.33
42.00	42.99	15,800	5,767,000	0	2	5	7	*11*	0.64
43	43.99	15,800	5,767,000	1	2	9	12	*27*	1.56
44.00	44.99	16,310	5,953,150	0	1	11	12	*14*	0.78
45	45.99	16,310	5,953,150	0	3	10	13	*19*	1.06
46.00	46.99	18,120	6,613,800	0	2	8	10	*14*	0.71
47	47.99	18,120	6,613,800	0	0	15	15	*15*	0.76
48.00	48.99	20,750	7,573,750	0	5	9	14	*24*	1.06
49	49.99	20,750	7,573,750	0	3	10	13	*19*	0.84
50.00	***50.99***	***20,750***	***7,573,750***	***1***	***5***	***24***	***30***	***51***	***2.24***

Weighted Points		Totals	6	213	65	284	480	
Fatal =	12	Average	0.32	11.21	3.42	14.95	25.26	1.35
Injury =	3	Median	0	9	3	13	19	1.06
Property =	1	Std. Dev.	0.48	5.56	2.41	7.18	13.04	0.67

High Accident Ranking Analysis
Classic Statistical Metho Manual of Transportation Engineering Studies, ITE, 1994, page 204

OB = XA + (K*S)

OB = accident frequency or rate at location	2.21
XA = mean frequency or rate for all locations	1.35
K = constant corresponding to level of confidence (90%)	1.28
S = sample standard deviation for all locations	0.67

High Accident Locations w/ Weighted Accidents / MVMT>2.21
(assuming 90%level of confidence)

Table 2.
Ranking of Accident rates by Interchange

Rank	Interchange	Average Daily Traffic Interchange Area (Vehicles Per Day)	Average Annual Traffic Interchange Area (Vehicles Per Year)	Number of Accidents By Type 2000 to 2002 Fatal	Injury	Prop.	Total	Weighted 3-year Accidents	Crash Rate 3-year (Wtd. Acc. / MEV)
1	Exit 44	18,323	6,687,895	0	4	13	17	25	1.25
2	Exit 34	19,310	7,048,150	0	8	0	8	24	1.14
3	Exit 46	22,888	8,354,120	0	7	4	11	25	1.00
4	Exit 48	30,098	10,985,770	0	6	7	13	25	0.76
5	Exit 40	16,546	6,039,290	0	4	1	5	13	0.72
6	Exit 37	16,900	6,168,318	0	1	5	6	8	0.43

Weighted Points		High Accident Locations w/ Weighted Accidents / MEV>2.12
Fatal =	12	(assuming 90%level of confidence)
Injury =	3	(high accident threshold based on larger sample size of previous
Property =	1	corridor study, which analyzed years 1997-1999)

APPENDIX B ALTERNATIVE EVALUATION MATRICES

I-90 Exit 34 - Black Hills National Cemetery

I-90 Sturgis - Black Hawk Corridor Preservation Study

PRELIMINARY
ALTERNATIVE SCREENING MATRIX

ALTERNATIVE EVALUATION CRITERIA

		Traffic and Service	*Geometrics*	**Right-of-Way**	*Safety*	*Environmental*	*Development*	*Utilities*	*Implementation Considerations*			*Overall Rating*	*General Notes*
									Cost	*Flexibility*	*Constructability*		
PROPOSED ALTERNATIVES	***Alternative 1 – Diamond Interchange***	Would accommodate Year 2025 traffic volumes at an acceptable Level of Service. Signals may be required if SD 79 connection were built here. ☐	Would address some existing deficiencies (ramp tapers, sight distance), but would not address close frontage road and RR spacing. Minimal new ROW needs. ■	Minimal new ROW needs. ☐	Not currently a high accident location. Improvements to existing geometric deficiencies would enhance safety, though tight ramp spacing would remain. ☐	Lesser impacts than other alternatives as it would maintain current interchange location. ☐	Requires no modification of existing Cemetery access, and does not impact developable land north of the interchange. ☐	An overhead electric distribution line crosses the interstate on the west side of the interchange. It appears there would be no conflicts. ☐	$6.0 Million ◪	Could be adapted to accommodate various Cemetery access options. Not as accommodating to a potential future SD 79 connection. ■	Relatively easy to construct - mostly improvements to existing interchange. I-90 bridges may provide most significant challenge. ☐	* ☐	Chosen as Most Feasible Alternative
	Alternative 1a – Single-Point Urban Interchange	Would accommodate Year 2025 traffic volumes at an acceptable Level of Service. Signal would be required for traffic control at single-point intersection. ☐	Would address existing deficiencies, including a marginal improvement to the close frontage road and RR spacing south of the interchange. Minimal ROW impacts. ◪	Minimal ROW impacts. ☐	Not currently a high accident location. Improvements to existing geometric deficiencies would enhance safety, though intersection spacing would remain tight. ☐	Lesser impacts than other alternatives as it essentially would maintain current interchange location. ☐	Requires no modification of existing Cemetery access, and does not impact developable land north of the interchange. ☐	An overhead electric distribution line crosses the interstate on the west side of the interchange. It appears there would be no conflicts. ☐	$6.0 Million ◪	Could be adapted to accommodate various Cemetery access options. Not as accommodating to a potential future SD 79 connection. ■	Structures for I-90 would present added construction difficulty. ◪	☐	Screened from consideration based on SDDOT input.
	Alternative 2 – Realigned Diamond Interchange	Would accommodate Year 2025 traffic volumes at an acceptable Level of Service. Signals may be required if SD 79 connection were built here. ☐	Would address existing deficiencies, notably tight frontage road and railroad spacing both north and south of the interchange. Would require additional Right-of-way north of interchange. Railroad grade separation would require alternative Cemetery access. ☐	Would require additional Right-of-way north and south of I-90. ■	Not currently a high accident location. Construction of new interchange to SDDOT standards would enhance safety. ☐	Some environmental impacts would likely be associated with the alignment of cross-road along west edge of Cemetery. South cross-road realignment would intersect depression that likely serves as drainage basin. ◪	Would maintain access to existing properties, including chapel north of I-90 and Fort Meade Rec. Area. Would impact developable land within the BLM parcel. Would impact access to the Cemetery, which would be accommodated with a south extension of the cross road. ◪	The realigned cross road would be in direct conflict with an overhead electric distribution line that crosses the interstate at the same location. ◪	$8.1 Million ■	Alternative could accommodate a relocated main Cemetery access. Alignment of cross-road more accepting of potential future SD 79 connection. Alternative would require significant adjustments to Cemetery access. ☐	Topography lends itself to relocating the interchange and cross road. ◪	* ◪	Could be designated as Most Feasible Alternative if SD 79 extension connects at Exit 34 and / or Cemetery expands west. Would provide additional flexibility to accommodate a potential future SD 79 connection, Cemetery Expansion and railroad grade separation.

☐ "Good" ◪ "Fair" ■ "Poor"

I-90 Exit 37 - Pleasant Valley Road

I-90 Sturgis - Black Hawk Corridor Preservation Study

PRELIMINARY ALTERNATIVE SCREENING MATRIX		ALTERNATIVE EVALUATION CRITERIA									
									Implementation Considerations		
		Traffic and Service	***Geometrics***	***Right-of-way***	***Safety***	***Environmental***	***Development***	***Utilities***	***Cost***	***Flexibility***	***Constructability***
PROPOSED ALTERNATIVES	***Alternative 1 – Diamond Interchange with realigned north ramps***	Would accommodate projected Year 2025 traffic volumes at an acceptable Level of Service. Diamond interchange would likely accommodate a SD 79 connection, but may require signalization and auxiliary lanes to do so.	Construction of an enhanced diamond would address substandard sight distances along cross road and ramps, and would increase spacing between ramp termini. Shifting north ramp terminal would require significant earth work to address existing side slope. Geometric enhancement is a grade separated railroad crossing south of the interchange.	Right-of-way would be needed to shift ramps north and accommodate ramp side slopes.	Current interchange not a safety problem. However, addressing geometric deficiencies would enhance safety.	Significant cut / fill required to accommodate relocated westbound ramps. However, environmental impacts are likely to be minimal.	No relocations would be required by the proposed alternative. Access to existing campground in northwest quadrant would remain in its current location.	Improvements to Pleasant Valley Drive on the south side of the railroad tracks would cross the Williston Basin Pipeline. An overhead electric distribution line crosses the interstate on the east side of the interchange. The proposed westbound off ramp would come within 30 feet of an overhead electric pole.	$5.6 Million	The structure for Pleasant Valley Road over I-90 was constructed in 1957; therefore, removing and replacing the bridge may be warranted. Improvements to the diamond interchange configuration would accommodate a potential future SD 79 connection to I-90.	Significant amount of embankment would be required to accommodate the relocated westbound ramps.

I-90 Exit 40 - Tilford Road

I-90 Sturgis - Black Hawk Corridor Preservation Study

PRELIMINARY ALTERNATIVE SCREENING MATRIX		ALTERNATIVE EVALUATION CRITERIA									
									Implementation Considerations		
		Traffic and Service	***Geometrics***	***Right-of-way***	***Safety***	***Environmental***	***Development***	***Utilities***	***Cost***	***Flexibility***	***Constructability***
PROPOSED ALTERNATIVES	***Alternative 1 – Diamond with realigned frontage roads***	Diamond interchange would accommodate projected Year 2025 traffic volumes without need for signalization.	Cross road sight distance is currently substandard. This would be addressed with the proposed alternative along with substandard access spacing.	ROW acquisitions would be necessary for both the Clover Place realignment and the realignment of the south frontage road.	Current interchange does not show a significant accident history. However, addressing geometric deficiencies would enhance safety.	Minimal environmental impacts would be anticipated.	Realigned north access road (Clover Place) would impact properties along Tilford Road. Properties south of I-90 would be impacted by frontage road realignment.	An overhead electric distribution line will be impacted on the south side of the interchange. This same line also crosses the interstate on the west side of the interchange. The westbound on ramp comes wihin 15 feet of an overhead electric pole. The realigned frontage roads would be in conflict with overhead electric distribution lines.	$5.9 Million	Realignment of the frontage roads would be problematic with impacts to property owners.	Topography and the lack of a continuous Tilford Road south of the interchange would present some challenges to the frontage road realignment.

I-90 Exit 44 - Deerview Road

I-90 Sturgis - Black Hawk Corridor Preservation Study

PRELIMINARY ALTERNATIVE SCREENING MATRIX		ALTERNATIVE EVALUATION CRITERIA											
									Implementation Considerations				
		Traffic and Service	*Geometrics*	*Right-of-way*	*Safety*	*Environmental*	*Development*	*Utilities*	*Cost*	*Flexibility*	*Constructability*	*Overall Rating*	*General Notes*
PROPOSED ALTERNATIVES	***Alternative 1 – Diamond with realigned sout frontage road***	Diamond interchange would accommodate projected Year 2025 traffic volumes without need for signalization. ☐	Multiple geometric deficiencies exist throughout the interchange, including cross road and ramp sight distances and adjacent access spacing. These deficiencies would be addressed with reconstruction of the diamond interchange. Close railroad spacing north. ◪	ROW would need to be acquired south of the interchange. ◪	Not currently a high accident location. Correction of existing geometric deficiencies would enhance safety. ☐	Environmental impacts are not readily apparent. Investigation of frontage road realignment may reveal some conflicts. ☐	Parcel of land in southeast quadrant is currently for sale. Realignment of the south frontage road could help to facilitate development of this corner by encouraging access management and smoothing terrain. ☐	The south realigned frontage road would be in conflict with an overhead electric distribution line. The eastbound off ramp would come within 30 feet of the overhead electric line. ◪	$7.7 Million	Phasing of the ramp improvements and south frontage road realignment would be difficult. The bridges for I-90 over Piedmont Road, constructed in 1957, are currently structurally deficient and will soon be replaced. Phasing the bridge construction with I-90 will be problematic. ◪	Realignment of south frontage road would be complicated by topography in the southeast quadrant of the interchange. ◪	* ◪	Selected as Most Feasible Alternative
	Alternative 1a - Diamond with Piedmont Road over I-90	Diamond interchange would accommodate projected Year 2025 traffic volumes without need for signalization. ☐	Multiple geometric deficiencies exist throughout the interchange, including cross road and ramp sight distances and adjacent access spacing. These deficiencies would be addressed with reconstruction of the diamond interchange. Would implement a railroad grade separation north of I-90. ☐	ROW would need to be acquired south of the interchange. ◪	Not currently a high accident location. Correction of existing geometric deficiencies would enhance safety. ☐	Environmental impacts are not readily apparent. Investigation of frontage road realignment may reveal some conflicts. ☐	Parcel of land in southeast quadrant is currently for sale. Realignment of the south frontage road could help to facilitate development of this corner by encouraging access management and smoothing terrain. ☐	The south realigned frontage road would be in conflict with an overhead electric distribution line. The eastbound off ramp would come within 30 feet of the overhead electric line. ◪	$7.4 Million	Phasing of the ramp improvements, constructing Piedmont Road over I-90 and realigning the south frontage road would be difficult. Phasing the bridge construction over the railroad while maintaining Piedmont Road access across the railroad would be problematic. ◪	Realignment of south frontage road would be complicated by topography in the southeast quadrant of the interchange. Realignment of south ramps would also be complicated by hill in southeast quadrant. Vertical alignment of Piedmont Road would be complicated. ■	* ◪	Variation of Most Feasible Alternative that would construct a cross-road bridge over I-90.
	Alternative 1b - Diamond with south roundabout intersection	Diamond interchange would accommodate projected Year 2025 traffic volumes without need for signalization. ☐	Multiple geometric deficiencies exist throughout the interchange, including cross road and ramp sight distances and adjacent access spacing. These deficiencies would be addressed with reconstruction of the diamond interchange. Close railroad spacing north. ◪	Implementation of roundabout would reduce ROW needs south of the interchange in comparison with Alternative 1. ☐	Not currently a high accident location. Correction of existing geometric deficiencies would enhance safety. ☐	Environmental impacts are not readily apparent. Investigation of frontage road realignment may reveal some conflicts. ☐	Roundabout would not complement southeast quadrant development to the extent of Alternative 1. ◪	The south realigned frontage road would be in conflict with an overhead electric distribution line. The eastbound off ramp would come within 30 feet of the overhead electric line. ◪	$7.4 Million	Phasing of the ramp improvements and south frontage road realignment would be difficult. The bridges for I-90 over Piedmont Road, constructed in 1957, are currently structurally deficient and will soon be replaced. Phasing the bridge construction with I-90 will be problematic. ◪	Roundabout would be easier to construct with the existing topography than the south frontage road realignment. ☐	◪	

☐ "Good" ◪ "Fair" ■ "Poor"

I-90 Exit 46 - Elk Creek Road

I-90 Sturgis - Black Hawk Corridor Preservation Study

PRELIMINARY
ALTERNATIVE SCREENING MATRIX

ALTERNATIVE EVALUATION CRITERIA

		Traffic and Service	*Geometrics*	*Right-of-way*	*Safety*	*Environmental*	*Development*	*Utilities*	*Implementation Considerations*			*Overall Rating*	*General Notes*
									Cost	*Flexibility*	*Constructability*		
PROPOSED ALTERNATIVES	***Alternative 1 – Diamond interchange with realigned frontage roads***	Diamond interchange configuration would accommodate Year 2025 traffic demand at an acceptable Level of Service. Signalization of ramp terminals would be anticipated.	Would improve existing geometric deficiencies (assuming interstate is lowered and bridge may be as well). Would move adjacent frontage road intersections well away from interchange. Would not address bridge skew.	Right-of-way acquisition would be necessary to accommodate south frontage road realignment.	Not currently an elevated accident location. However, addressing the existing geometric deficiencies would improve traffic safety.	Avoids gas station. However, area surrounding gas station could be contaminated. A significant cut would be required to accommodate the south frontage road realignment. South side roundabout presents alternative that would reduce impacts.	Access to existing businesses would be maintained and property impacts would be negligible. Would not enhance opportunities for future development.	The widened Elk Creek Road would conflict with an overhead transmission line and a distribution line on the east side of Elk Creek Road. The realigned south frontage road would conflict with several ovehead electric lines adjacent to the substation.	$6.5 Million	Would maintain existing access constraints. Would not be as accommodating to future development as alternatives 2 and 3. Reconstruction of the bridge over I-90 would be difficult to phase.	Constructing the I-90 bridge and realigning the south frontage road would be complex but feasible.	◪	
	Alternative 1 Option - south roundabout	Diamond interchange configuration would accommodate Year 2025 traffic demand at an acceptable Level of Service.	Would improve existing geometric deficiencies (assuming interstate is lowered and bridge may be as well). Would not address bridge skew.	South roundabout option would reduce ROW impacts.	Not currently an elevated accident location. However, addressing the existing geometric deficiencies would improve traffic safety.	Would impact gas station.	Would impact existing gas station.	The widened Elk Creek Road would conflict with an overhead transmission line and a distribution line on the east side of Elk Creek Road.	$6.4 Million	Would maintain existing access constraints. Would not be as accommodating to future development as alternatives 2 and 3. Reconstruction of the bridge over I-90 would be difficult to phase.	Constructing the roundabout without shutting down the frontage road and ramps would be complex.	◪	
	Alternative 2 - Relocated Diamond with Realigned north frontage road	Diamond interchange configuration would accommodate Year 2025 traffic demand at an acceptable Level of Service. Signalization of ramp terminals would be anticipated.	Move to the east would increase spacing to north and south frontage roads almost as significantly as Alternative 1. Railroad overpass would improve geometric conditions. Would address existing cross road skew.	Would require ROW acquisitions north and south of I-90.	Not currently an elevated accident location. However, addressing the existing geometric deficiencies would improve traffic safety.	Would require take of triangular property in Northeast quadrant of interchange. Environmental status of this property is unknown.	Would retain access to existing businesses. Would accommodate access to new development by improving access management.	The realigned Elk Creek Road would conflict with an overhead electric distribution line that crosses Elk Creek Road north of the Railroad track.	$7.3 Million	Phasing of the relocation of the ramps to the new cross road would be moderately difficult.	Constructing the bridge over I-90 would be difficult while maintaining traffic on I-90 and the interchange ramps.	◪	
	Alternative 3 – Single Point Urban Interchange with North Frontage Road Connection	Diamond interchange configuration would accommodate Year 2025 traffic demand at an acceptable Level of Service. Single-point intersection would be signalized.	Move to the east would increase spacing to north and south frontage roads almost as significantly as Alternative 1. Would address existing cross road skew.	Would require ROW acquisitions north and south of I-90.	Not currently an elevated accident location. However, addressing the existing geometric deficiencies would improve traffic safety.	Would require take of triangular property in Northeast quadrant of interchange. Environmental status of this property is unknown.	Would retain access to existing businesses. Would accommodate access to new development by improving access management.	The realigned Elk Creek Road would conflict with an overhead electric distribution line that crosses Elk Creek Road north of the Railroad track.	$5.4 Million	Phasing of the relocation of the ramps to the new cross road would be moderately difficult.	Constructing the bridge over I-90 would be difficult while maintaining traffic on I-90 and the interchange ramps.	* ◪	Selected as Most Feasible Alternative.

□ "Good" ◪ "Fair" ■ "Poor"

I-90 Exit 48 - Stagestop Road
(Interchange Alternatives)

I-90 Sturgis - Black Hawk Corridor Preservation Study

PRELIMINARY ALTERNATIVE SCREENING MATRIX		ALTERNATIVE EVALUATION CRITERIA												
									Implementation Considerations					
		Traffic and Service	***Geometrics***	***Right-of-way***	***Safety***	***Environmental***	***Development***	***Utilities***	***Cost***	***Flexibility***	***Constructability***	***Overall Rating***	***General Notes***
PROPOSED ALTERNATIVES	***Alternative 1 – Diamond interchange***	Analysis of projected Year 2025 traffic volumes indicates an acceptable level of service if the interchange ramp terminals are signalized. Access spacing would improve. ☐	Reconstruction of the diamond interchange would address existing geometric deficiencies, with the exception of the cross road skew angle. ◪	No ROW impacts. ☐	This interchange is not currently categorized as a safety hazard. Improvement of existing geometric deficiencies would enhance safety. ☐	Minimal environmental impacts would be anticipated to occur with this alternative. ☐	Shifting the north ramp terminal south would help to improve access to development north of the interchange. ☐	The widening of Stagestop Road on the north side of the interchange would conflict with an overhead electric distribution line. ☐	$4.8 Million ☐	Reconstructing the bridge over I-90 would be difficult to phase. Diamond interchange could accommodate growth beyond Year 2025. ◪	Widening the bridge over I-90 while maintaining clearance under the structure may be problematic. ◪	☐	
	Alternative 2 - Single-Point Urban Interchange	Analysis of projected Year 2025 traffic volumes indicates an acceptable level of service if the interchange ramp terminal is signalized. Access spacing would improve. ☐	Construction of Alternative 2 would address existing geometric deficiencies, with exception of cross road skew angle. Would improve access spacing with single-point interchange. ☐	No ROW impacts. ☐	This interchange is not currently categorized as a safety hazard. Improvement of existing geometric deficiencies would enhance safety. ☐	Minimal environmental impacts would be anticipated to occur with this alternative. ☐	Construction of single-point interchange would improve access spacing along cross-road, enhancing development potential. ☐	The widening of Stagestop Road on the north side of the interchange would conflict with an overhead electric distribution line. ☐	$4.9 Million ☐	Constructing the bridge over I-90 would be difficult to phase. Single-point interchange could accommodate growth beyond Year 2025. ◪	The bridge for a Single Point Interchange would be difficult to construct over I-90. ■	* ☐	Selected as Most Feasible Alternative.
	Alternative 3 – Shifted Diamond Interchange	Analysis of projected Year 2025 traffic volumes indicates an acceptable level of service if the interchange ramp terminals are signalized. ☐	Construction of Alternative 3 would address existing geometric deficiencies, including the cross road skew angle. ☐	ROW acquisition would be required to accommodate realigned cross-road. ◪	This interchange is not currently categorized as a safety hazard. Improvement of existing geometric deficiencies would enhance safety. ☐	Minimal environmental impacts would be anticipated to occur with this alternative. ☐	Access to existing businesses would be maintained. Would help guide development west of the current interchange location. ☐	The realignment of Stagestop Road would conflict with overhead electric distribution lines north of the interchange. ◪	$6.4 Million ◪	Phasing the westbound ramps to the realigned cross road would be moderately difficult. ☐	Would be moderately difficult to construct. ◪	* ☐	Selected as Most Feasible Alternative.
	Alternative 3a – Relocated Diamond Interchange	Analysis of projected Year 2025 traffic volumes indicates an acceptable level of service if the interchange ramp terminals are signalized. Access to existing properties would be provided in alternate fashion, and new cross road alignment would provide access framework for new development. ◪	Construction of Alternative 3a would address existing geometric deficiencies, including the cross road skew angle. ■	Significant ROW acquisition would be required to accommodate cross road and interchange relocation. ■	This interchange is not currently categorized as a safety hazard. Improvement of existing geometric deficiencies would enhance safety. ☐	Environmental impacts associated with this alternative could be significant due to the realignment of the cross road. ◪	A significant change to business access along the cross road would occur with this alternative. However, access to existing businesses would be maintained. Would help guide development west of the current interchange location. ■	The realignment of Stagestop Road would conflict with overhead electric distribution lines north of the interchange. Alternative may also conflict with proposed sewer plant. ◪		Phasing the westbound ramps to the realigned cross road would be moderately difficult. Alternative would facilitate development and traffic circulation west of the current interchange location while maintaining vehicular access to existing development in the area. ☐	The transition from the existing Stagestop Road on the south side of the interchange would be difficult. ◪	◪	

☐ "Good" ◪ "Fair" ■ "Poor"

I-90 Exit 48
(North Access Alternatives)

I-90 Sturgis - Black Hawk Corridor Preservation Study

PRELIMINARY
ALTERNATIVE SCREENING MATRIX

ALTERNATIVE EVALUATION CRITERIA

		Traffic and Service	*Geometrics*	*Right-of-way*	*Safety*	*Environmental*	*Development*	*Utilities*	*Implementation Considerations*			*Overall Rating*	*General Notes*
									Cost	*Flexibility*	*Constructability*		
PROPOSED ALTERNATIVES	***North Access Alternative 1 – south J.B. Road Connection***	Would improve local access spacing and function by creating indirect access to north parcels. ☐	Addresses close access spacing north of the interchange, but remains shy of SDDOT access spacing recommendations. Frontage road would remain close to I-90, however, I-90 could be shifted south to improve spacing. ◪	Right-of-way would be needed to accommodate proposed alignment of JB Road. ☐	Improved access spacing enhances safety of interchange complex. However, realignment would introduce a new at-grade RR crossing. ◪	Minimal impacts. ☐	Would assist future development by providing a framwork for north access. Does not fully take any existing properties (partial take north of railroad) and would maintain existing access. ☐	Realigned JB Road would cross two overhead electric distribution lines. ☐	$300,000 ☐	Would be relatively simple to phase. Does not preclude future growth and would enhance viability of future development. ☐	Relatively easy to construct the realignment of JB Road. ☐	* ☐	Selected as Most Feasible Alternative.
	North Access Alternative 2 - North J.B. Road Connection	Would improve local access spacing and function by creating indirect access to north parcels. ☐	Addresses close access spacing north of the interchange, and meets SDDOT access spacing recommendations. Frontage road would remain close to I-90, however, I-90 could be shifted south to improve spacing. ◪	Additional Right-of-way would be needed to accommodate significant JB Road extension. ■	Improved access spacing enhances safety of interchange complex. Realigned access road could be grade-separated across railroad. ☐	Some impacts would likely be associated with routing access road through development south of railroad tracks. ◪	Would impact several properties south of railroad tracks. ◪	The JB road realignment would conflict with several overhead electric distribution lines. ◪	$3.7 Million ◪	Construction of grade separation would need to be coordinated with the railroad. Does not preclude future growth and would enhance viability of future development. ◪	Construction of Railroad grade separation would create some difficulty. ◪	◪	
	North Access Alternative 3 - Frontage Road relocation	Would improve local access spacing and function by creating indirect access to north parcels. ☐	Very close to railroad, but would improve separation from I-90. Difficult to tie into Stagestop Road at west end. ■	Significant ROW would be necessary to accommodate alignment of JB Road adjacent to Railroad tracks. ■	Realigned frontage road would cross railroad at-grade. Increased distance from mainline I-90 would enhance safety. ◪	Could be impacts associated with properties south of railroad. ◪	Would impact multiple properties south of the railroad tracks. ■	The north access road realignment would cross several overhead electric distribution lines. ☐	$1.5 Million ◪	Phased construction would be difficult as the alternative would have to be built in its entirety. ◪	◪	◪	

☐ “Good” ◪ “Fair” ■ “Poor”

I-90 Exit 48
(South Access Alternatives)

I-90 Sturgis - Black Hawk Corridor Preservation Study

PRELIMINARY ALTERNATIVE SCREENING MATRIX

ALTERNATIVE EVALUATION CRITERIA

		Traffic and Service	*Geometrics*	*Right-of-way*	*Safety*	*Environmental*	*Development*	*Utilities*	*Implementation Considerations*			*Overall Rating*	*General Notes*
									Cost	*Flexibility*	*Constructability*		
PROPOSED ALTERNATIVES	***South Access Alternative 1 – Realigned access road***	Would redirect current access to Stagestop Road, but maintains access to all businesses. Would create 4-legged intersection along Stagestop, consolidating accesses. ☐	Alternative 1 would require ROW purchase surrounding the existing Haggan's store. Parcel south of Haggan's would accommodate access consolidation. ☐	Alternative 1 would require ROW purchase surrounding the existing Haggan's store. ◪	Consolidation of accesses would enhance traffic safety along Stagestop Road south of the interchange. ☐	A chemical storage site is located at the northeast corner of SD 79 and Stagestop Road. However, it is not anticipated that this location would interfere with Alternative 1. ☐	Alternative 1 would help to create a framework for access management south of I-90 that would enhance the viability of existing businesses. ◪	The realigned access road would cross one overhead electric distribution line. ☐	$400,000 ☐	Could accommodate a variety of future development plans, but would have to be built in its entirety. ◪	Would be relatively easy to construct. ☐	☐	
	South Access Alternative 2 – New SD 79 access	Would creates similar situation along Stagestop Road as Alternative 1 while improving access management along SD 79. ☐	Parcel south of Haggan's would accommodate access consolidation. ☐	Would require acquisition of land north and south of SD 79 to accommodate 4-legged intersection. ■	Consolidation of accesses would enhance traffic safety along Stagestop Road south of the interchange and along SD 79. ☐	A chemical storage site is located at the northeast corner of SD 79 and Stagestop Road. However, it is not anticipated that this location would interfere with Alternative 2. ☐	Alternative 2 would help to create a framework for access management south of I-90 that would enhance the viability of existing businesses along both Stagestop Road and SD 79. ☐	The realigned access road south of SD 79 would conflict with an overhead electric pole. ☐	$500,000 ☐	Would accommodate a variety of future development plans. Slightly more flexible than Alternative 1 because SD 79 connection keeps more land available for future development. ◪	Realigning access on SD 79 would entail keeping SD 79 access open. ☐	* ☐	Selected as Most Feasible Alternative.

☐ "Good" ◪ "Fair" ■ "Poor"

Frontage / Local Access Roads between Exits 44 and 46

I-90 Sturgis - Black Hawk Corridor Preservation Study

PRELIMINARY ALTERNATIVE SCREENING MATRIX		ALTERNATIVE EVALUATION CRITERIA									
									Implementation Considerations		
		Traffic and Service	*Geometrics*	*Right-of-way*	*Safety*	*Environmental*	*Development*	*Utilities*	*Cost*	*Flexibility*	*Constructability*
PROPOSED ALTERNATIVES	***Alternative 1 - Realigned I-90 & Frontage / Local Roads***	N/A	Eliminates four at-grade RR crossings and shifts mainline I-90 north away from south frontage	Significant ROW acquisition would be necessary to accommodate north frontage road realignment.	Improvements to existing geometric deficiencies would enhance safety.	Realignment of north frontage road would impact crossing of creek.	Impacts plans for new homes north of I-90.	There would be several conflicts with multiple overhead electric distribution lines associated with the frontage road realignment.	$3.8 Million	Would accommodate a 6-lane I-90 best of the three alternatives. The extent of these improvements would, however, make this alternative difficult to phase and construction duration may be a factor.	Construction of a realigned Interstate and developing the north frontage road would need to be phased to keep access open throughout.

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