MEADE COUNTY

RAPID CITY AREA Metropolitan Planning Organization

SOUTHERN MEADE COUNTY
CORRIDOR STUDY

October 2019

DRAFT REPORT

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Abbreviations and Acronyms

ADT	Average Daily Traffic
AADT	Average Annual Daily Traffic
AWSC	All Way Stop Control
BHE	Black Hills Energy
CY	Cubic Yards
FHWA	Federal Highway Administration
GIS	Geographic Information System
HCS	Highway Capacity Software
LOS	Level of Service
MPH	Miles per Hour
NEPA	National Environmental Policy Act
RCAMPO	Rapid City Area Metropolitan Planning Organization
RCP	Reinforced Concrete Pipe
ROW	Right-of-Way
SAT	Study Advisory Team
SDDOT	South Dakota Department of Transportation
TWSC	Two Way Stop Control

Executive Summary

ES.1 Purpose of the Study

Due to the additional demands on the county road system generated by increased development, the MEADE Moving Forward 2040 Transportation Plan identifies a need for an additional east-west connection between Erickson Ranch Road and 143rd Avenue. Identifying a conceptual alignment will enable Meade County to plan for potential development in the area. The ultimate goal of the Southern Meade County Corridor Study (the Study) is to identify reasonable and feasible alternatives for a proposed corridor and define the vision for the road's access and intersection control, overall safety, and mobility.

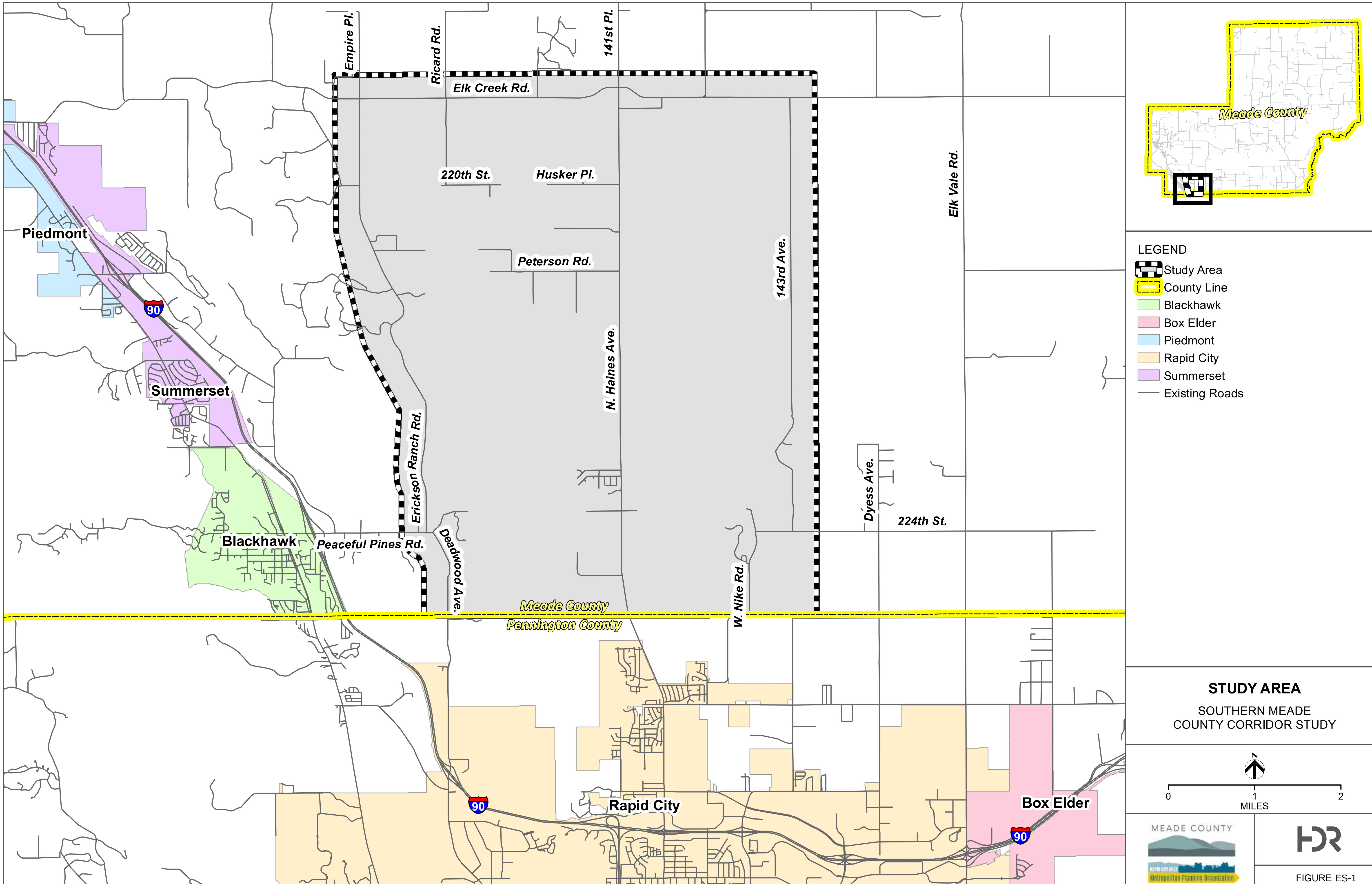
The Study Area, shown in **Figure ES- 1**, is bounded by the Meade County/Pennington County border to the south, Elk Creek Road to the north, Erickson Ranch Road to the west, and 143rd Avenue to the east.

Meade County, in conjunction with the Rapid City Metropolitan Planning Organization (RCAMPO), the South Dakota Department of Transportation (SDDOT), and the Federal Highway Administration (FHWA), contracted with HDR Engineering, Inc. (HDR) to perform this corridor study. A Study Advisory Team (SAT) was assembled to guide the Study through completion.

ES.2 Study Process

The Study synthesized previous studies applicable to the Study Area and performed the necessary data collection to aid in the analysis of different alternatives. Traffic for current and future conditions was forecasted and analyzed to determine the safety and operational needs of the existing roadway network as well as the proposed corridor. An environmental scan was performed with a 500-foot buffer surrounding the study corridor. Alternatives, including a no build option, were investigated for the proposed connector road. Throughout the Study process, public involvement was achieved through SAT meetings, public open houses, landowner meetings, and a project-specific study website.

A total of 12 build alternatives were considered during the preliminary alternatives screening process. Subsequently, these were narrowed down to three feasible build alternatives. The SAT selected Build Alternatives 4, 5, and 6 for further examination. The no-build alternative and the three aforementioned build alternatives were scrutinized further during the alternatives analysis process. Ultimately, one alternative was recommended based on the purpose and need, landowner impacts, safety, constructability, and cost.



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ES.3 Study Findings and Recommendations

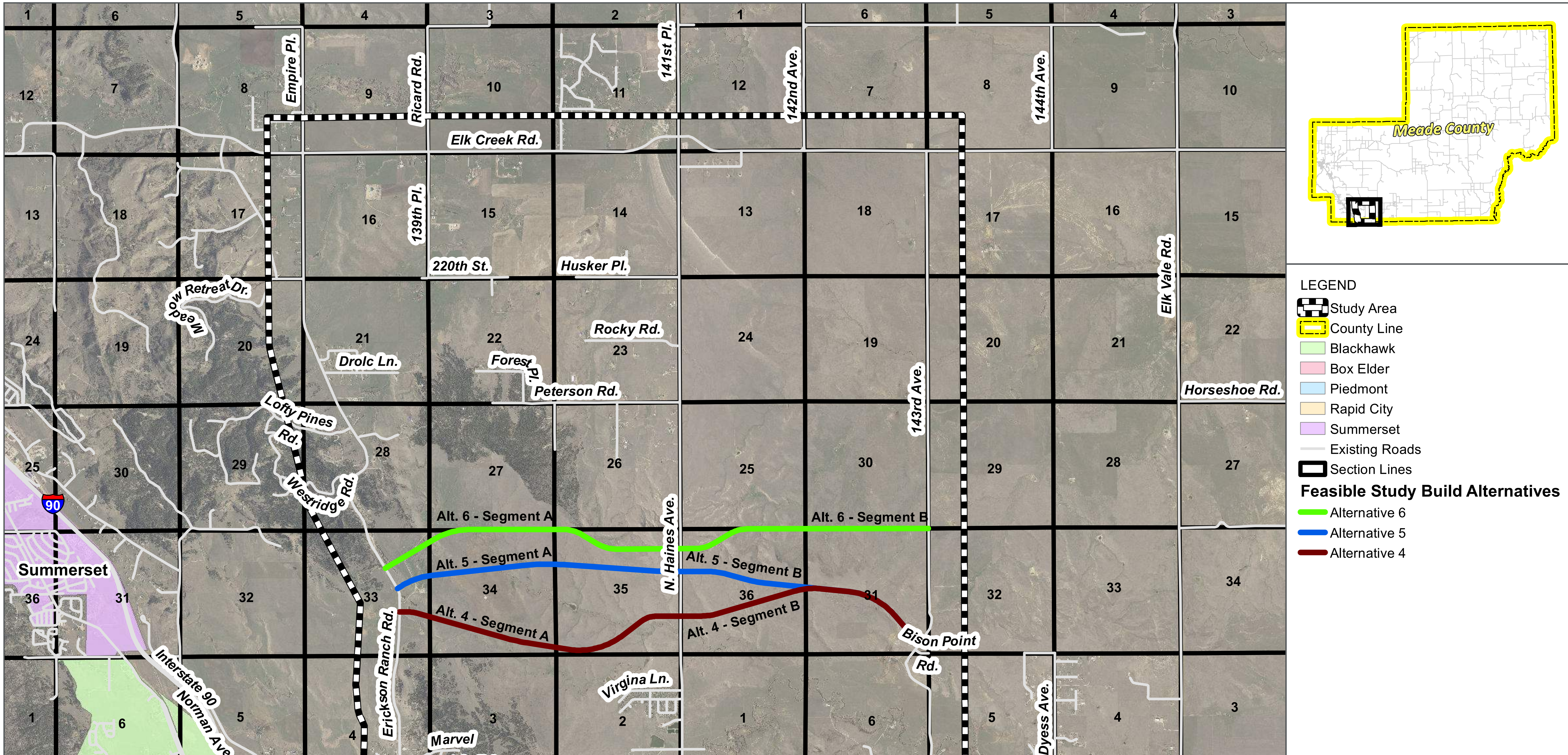
The findings and recommendations of this report are summarized in the bullets below.

Traffic Operations

- All intersections and roadway segments within the Study Area, under existing and 2045 No-Build Conditions, are expected to operate at acceptable levels of service (LOS C or better).
- Based on a review of daily traffic forecasts and segment capacity, if the Study Area stays predominantly rural, all existing two-lane roadways are expected to accommodate traffic volumes through the 2045 Planning Horizon. If the area becomes more urbanized, particularly along the Meade County border, a 3-lane cross-section may be appropriate to accommodate forecasted traffic volumes along these corridors at the next time of reconstruction.
- Therefore, traffic operations will not likely drive the need for this east-west corridor.

Recommended Alternative

- The no-build alternative does not encourage orderly, efficient land development. While the no-build alternative preserves agricultural lands and prevents the splitting of agricultural parcels in the short term, these farming and ranching lands will become more fragmented as disjointed neighborhood communities continue to develop in a scattered manner away from existing, incorporated communities. In the long term, the no-build alternative does not align with Meade County's previously listed goals and does not meet the purpose and need of this Study.
- All three build alternatives will impact landowners in different ways. As a result, there was no preferred alternative among landowners. The recommended alternative was selected based on safety, constructability, and cost. All three feasible build alternatives can be seen in **Figure ES- 2**.
- The recommended alternative is Alternative 5. This alternative has optimal intersection geometrics, is less expensive than the other two alternatives, and has the fewest wetland and utility impacts.
- Alternative 6 was eliminated because of poor constructability, high construction cost, and the number of utility impacts.
- Alternative 4 was eliminated because of safety concerns regarding the intersection at Haines Avenue and the anticipated utility impacts on both Black Hills Energy (BHE) transmission lines.
- Meade County has a long list of immediate roadway needs and building new roadways has not been identified as a top priority. However, the County appreciates the importance of having a plan in place for the future connector road. In the interim, this plan will help guide Meade County staff and area developers regarding future development and impacts on area transportation needs. The identified corridor would allow the preservation of a future route and ensure appropriate access management for any potential growth within the area.



FEASIBLE STUDY BUILD ALTERNATIVES

SOUTHERN MEADE COUNTY CORRIDOR STUDY

FIGURE ES-2

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Improvements to Existing Roadway Network

- Elk Vale Road provides a direct north-south connection to I-90 (Exit 61) and the US-16 Bypass. Due to the regional significance of Elk Vale Road, it is recommended that Meade County plan for a connection between 143rd Avenue and Elk Vale Road. If a connection is not planned, then the section of 143rd Avenue between the future roadway and 224th Street should be upgraded to an arterial typical section. The 143rd Avenue Bridge over Box Elder Creek should be evaluated for the additional traffic volumes and the horizontal curve and longitudinal grades should be reconstructed to meet design criteria. Future improvements should consider forecasted traffic volumes and current roadway geometric design criteria.

Proposed Corridor Design Elements

- The two-lane highway section of the proposed corridor meets LOS goals for this Study. It is recommended that other roadway design elements meet current and applicable design standards for the proposed roadway.
- At the proposed east-west corridor intersections with Erickson Ranch Road and 143rd Avenue, LOS goals can be achieved with shared left/through/right lane configurations assuming stop-control from the proposed east-west corridor approach, as shown in **Figure ES- 3**.
- At the intersection between Haines Avenue and the proposed east-west corridor, the worst-case stop-controlled approach does not meet LOS goals for this Study. At this intersection, a northbound left-turn lane is warranted and an opposing southbound left-turn lane is recommended. This would assume stop-control from the proposed east/west corridor approach. If the intersection was converted from a two-way stop-controlled intersection to an all-way stop-controlled intersection, a shared left/through/right configuration would meet LOS goals for this Study. The aforementioned intersection configuration options are presented in **Figure ES- 3**.

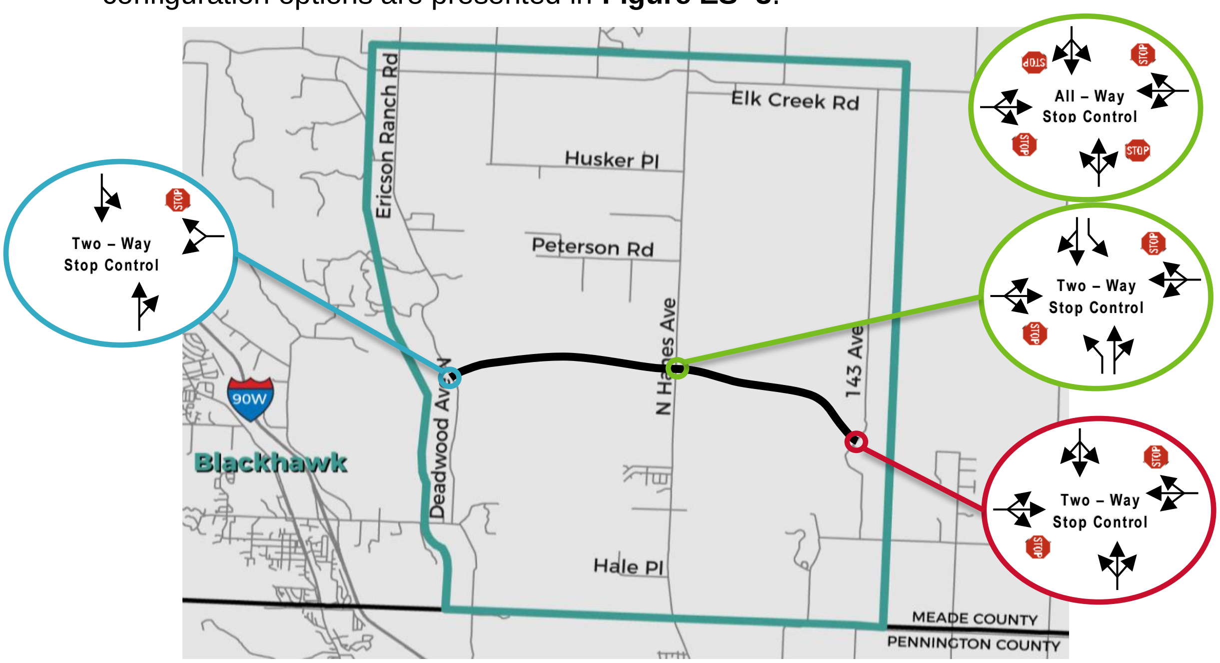


Figure ES- 3. Proposed Corridor Intersection Configurations

1.0 Project Overview

Due to the additional demands on the county road system generated by increased development, the MEADE Moving Forward 2040 Transportation Plan identifies a need for an additional east-west connection between Erickson Ranch Road and 143rd Avenue. Identifying a conceptual alignment will enable Meade County to plan for potential development in the area.

The Study Area, shown in **Figure 1,** is bounded by the Meade County/Pennington County border to the south, Elk Creek Road to the north, Erickson Ranch Road to the west, and 143rd Avenue to the east. The Study included Elk Creek Road, Erickson Ranch Road, 143rd Avenue, 224th Street, 225th Street, and Nike Road.

Elk Vale Road was not part of the original Study Area, but it was included in the traffic forecasts and the preliminary alternative screening process because of its regional importance to connectivity along the eastern edge of the Study Area. Elk Vale Road provides a direct north-south connection to I-90 (Exit 61) and the US-16 Bypass.

Meade County, in conjunction with the Rapid City Metropolitan Planning Organization (RCAMPO), the South Dakota Department of Transportation (SDDOT), and the Federal Highway Administration (FHWA), contracted with HDR Engineering, Inc. (HDR) to perform this Study. A Study Advisory Team (SAT) was assembled to guide the Study through completion. The SAT is composed of representative parties from Meade County, the RCAMPO, SDDOT, and FHWA.

1.1 Study Objectives

A corridor study is the first step in planning for the future of a transportation facility. By defining the Study Area's needs, the corridor study will help focus planning efforts and act as catalyst for discussion regarding how best to invest in the Study Area's future transportation needs. The ultimate goal of the study is to identify reasonable and feasible alternatives for a proposed corridor and define the vision for the road's access, intersection control, overall safety, and mobility.

This Study is expected to fulfill the following objectives:

- Synthesize previous information, reports, and studies applicable to the Study Area and perform the necessary data collection to aid in the analysis of various alternatives.
- Analyze and forecast traffic for current and future conditions.
- Identify up to three build alternatives in addition to a no build option. Examine each alternative at the conceptual level to determine the advantages and disadvantages. Provide recommended alternatives.
- Perform an environmental scan within a 500-foot buffer surrounding the study corridor and summarize the findings.

Currently, there is no funding programmed for a new corridor through the Study Area, nor is any contained in the current 20 year plan. The Study is intended to provide all partners involved with an overall vision for the corridor and guide future decisions.

1.2 Purpose and Need

The purpose of the Southern Meade County Corridor Study is to identify a corridor that would accommodate the planned future land use as described in the following plans:

- Meade County Comprehensive Plan adopted January 2010
- Rapid City Comprehensive Plan adopted April 2014
- RapidTRIP 2040 Long Range Transportation Plan dated September 2015
- MEADE Moving Forward 2040 Transportation Plan dated February 2016

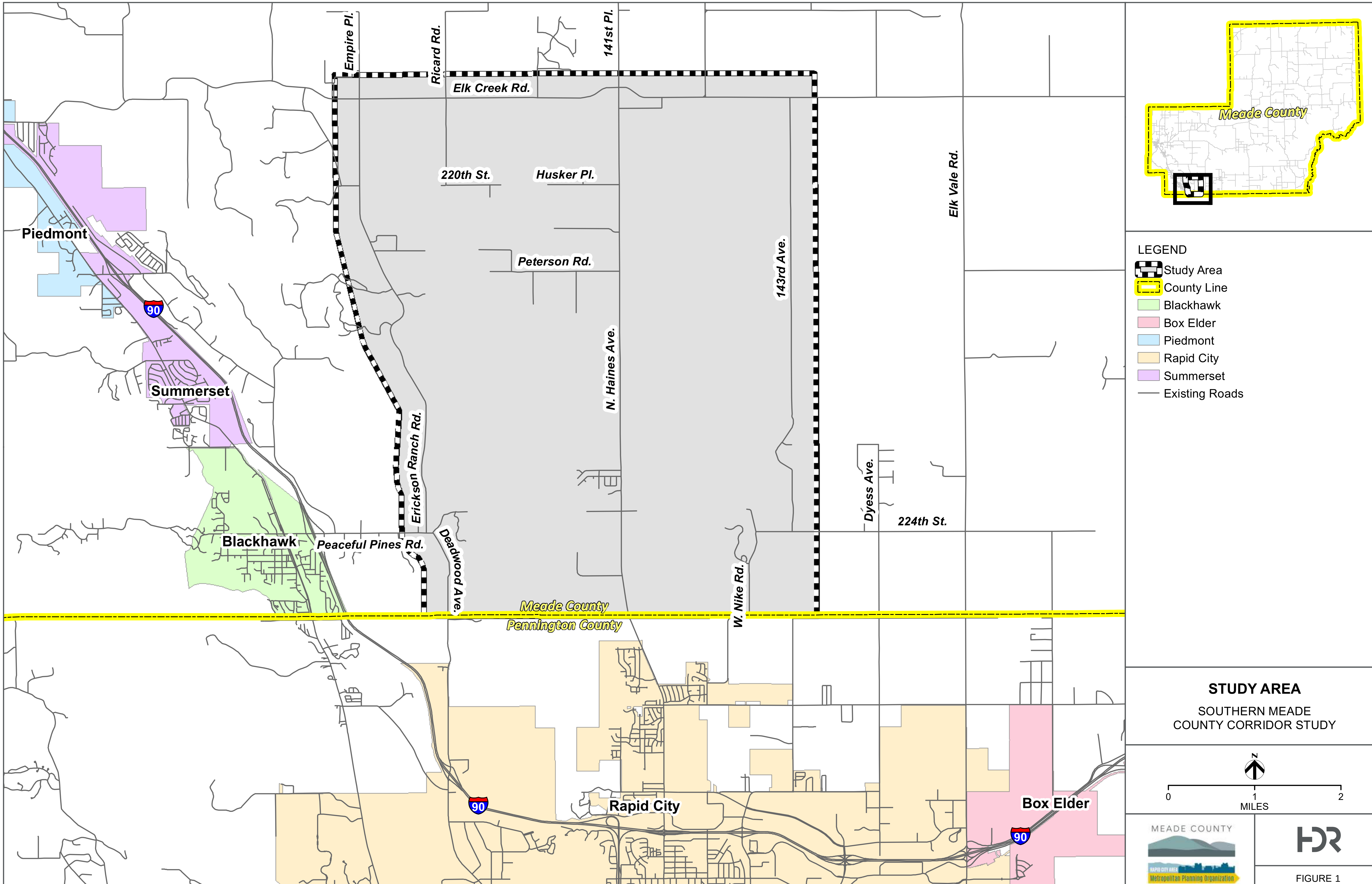
The identified corridor would allow for the preservation of a future route and ensure appropriate access management for any potential growth within the area.

As noted in the MEADE Moving Forward 2040 Transportation Plan, this area is projected to have medium to high residential growth. Residential development is projected to increase along Elk Creek Road, Erickson Ranch Road, and Haines Avenue. Rural residential development is currently occurring at a higher concentration in the northern half of the Study Area and, more recently, immediately north of the Study Area. The current growth in residential development is inconsistent with the goals and objectives of the Meade County Comprehensive Plan, which seeks to encourage orderly, efficient land development within unincorporated areas of Meade County. This development is also contributing directly to urban sprawl and premature fragmentation of agricultural land. The Meade County Comprehensive Plan calls for an adequately spaced, arterial, grid-like network that discourages scattered, non-farm residential developments and encourages the expansion of residential development near existing, incorporated communities. Identifying a corridor before the area develops fully allows for preservation and access management, thereby reducing future transportation, construction, and maintenance costs.

1.3 Additional Goals and Objectives

The Meade County Comprehensive Plan, MEADE Moving Forward 2040 Transportation Plan, Rapid City Comprehensive Plan, and RapidTRIP 2040 Long Range Transportation Plan all have specific goals within Meade County and the RCMPO boundary. These planning goals helped develop the objectives for the Study. The following goals are most applicable to this corridor:

- To encourage orderly, efficient land development within the unincorporated areas of Meade County (Meade County Comprehensive Plan).
- To manage growth within the framework of the Meade County Comprehensive Plan
- Land Use Plan and other comprehensive municipal plans (Meade County Comprehensive Plan).
- To maintain a distinction between rural areas and municipalities while preserving and enhancing community identity (Meade County Comprehensive Plan).
- To provide a transportation system that promotes the safe and efficient movement of people, goods, and services (Meade County Comprehensive Plan).
- To preserve environmental, historical, and cultural resources (Meade County Comprehensive Plan).
- To maintain a viable agricultural economy and preserve the rural quality of life (Meade County Comprehensive Plan).
- Encourage the clustering of rural residential development to conserve natural features, limit impacts on the natural environment, and maximize infrastructure, such as roads (Rapid City Comprehensive Plan).
- New East-West Connection recommended from Deadwood Avenue/Erickson Ranch Road and Haines Avenue (MEADE Moving Forward 2040 Transportation Plan, Rapid City Comprehensive Plan, and RapidTRIP 2040 Long Range Transportation Plan).



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1.4 Study Schedule

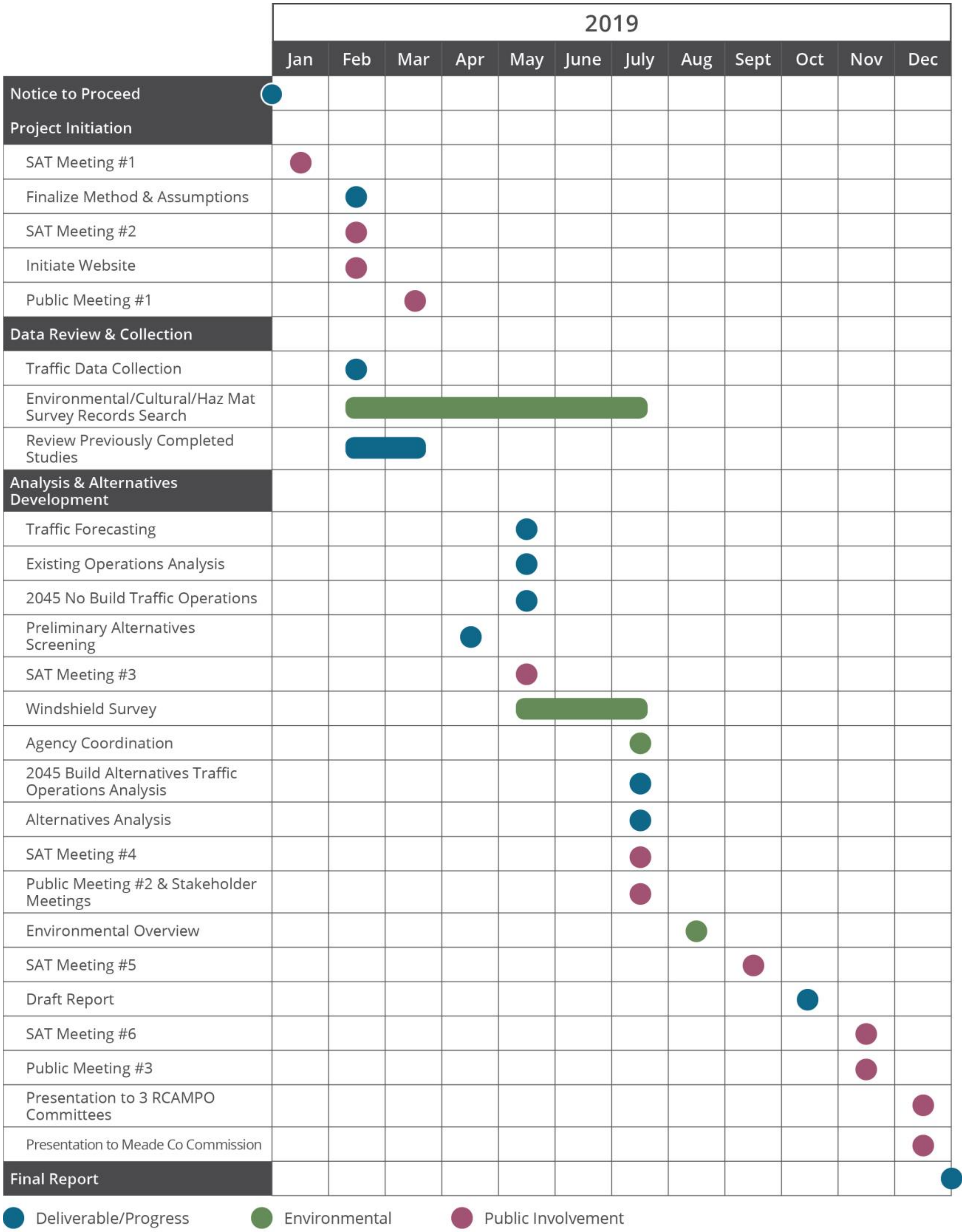


Figure 2. Study Schedule

2.0 Public Participation

Public involvement and engagement with federal, state, and local resource agency representatives are key elements in linking planning studies to future NEPA reviews and processes. Public agencies, landowners, and members of the public were invited to participate in the planning process and provide input on needs, issues, concerns, and recommended improvement options. Throughout the study process, public involvement was achieved through various avenues including a project-specific study website, SAT meetings, public open houses, and landowner meetings.

2.1 Study Website

A study website was hosted at www.SouthernMeadeCountyCorridorStudy.com and was maintained throughout the study process. The purpose of the website was to dispense information to the public regarding the status of the Study. Public meeting announcements, presentations, meeting summaries, and all technical memorandums and reports were available for download through the Study website. The website also allowed the public to provide feedback electronically.

2.2 Study Advisory Team Meetings

A Study Advisory Team was formed to guide the Study through completion. The SAT was comprised of representative parties of the Rapid City Area MPO, Meade County, SDDOT, and the FHWA. Members of the SAT are listed in **Table 1**.

Table 1. Study Advisory Team Members

Participant	*Agency*
Bill Rich	*Meade County - Planning/Zoning*
Rhea Crane	*Meade County - Planning/Zoning*
Scott Tegethoff	*Meade County Highway*
Talbot Wieczorek	*Meade County Commission*
Doreen Creed	*Meade County Commission*
Kelly Brennan	*Rapid City Area MPO*
Kip Harrington	*Rapid City Area MPO*
Jerry Ortbahn	*SDDOT*
Sarah Gilkerson	*SDDOT*
Stacy Bartlett	*SDDOT*
Mark Hoines	*Federal Highway Administration*

Meetings were held with the SAT periodically throughout the study timeline.

- SAT Meeting #1 – Methods and Assumptions Meeting – January 28, 2019
- SAT Meeting #2 – Public Meeting #1 Preparation – February 18, 2019
- SAT Meeting #3 – Preliminary Alternative Screening – May 13, 2019
- SAT Meeting #4 – Alternatives Analysis and Public Meeting #2 and Landowner Meetings Preparation – July 17, 2019
- SAT Meeting #5 – Public Meeting Debrief – August 12, 2019
- SAT Meeting #6 – Draft Corridor Study Report & Public Meeting #3 Preparation – November 5, 2019

The Draft Corridor Study Report was presented to both the Meade County Commissioners and the three committees of the Rapid City Area Metropolitan Planning Organization on the following dates:

- Meade County Commissioners – December 10, 2019
- Citizen's Advisory Committee – December 12, 2019
- Technical Coordinating Committee – December 12, 2019
- Executive Policy Committee – December 12, 2019

2.3 Public Open House Meetings

Open house meetings were held to gather feedback from the general, traveling public and landowners within the Study Area. The public meeting dates, times, and locations were advertised in three local newspapers, the Meade County website, and the Rapid City Area Metropolitan Planning Organization website. The public meetings included a short presentation followed by a comment and question period where participants were able to voice their questions and concerns. Following the meetings, participants were encouraged to provide written feedback by email, mail, or the Study website.

Public meeting reports were created to summarize each public meeting and are provided in **Appendix A**. The date and topic of each public meeting is listed below.

Public Meeting #1 – March 6, 2019

The first public meeting introduced the Study to the public. The meeting topics included the Study's background, goals, and schedule. Maps were provided throughout the room showing the existing roadway network, parcels, topography, floodplain, and other physical constraints.

Public Meeting #2 – July 24, 2019

The second public meeting presented the alternatives as well as the advantages and disadvantages of each. This public meeting was held concurrent with the landowner meetings. Landowners were encouraged to attend the public meeting as well.

Public Meeting #3 – November 14, 2019

The third public meeting presented the recommended alternative as well as the draft corridor study report.

2.4 Landowner Meetings

Individual landowner meetings were held on July 24, 2019 for the parcels directly affected by the alternatives developed. The landowner meetings were held concurrent with the second public meeting. Landowners were contacted over the phone to coordinate meeting times. A follow-up letter was also sent to provide more information and confirm the meeting date and time. Eight landowners were invited to these meetings. Landowner feedback was documented and is summarized in the public meeting report in **Appendix A**.

Many landowners were against the project and preferred the no-build alternative. They preferred the no-build alternative because a roadway through their property would impact their current land operation, they did not see the need to plan for a roadway through this area, or both. Two landowners were proponents of the project. However, one of the proponents did not like the alternatives presented because they did not take municipal utilities into account.

The following landowners have parcels affected by the alternatives:

Erickson Ranch Road to Haines Avenue

- Kirk Erickson
- Bob Borgmeyer
- Larry and Shirley Smith

Haines avenue to 143rd Avenue

- Jay McPherson
- Karen Muller; Travis and Judy Backman
- Darin Klapperich
- Robert Heidgerken
- Jon Jordan

3.0 Existing and Projected Future Conditions

3.1 Data Collection

Data collection was completed in two phases: 1) compile existing data inventory items, and 2) collect turning movement and volume counts.

The existing data inventory items included:

- Aerial photography
- Topography
- Future land use plans
- Known historical properties and areas of environmental significance
- Existing design standards and ordinances
- SDDOT Road Design Manual
- Previous applicable planning studies
- Historical crash data between 2014-2018
- RCAMPO Traffic Demand Model Forecast Output

The following traffic data items were collected:

- Peak hour (morning and afternoon or evening) intersection turning movement counts were collected on Tuesday, February 19, 2019.
- 24-hour roadway segment counts were collected on Tuesday, February 19, 2019.

3.1.1 Intersection and Roadway Segment Volumes

Table 2 and **Table 3** summarize the intersection turning movement count (TMC) locations and roadway segment count locations.

Table 2. Intersection Turning Movement Count Locations

ID #	*Intersection*	*Count Type*
1	*Elk Creek Road & Erickson Ranch Road*	*4-hr TMC*
2	*Elk Creek Road & Haines Avenue*	*4-hr TMC*
3	*Elk Creek Road & 143rd Avenue*	*4-hr TMC*
4	*143rd Avenue & 224th Street*	*4-hr TMC*
5	*Peaceful Pines Road & Erickson Ranch Road*	*4-hr TMC*

Table 3. Roadway Segment Count Locations

ID #	Intersection	Count Type
1	Erickson Ranch Road (near Westridge Road) – 2 lanes	24-hr Volume/Class
2	Haines Road (south of Elk Creek) – 2 lanes	24-hr Volume/Class
3	Haines Road (near Hale Road) – 2 lanes	24-hr Volume/Class
4	Elk Vale Road (south of Elk Creek Road) – 2 lanes	24-hr Volume/Class
5	Elk Creek Road (west of Haines Avenue) – 2 lanes	24-hr Volume/Class
6	Elk Creek Road (east of Haines Avenue) – 2 lanes	24-hr Volume/Class

Study counts reflect a typical weekday and were collected either on a Tuesday, Wednesday, or Thursday while school was in session. Counts collected as part of this Study included vehicle classification. Seasonal factors to convert all counts to a similar planning season were obtained from the SDDOT.

3.1.2 Existing Master Plans and Previous Studies

The following previously conducted studies were reviewed during the course of this Study:

MEADE MOVING FORWARD 2040 TRANSPORTATION PLAN

- There are concerns on North Haines Avenue, Elk Creek Road, and Elk Vale Road due to increased general traffic and truck travel.
- The Study Area is located within a medium growth (3%) to high growth (4%) area.
- Roadway Standards
    - Road surface decisions
    - Arterial typical sections
    - Access management guidelines for Arterial Roads

MEADE COUNTY COMPREHENSIVE PLAN

- Street classifications – function of arterial roadways
- Fundamental goals of the County and associated policies

PLAN RAPID CITY – COMPREHENSIVE PLAN UPDATE

- Fundamental goals of the County and associated policies

RAPID CITY MAJOR STREET PLAN

- There are no roadways planned in the immediate vicinity outside the Study Area that should be taken into consideration.

RAPIDTRIP 2040 – RAPID CITY AREA LONG RANGE TRANSPORTATION PLAN UPDATE

- This proposed east-west corridor is listed as project 59 and 60 in the roadway needs plan.

MEADE COUNTY ORDINANCES

- Ordinance 10, Section 3.02: Additional roadway standards
- Ordinance 20, Section 4.01: Subdivision need to conform the Meade County Comprehensive Plan

ELLSWORTH AIRFORCE BASE JOINT LAND USE STUDY

- The Study Area is outside of the Ellsworth AFB Safety Military Compatibility Area. However, the Ellsworth AFB Noise Military Compatibility Area does overlap with the eastern half of the Study Area, which has some building guidelines.

3.1.3 Methods and Assumptions

A Methods and Assumptions document was developed with representatives from RCAMPO, Meade County, SDDOT, FHWA and HDR in preparation for the Methods and Assumptions Meeting held as part of the project start-up. The document was intended to serve as a historical record of the process, dates, and decisions made by the study team representatives for the Study.

The complete signed version of the Methods and Assumptions document is provided in **Appendix B**.

3.2 Environmental Scan

An environmental scan was performed to evaluate threatened and endangered species, archaeological and historical resources, Section 4(f) or 6(f) properties, wetlands and other waters of the U.S, floodplains and floodways, noise, and right-of-way based on a desk-top review of environmental data. Refer to the Environmental Scan Technical Memorandum in **Appendix C** for further details.

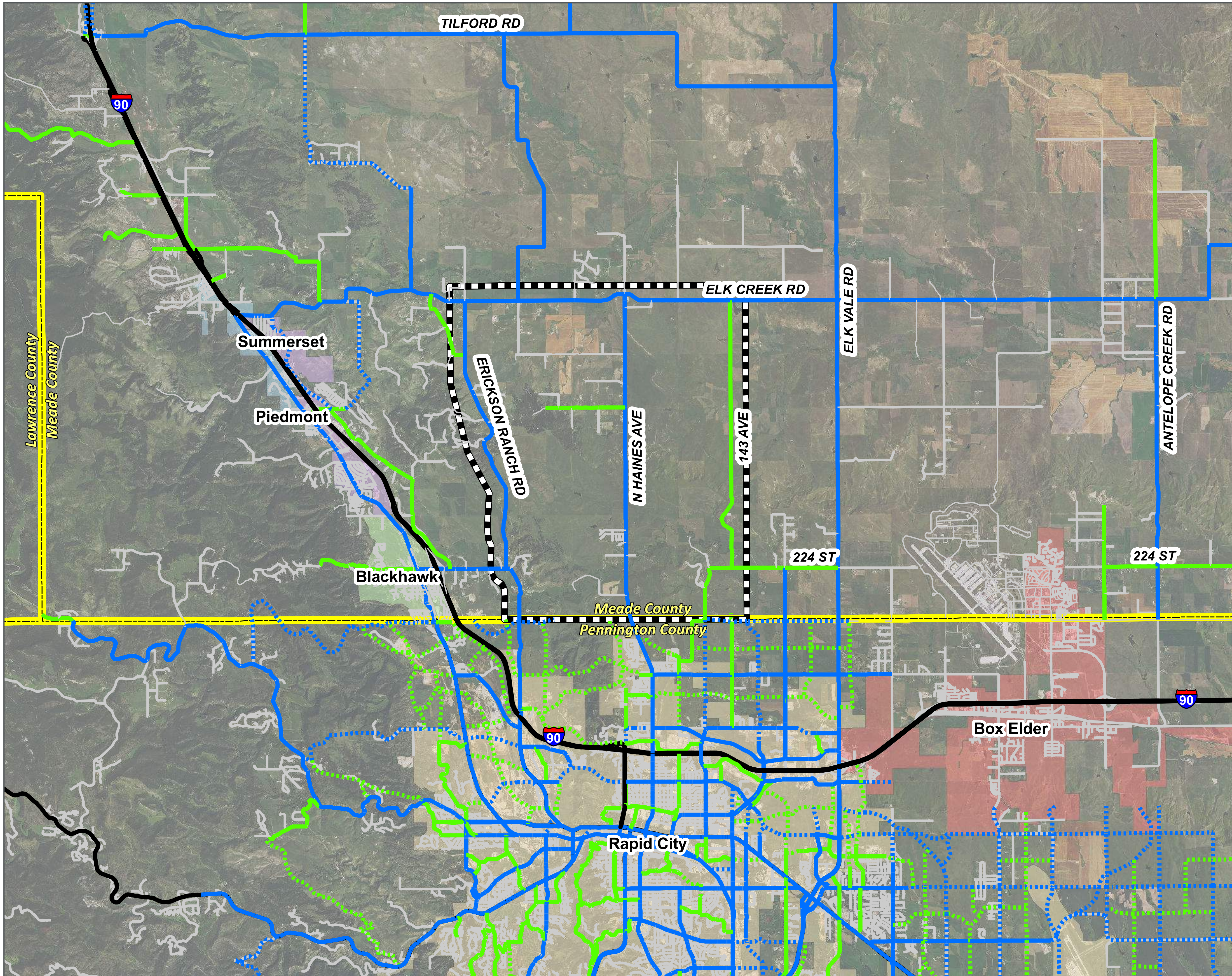
The Environmental Scan Study Area was comprised of all three study build alternatives, each with a 1,000 foot corridor around the build alignment (500 feet from the centerline on either side). A summary of the direct, indirect, and cumulative environmental impacts pertaining to each feasible build alternative is provided within the Alternative Analysis section of this report (Section 4.2).

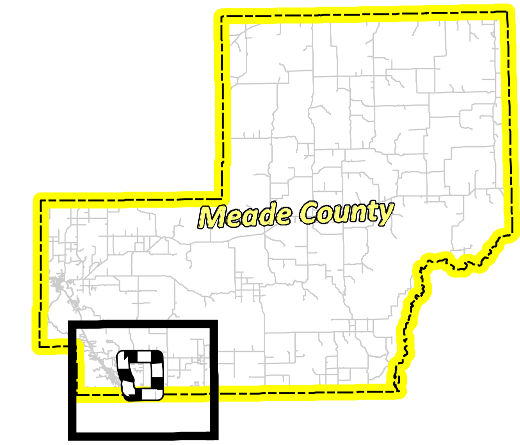
3.3 Existing Roadway Network

The major north-south arterials within and adjacent to the Study Area include Erickson Ranch Road, Haines Avenue, and Elk Vale Road. These roadways are spaced approximately 3 to 4 miles apart and provide ample opportunity for northern communities to access the Rapid City area and Interstate-90 to the south. All of the aforementioned north-south arterials are paved. Erickson Ranch Road feeds into Deadwood Avenue/Peaceful Pines Road. The Rapid City Comprehensive Plan (2014 update) identifies Deadwood Avenue and Haines Avenue as entrance corridors to Rapid City. Elk Vale Road provides direct access to the US-16 bypass.

The major east-west corridors include Interstate 90 and Elk Creek Road. These are spaced almost 9 miles apart. Elk Creek Road is paved to the west of Haines Avenue and unpaved to the east of Haines Avenue. Elk Creek Road connects to Interstate 90 west of the Study Area.

The functional classifications of the existing roadway network can be seen in **Figure 3**. The roadway surfacing type of the existing roadway network is illustrated in **Figure 4**.





LEGEND

- Study Area
- County Line

City Limits

- Blackhawk
- Box Elder
- Piedmont
- Rapid City
- Summerset
- Existing Roads
- Interstate
- Arterial
- Proposed Arterial
- Collector
- Proposed Minor Collector

EXISTING ROADWAY NETWORK (FUNCTIONAL CLASSIFICATION)

SOUTHERN MEADE COUNTY CORRIDOR STUDY

N

0 1 2
MILES

MEADE COUNTY

Rapid City Area Metropolitan Planning Organization

HDR

EXHIBIT 3

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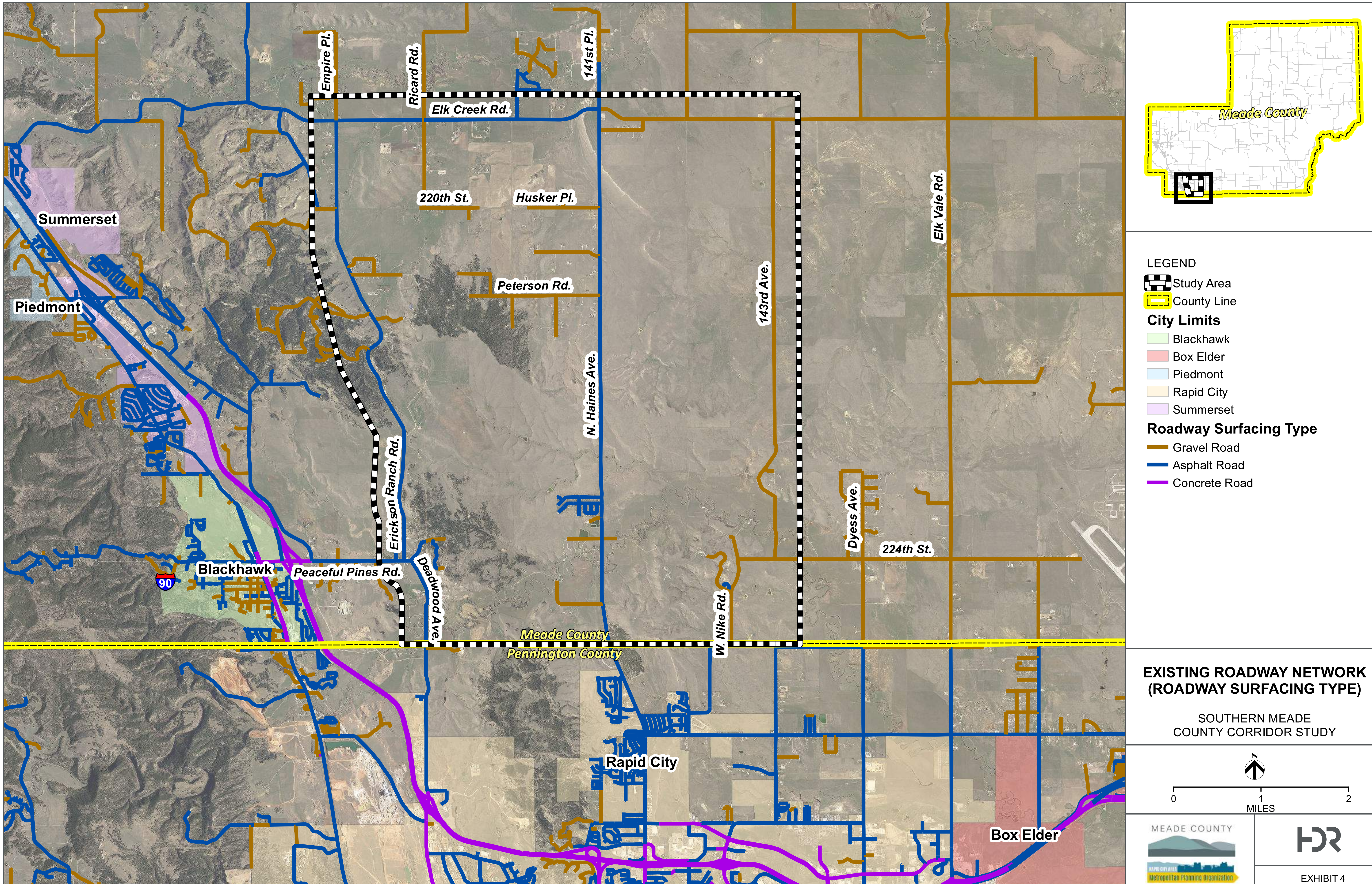

EXISTING ROADWAY NETWORK (ROADWAY SURFACING TYPE)

SOUTHERN MEADE COUNTY CORRIDOR STUDY

EXHIBIT 4

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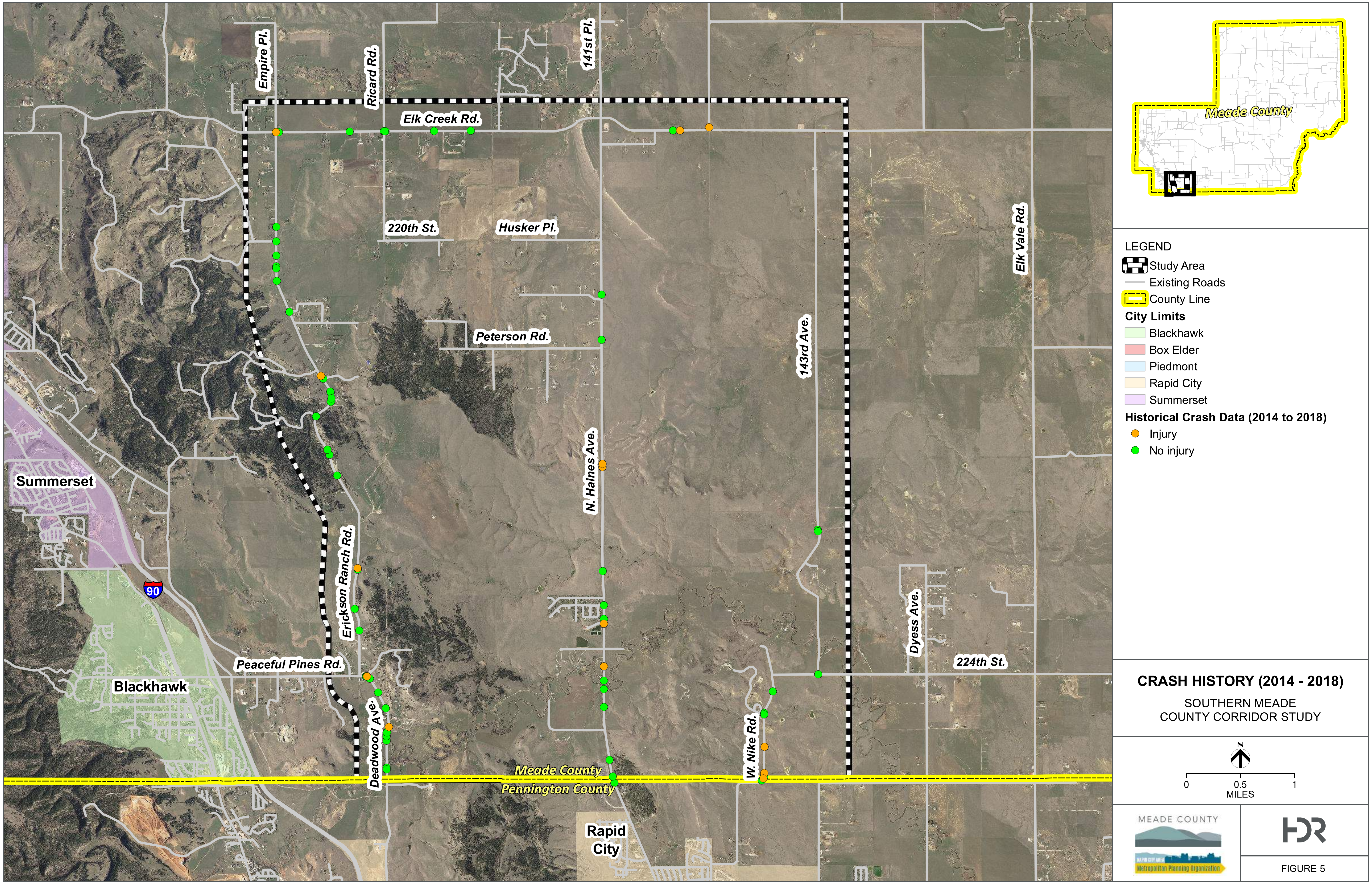
3.4 Crash History

The crash history from 2014 through 2018 was reviewed to help identify crash trends or areas of high frequency within the Study area. This history also helped identify locations that may warrant consideration for safety-related improvements in future designs. Crash data from Erickson Ranch Road/Deadwood Avenue, Haines Avenue, 143rd Avenue, Nike Road, and Elk Creek Road were included in the review. An analysis of intersections and roadway segments was conducted.

Between 2014 and 2018, 73 crashes were reported on the primary Study Area corridors. These crashes are shown spatially and identified as ‘injury’ or ‘no injury’ crashes in **Figure 5.** Zero fatalities were reported within the Study Area during this timeframe. Refer to the Crash History Review Technical Memorandum in **Appendix D**, for the full crash history analysis and additional details.



Empire Pl.
Ricard Rd.
141st Pl.
Elk Creek Rd.
220th St.
Husker Pl.
Peterson Rd.
N. Haines Ave.
143rd Ave.
Elk Vale Rd.
Summerset
Blackhawk
90
Erickson Ranch Rd.
Peaceful Pines Rd.
Deadwood Ave.
W. Nike Rd.
Dyess Ave.
224th St.
Meade County
Pennington County
Rapid City
Meade County
LEGEND
Study Area
Existing Roads
County Line
City Limits
Blackhawk
Box Elder
Piedmont
Rapid City
Summerset
Historical Crash Data (2014 to 2018)
Injury
No injury
CRASH HISTORY (2014 - 2018)
SOUTHERN MEADE
COUNTY CORRIDOR STUDY
N
0
0.5
1
MILES
MEADE COUNTY
Rapid City Area Metropolitan Planning Organization
HDR
FIGURE 5
PATH: Z:\PROJECTS\10151083 - RCMPO MEADE CTY CORRIDOR STUDY\GIS\HDR\CORRIDOR REPORT\FIGURE X CRASH HISTORY.MXD - USER: SSLOWEY - DATE: 9/19/2019

3.4.1 Primary Study Corridor Intersection Summary

Of the 4 intersections reviewed, only the Elk Creek Road and Erickson Ranch Road intersection experienced an intersection crash. This crash was a single-motorcycle roadway departure crash.

3.4.2 Primary Study Corridor Segment Summary

Roadway departure is the predominant manner of collision along the Study Area corridor segments, accounting for over half of the total segment crashes (39 of 73; 53 percent). The next most frequent manner of collision is a vehicle-animal crash (27 of 73; 37 percent).

Of the 73 crashes, 14 involved an injury. All 14 injury crashes were single-vehicle, roadway departure type crashes. The predominant location for injury crashes was straight, flat roadway segments. Speed, alcohol, or both were common contributing factors. All injury crashes occurred on dry roadways during clear weather conditions.

A large portion of the crashes along the Study Area corridor segments took place on either horizontal or vertical curves. Of the 73 segment crashes, 20 occurred along a vertical curve. Speed was noted as a contributing factor in 12 of these crashes. Two angle and two rear-end crashes occurred along horizontal curves, emphasizing the importance of stopping sight distance at all access points and clear intersection sight lines for turning vehicles . Of the 14 injury crashes, 2 occurred on horizontal curves within the Study Area.

Figure 6 and **Figure 7** illustrate the proportion of different roadway segment crash types and crash severities, respectively, for the Study Area's roadway segments.

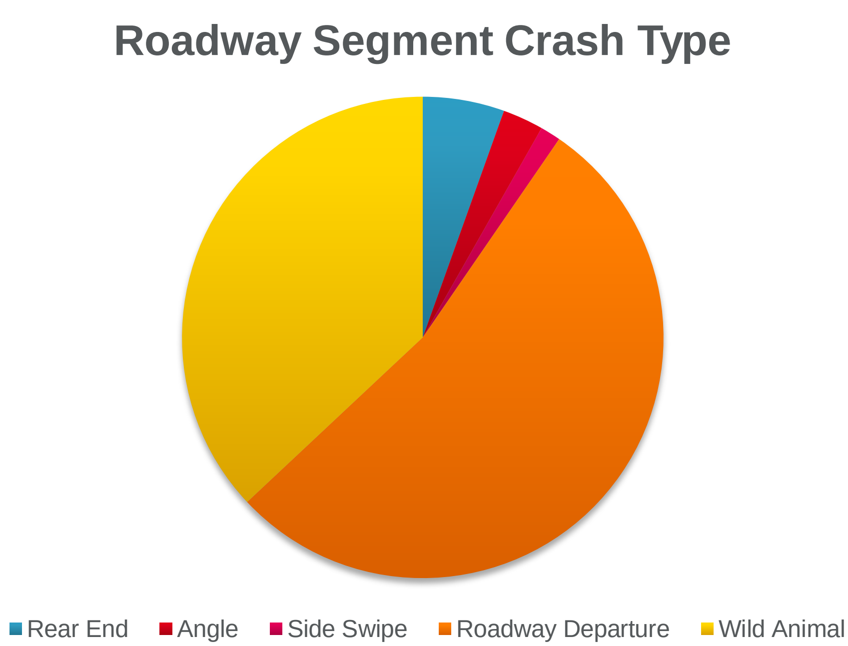


Figure 6. Summary of Roadway Segment Crash Types

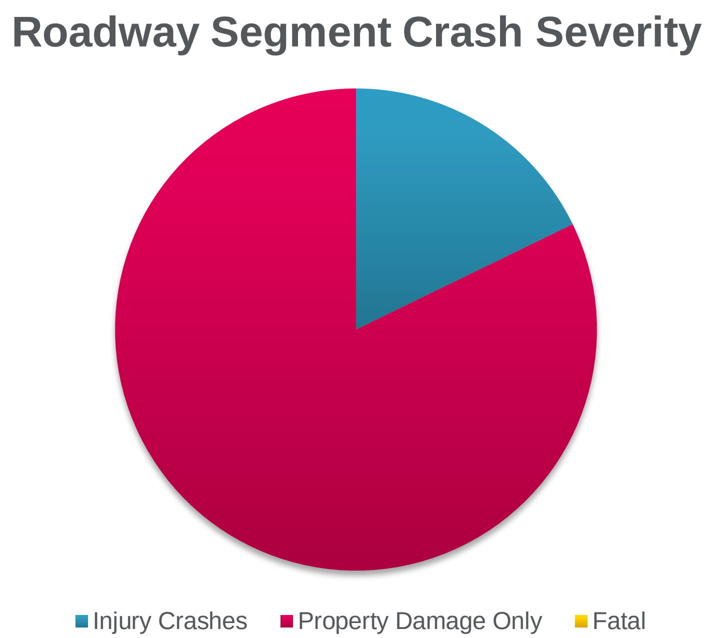


Figure 7. Summary of Roadway Segment Crash Severity

The primary study corridors within the Study Area were divided into eight segments for analysis. Considerations in determining segment boundaries included the location of major intersections, changes in roadway surfacing, and notable increases or decreases in traffic volumes.

The lone segment with a crash rate exceeding the critical crash rate was the 224th Street/Nike Road segment between 143rd Avenue and the Meade County/Pennington County boundary. This segment exhibited 10 crashes, 3 of which resulted in injuries. Of these 10 crashes, 9 were single-vehicle, roadway departure crashes.

Additionally, 5 of the 10 crashes occurred along the horizontal curve that crosses the Meade County/Pennington County boundary, shown in **Figure 8**. All 5 crashes were single-vehicle, roadway departure crashes and 4 of the 5 involved a northbound vehicle. Vehicles traveling northbound approach the curve on a paved, two-lane roadway, but the roadway transitions to gravel at the onset of the horizontal curvature. This can create a difficult situation for motorists when high speeds are involved. Of the 5 crashes, 4 noted driving too fast for conditions and over-correcting or over-steering as a driver contributing circumstance. The fifth crash involved alcohol and careless driving.

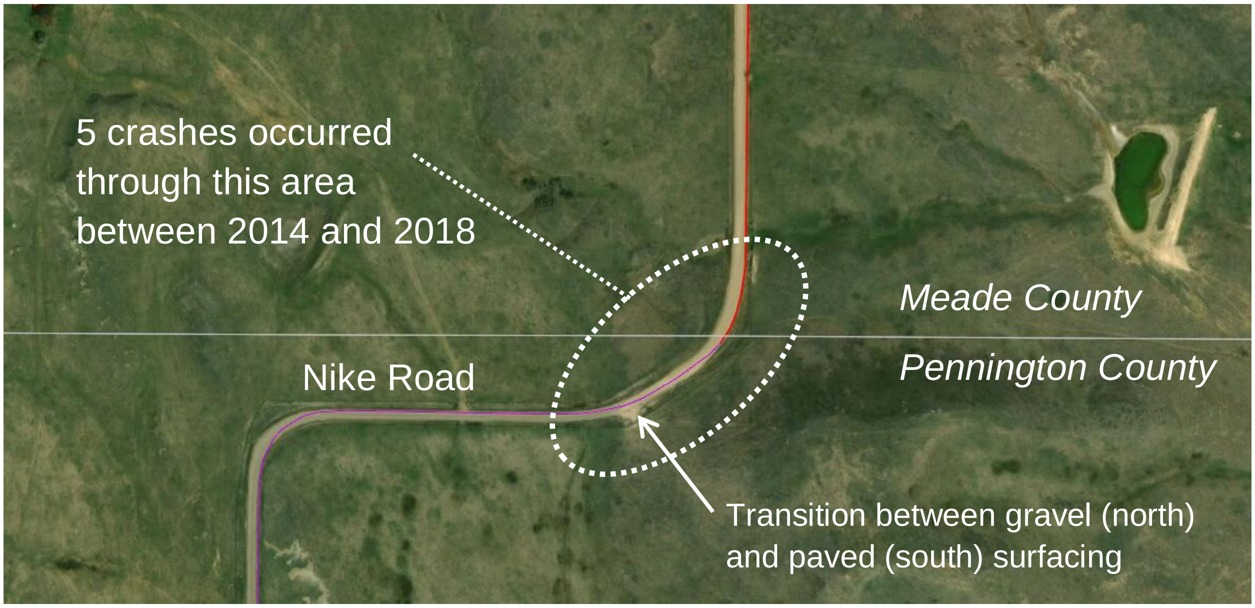


Figure 8: Nike Road Horizontal Curve at Meade County/Pennington County Boundary

Aerial source: SDDOT Interactive Road System Map

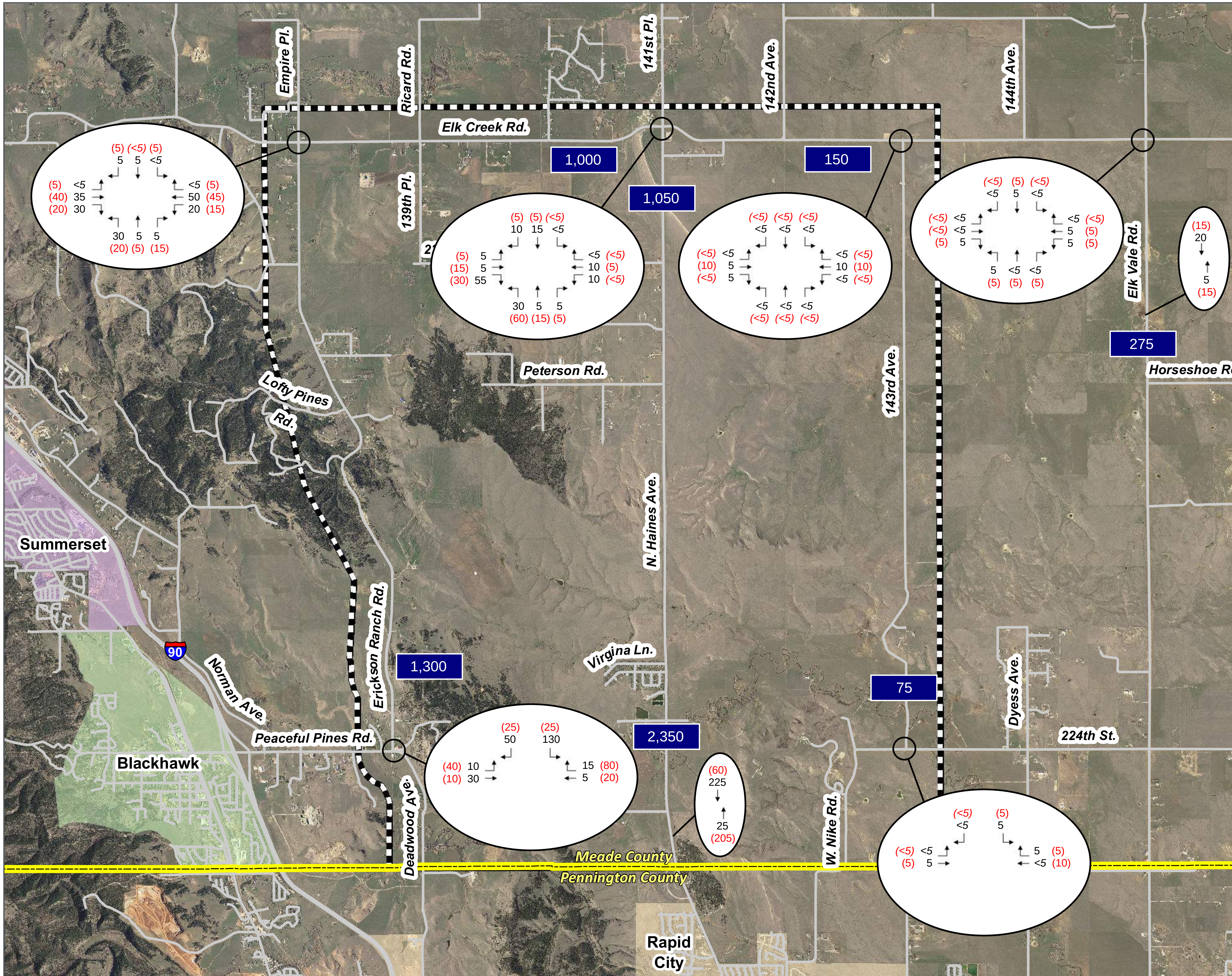
3.5 Existing Traffic Operations

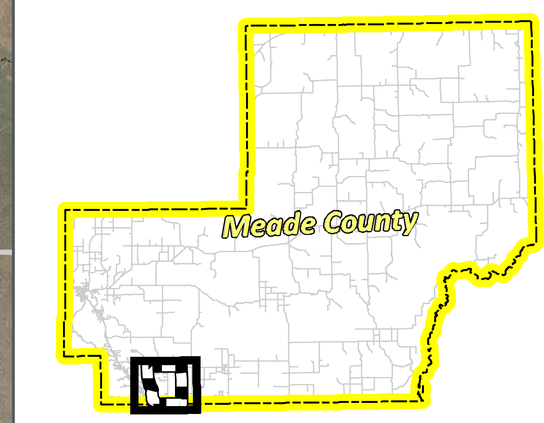
Traffic operations were analyzed for the existing conditions (Year 2019) to identify existing traffic operational needs at primary intersections and along highway segments throughout the traffic analysis Study Area. Elk Vale Road was not part of the original Study Area, but was included in the traffic forecasts because of its regional importance to connectivity along the eastern edge of the Study Area. Elk Vale Road provides a direct north-south connection to Interstate 90 (Exit 61) and the US-16 Bypass.

Refer to the Traffic Forecasts Technical Memorandum in **Appendix E** for further details on the development of existing traffic volume sets. Refer to the Existing and Future No-Build Conditions Traffic Operations Technical Memorandum in **Appendix F** for further details on the existing traffic operations analysis.

3.5.1 Existing Year Traffic Volume Development

Daily segment volumes and AM and PM peak hour intersection volumes were developed for the 2019 Existing Condition No-Build Condition scenario. The volume set was developed using the 2019 segment and peak hour counts factored to a design season (August) to account for seasonal fluctuations. Intersection turning movement volumes were smoothed across the corridor. As shown in **Figure 9**, 2019 Existing Conditions Traffic Volumes, low–volume movements (one or two vehicles over the peak hour) are presented as <5 to depict the low-volume nature of the specific movement.





LEGEND

- Study Area
- Existing Roads
- County Line

City Limits

- Blackhawk
- Box Elder
- Piedmont
- Rapid City
- Summerset

TRAFFIC LEGEND

20 (40) AM (PM) Traffic Volumes

1,900 Daily Traffic Volumes

All volumes reflect a peak season (August).

2019 EXISTING CONDITIONS TRAFFIC VOLUMES PEAK SEASON

SOUTHERN MEADE COUNTY CORRIDOR STUDY

N

0 0.5 1
MILES

MEADE COUNTY

Rapid City Area Metropolitan Planning Organization

HDR

FIGURE 9

3.5.2 Level of Service Goals for Study

The following minimum allowable LOS thresholds were established for this Study:

- Signalized intersections minimum allowable LOS – LOS B
- Two-way stop-controlled intersections LOS – LOS B (worst-case stop-controlled approach)
- Two-lane highways
    - Rural collector LOS – LOS C
    - Rural minor arterial LOS – LOS B

These LOS thresholds were used to identify areas of operational need along the corridor. In future build conditions operational analysis, these thresholds will be used to guide the development of potential improvements and the subsequent evaluation of concepts.

3.5.3 Intersection Traffic Operations Analysis

The existing conditions traffic operations analysis reflects a scenario that analyzes the current network using recently collected traffic counts (2019) and existing roadway conditions, such as number of lanes, intersection traffic control, and speed limits.

The 2019 Existing Conditions intersection operations are summarized in **Table 4**. Intersection traffic operations for the 2019 Existing Conditions all measure delay within acceptable LOS thresholds (LOS B or better) for this Study.

Table 4: Study Area Intersections – Existing Conditions

Study Intersection	***Intersection Control Type***	***AM Peak Period***	***PM Peak Period***
		LOS	***LOS***
Elk Creek Road & Erickson Ranch Road	*TWSC** N/S approaches	*B*	*B*
Elk Creek Road & Haines Avenue	*AWSC*	*A*	*A*
Elk Creek Road & 143rd Avenue	*TWSC** S approach	*A*	*A*
Peaceful Pines Road/ Deadwood Avenue & Erickson Ranch Road	*TWSC** N approach	*A*	*A*
224th Street & 143rd Avenue	*TWSC** N approach	*A*	*A*

* Two-way stop-control LOS reflects worst-case stop-controlled approach.

3.5.4 Two-Lane Highway Traffic Operations Analysis

Two-lane highway segments were analyzed using 2019 Existing Conditions traffic volumes for the paved highway segments only. Similar to the intersection analyses, the existing conditions analysis reflects roadway geometrics and conditions present in 2019.

The two-lane highway operational analyses for the 2019 Existing Conditions is summarized in **Table 5.** The analyses show that all analyzed segments resulted in an LOS C or better, which meets rural collector LOS goals for this Study. Segments with the greatest percentage of time a vehicle spends following another vehicle are located towards the southern Study Area boundary and exhibit higher commuter volumes to and from Rapid City.

Table 5: Two-Lane Highway Segments – Existing Conditions

Study Two-Lane Highway Segment	Functional Classification	Peak Hour	Peak Direction of Travel	AM Peak Period LOS	PM Peak Period LOS
Erickson Ranch Road Elk Creek Road – Westridge Road	*Rural Collector*	*AM*	*SB*	*A*	
		PM	*NB*		*A*
Erickson Ranch Road Westridge Road – Peaceful Pines Road	*Rural Collector*	*AM*	*SB*	*C*	
		PM	*NB*		*B*
Haines Avenue Elk Creek Road – Virginia Lane	*Rural Collector*	*AM*	*SB*	*A*	
		PM	*NB*		*A*
Haines Avenue Virginia Lane – Pennington County	*Rural Collector*	*AM*	*SB*	*B*	
		PM	*NB*		*B*
Elk Creek Road Erickson Ranch Road – Haines Avenue	*Rural Collector*	*AM*	*EB*	*A*	
		PM	*WB*		*A*

1 PTSF reflects analysis in the peak direction

3.6 Projected Future Traffic Operations

Traffic operations were analyzed for the 2045 Planning Horizon No-Build and 2045 Planning Horizon Build Conditions to identify planning horizon traffic operational needs at primary intersections and along highway segments throughout the traffic analysis Study Area. Similar to the existing conditions, Elk Vale Road was not part of the original Study Area, but was included in the traffic forecasts because of its regional importance to connectivity along the eastern edge of the Study Area.

The primary difference between the 2045 No-Build and 2045 Build Conditions is the inclusion of a proposed east-west corridor north of the Meade County-Pennington County border linking Erickson Ranch Road, Haines Avenue, and 143rd Avenue. In this Study, the corridor was extended over to Elk Vale Road for illustrative purposes, as previously described. If the proposed east-west corridor is not extended east to 143rd Avenue, the segment volumes would be applicable to the 224th Street segment between 143rd Avenue and Elk Vale Road.

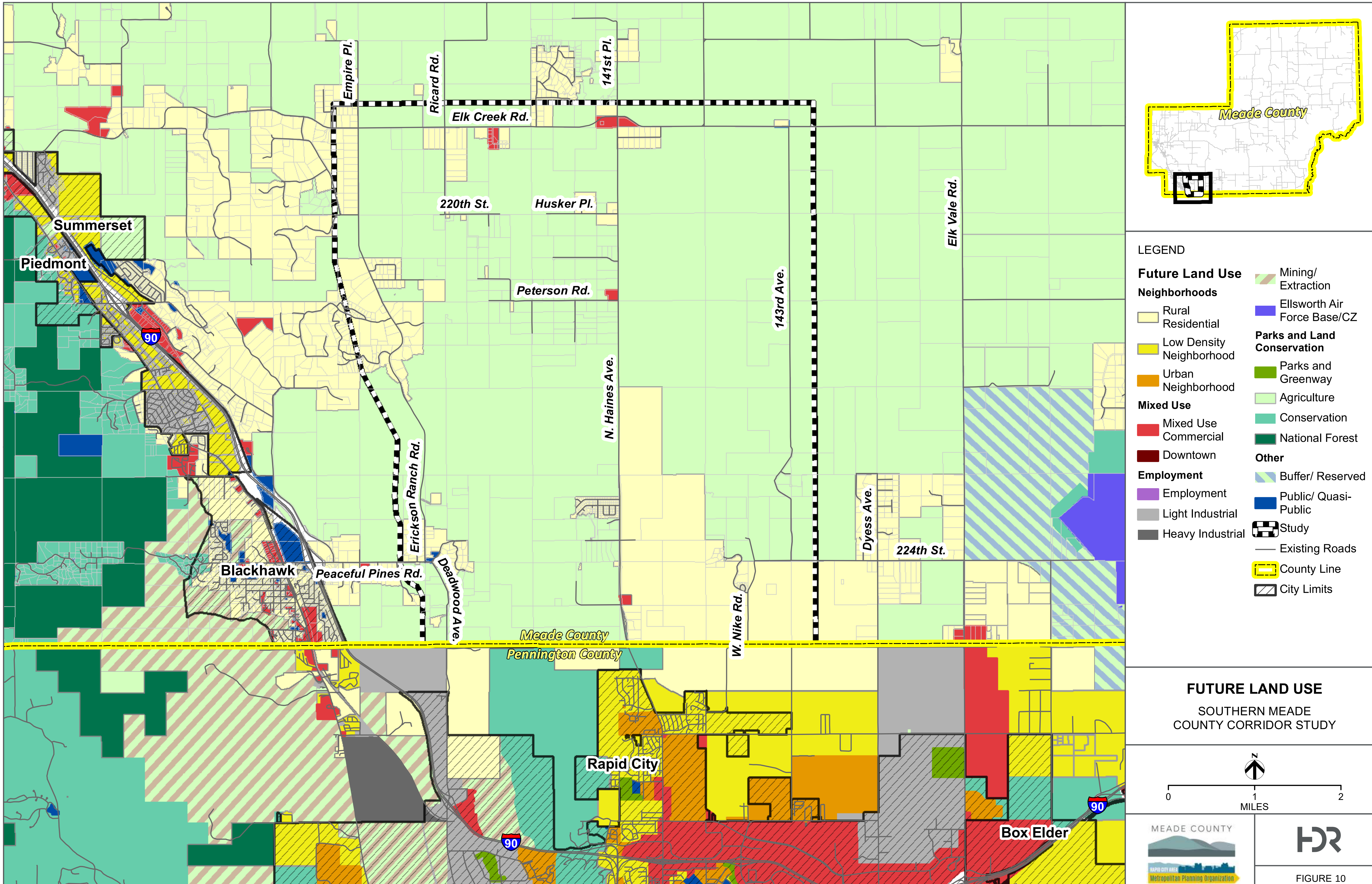
Refer to the Existing and 2045 No-Build Conditions Traffic Operations Technical Memorandum in **Appendix F** and the 2045 Build Conditions Traffic Operations Technical Memorandum in **Appendix G** for further details on the future year traffic operations analysis.

3.6.1 Future Year Traffic Volume Development

Meade County only has future land use mapped east of Haines Avenue. Future land use from the Rapid City Comprehensive Plan (2014 update) was utilized west of Haines Avenue. The future land use is a mix of agriculture and rural residential, as shown in **Figure 10**. The future land use expected within the Study Area is associated with low trip generation land uses. It is expected that land use will likely maintain the highly directional traffic patterns to and from Rapid City through this Study's 2045 planning horizon.

Daily segment volumes and AM and PM peak hour intersection volumes were developed for the 2045 Planning Year No-Build Condition and 2045 Planning Year Build Condition scenarios. Both traffic forecasts for 2045 were prepared using the most current version of the Rapid City Area MPO travel demand model (year 2040). Methodology used in the development of segment and intersection peak hour forecasts was consistent with *NCHRP 765: Analytical Travel Forecasting Approaches for Project-Level Planning and Design*. The forecasting, distribution, and assignment of traffic process for the 2045 No-Build and Build Conditions scenarios are described further in the Traffic Forecast Technical Memorandum in **Appendix E**.

Analysis traffic volumes for the 2045 No-Build and Build Conditions are summarized in **Figure 11** and **Figure 12**.

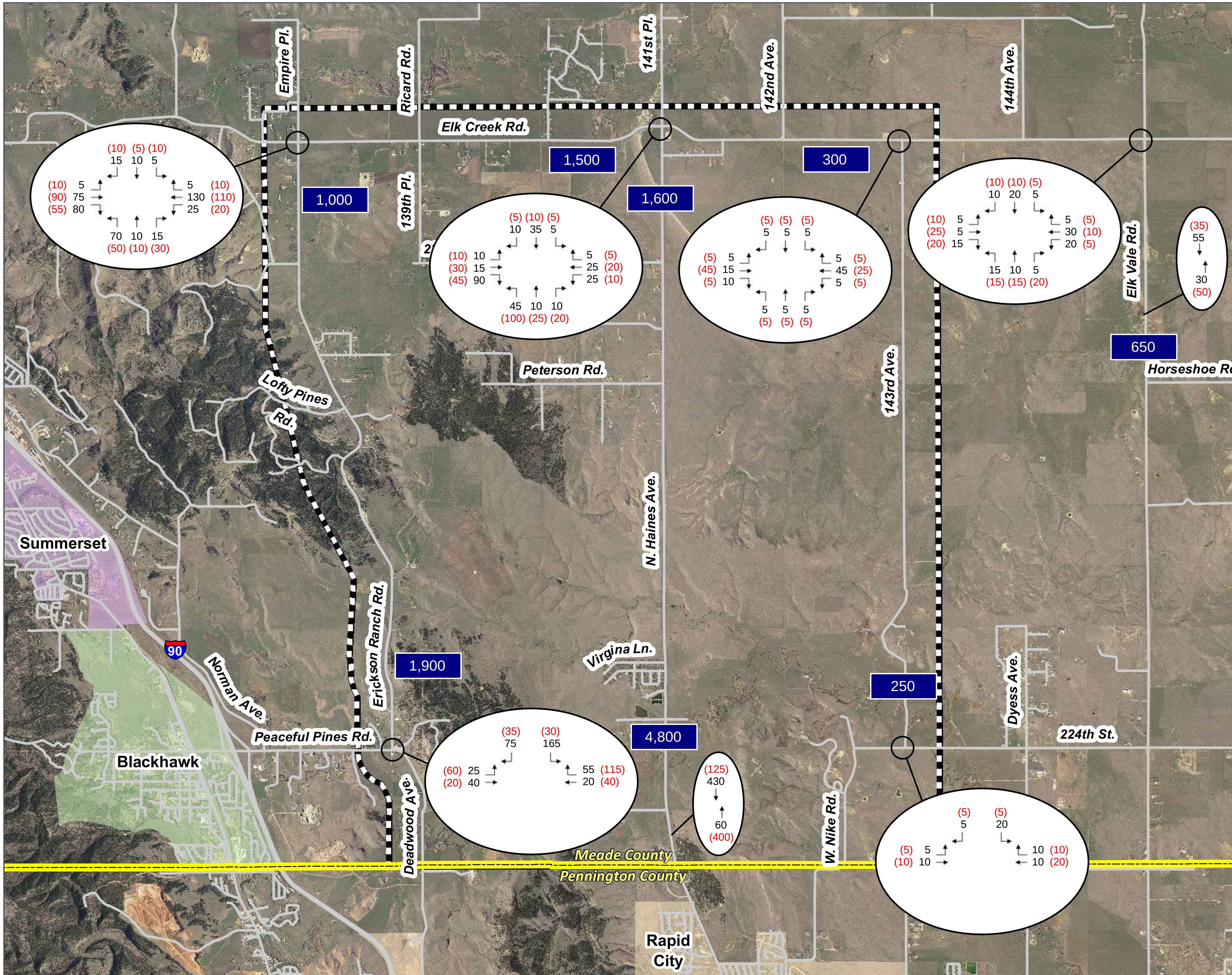


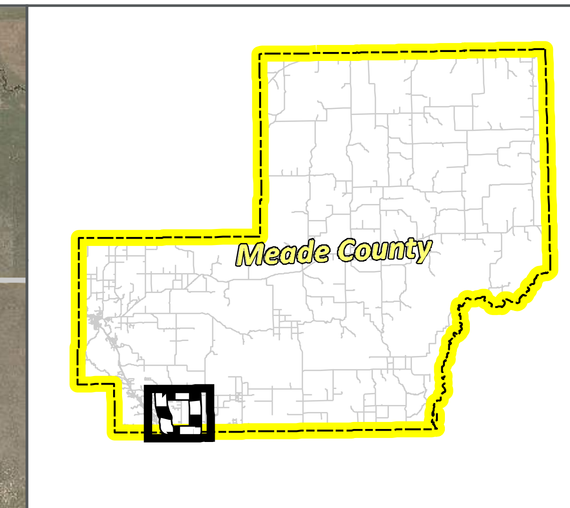
FUTURE LAND USE

SOUTHERN MEADE COUNTY CORRIDOR STUDY

FIGURE 10

PATH: Z:\PROJECTS\10151083 - RCMPO MEADE CTY CORRIDOR STUDY\GIS\HDR\CORRIDOR REPORT\FIGURE X EXISTING LAND USE.MXD - USER: SSLOWEY - DATE: 9/19/2019





LEGEND

Study Area

Existing Roads

County Line

City Limits

Blackhawk

Box Elder

Piedmont

Rapid City

Summerset

TRAFFIC LEGEND

20 (40) AM (PM) Traffic Volumes

1,900 Daily Traffic Volumes

All volumes reflect a peak season (August).

2045 NO-BUILD CONDITIONS TRAFFIC VOLUMES PEAK SEASON

SOUTHERN MEADE COUNTY CORRIDOR STUDY

N

0 0.5 1

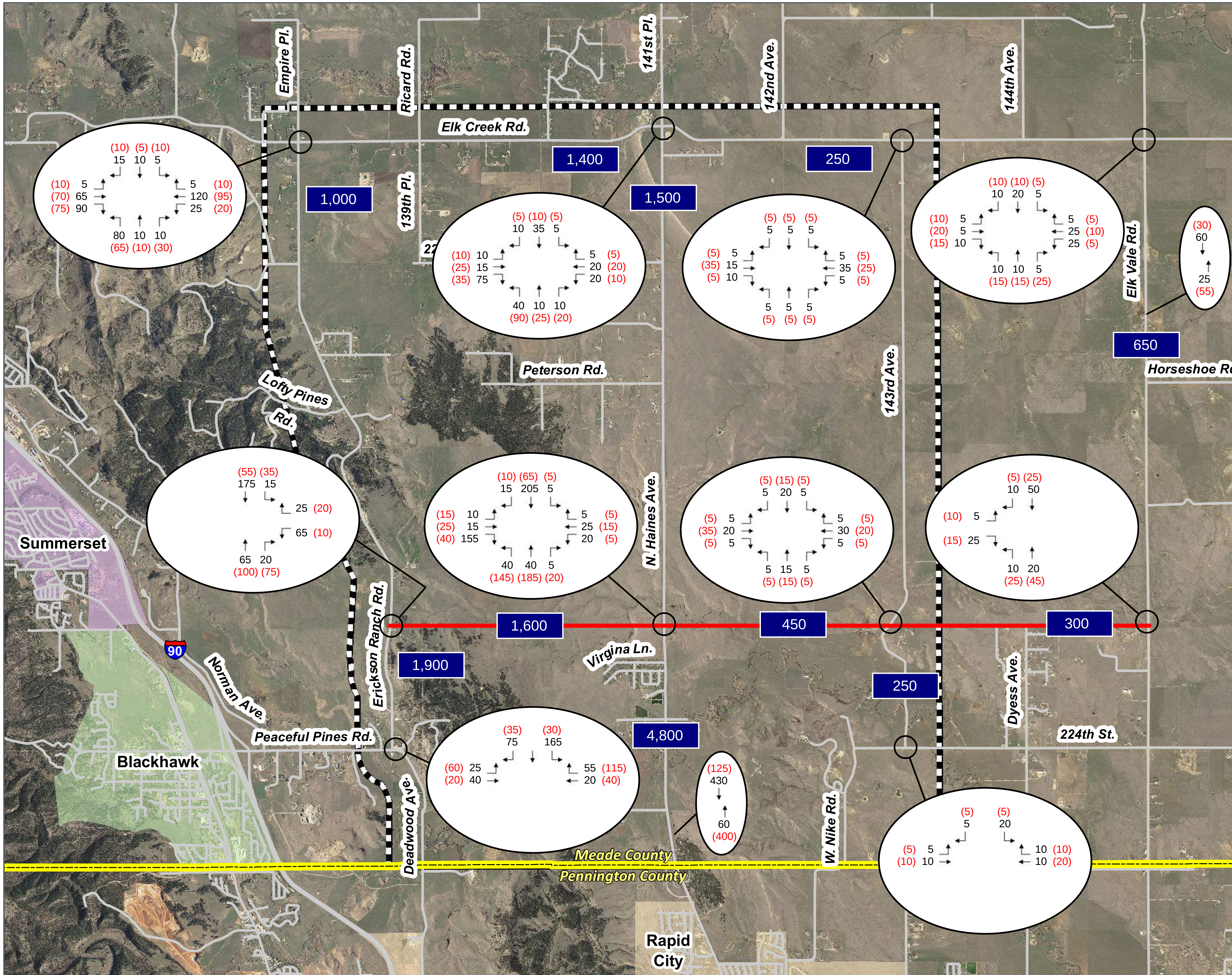
MILES

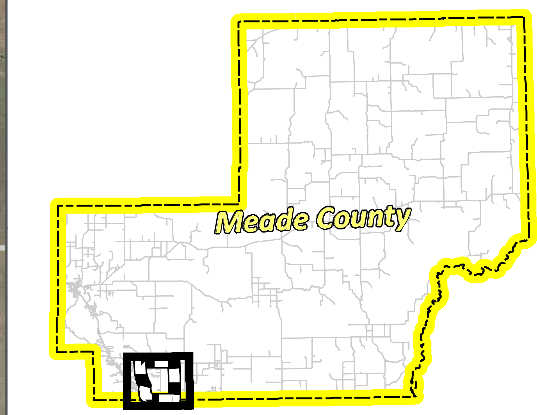
MEADE COUNTY

Rapid City Area Metropolitan Planning Organization

FIGURE 11

PATH: Z:\PROJECTS\10151083 - RCMPO MEADE CTY CORRIDOR STUDY\GIS\HDR\CORRIDOR REPORT\FIGURE X TRAFFIC VOLUMES.MXD - USER: SSLOWEY - DATE: 10/9/2019





LEGEND

- Study Area
- Existing Roads
- County Line

City Limits

- Blackhawk
- Box Elder
- Piedmont
- Rapid City
- Summerset
- Analysis Alignment for Proposed East/West Corridor

TRAFFIC LEGEND

20 (40) AM (PM) Traffic Volumes

1,900 Daily Traffic Volumes

All volumes reflect a peak season (August).

2045 BUILD CONDITIONS TRAFFIC VOLUMES PEAK SEASON

SOUTHERN MEADE COUNTY CORRIDOR STUDY

N

0 0.5 1
MILES

MEADE COUNTY

Rapid City Area Metropolitan Planning Organization

HDR

FIGURE 12

PATH: Z:\PROJECTS\10151083 - RCMPO MEADE CTY CORRIDOR STUDY\GIS\HDR\CORRIDOR REPORT\FIGURE X TRAFFIC VOLUMES.MXD - USER: SSLOWEY - DATE: 10/9/2019

3.6.2 No Build and Build 2045 Intersection Traffic Operations Analysis

The purpose of the 2045 No-Build Conditions analysis is to identify future-year needs and help guide the subsequent development of potential improvements within the Study Area. Operational results are summarized in **Table 6.**

Table 6: Study Area Intersections – 2045 No-Build Conditions

Study Intersection	Intersection Control Type	AM Peak Period LOS	PM Peak Period LOS
Elk Creek Road & Erickson Ranch Road	*TWSC** N/S approaches	*B*	*B*
Elk Creek Road & Haines Avenue	*AWSC*	*A*	*A*
Elk Creek Road & 143rd Avenue	*TWSC** S approach	*A*	*A*
Peaceful Pines Road/ Deadwood Avenue & Erickson Ranch Road	*TWSC** N approach	*A*	*A*
224th Street & 143rd Avenue	*TWSC** N approach	*A*	*A*

* Two-way stop-control LOS reflects worst-case stop-controlled approach.

A summary of the 2045 Build Conditions traffic operations analysis at the primary intersections within the Study Area is provided in **Table 7**. Each intersection was built-out, as needed, in the HCS7 traffic model to achieve LOS goals for this Study. The resulting recommended intersection lane configurations are shown in **Figure 19** (Conclusions and Recommendations section of this report).

Table 7: Study Area Intersections – 2045 Build Conditions

Study Intersection	Intersection Control Type	AM Peak Period LOS	PM Peak Period LOS
Elk Creek Road & Erickson Ranch Road	TWSC*	B	B
Elk Creek Road & Haines Avenue	AWSC	A	A
Elk Creek Road & 143rd Avenue	TWSC*	A	A
Peaceful Pines Road/ Deadwood Avenue & Erickson Ranch Road	TWSC*	B	A
224th Street & 143rd Avenue	TWSC*	A	A
East/West Corridor & Erickson Ranch Road	TWSC*	B	A
East/West Corridor & Haines Avenue	TWSC* AWSC Roundabout	C A A	C B A
East/West Corridor & 143rd Avenue	TWSC*	A	A

* Two-way stop-control LOS reflects worst-case stop-controlled approach.

No modifications were needed to achieve LOS goals at any of the existing intersections. This implies that the existing intersection configurations are adequate for future-year volumes developed for this Study.

Along the proposed corridor, each intersection was initially analyzed with a shared approach lane configuration of left/through/right from a single lane. Locations where lanes were separated to achieve LOS goals are noted in the discussion.

It was observed that the primary location with a notable delay in two-way stop-control (TWSC) conditions is the proposed east-west corridor and Haines Avenue intersection. Worst-case stop-controlled approach delay was measured at LOS C in both the AM and PM peak periods. The greatest delays were measured on the low-volume westbound approach. As a result, separating left-turn and through traffic would provide minimal benefit to this LOS measure.

Two other intersection alternatives were analyzed at the proposed east-west corridor and Haines Avenue intersection. Both an AWSC intersection and roundabout result in acceptable LOS for this Study and are feasible solutions to address future traffic volumes at this intersection. The roundabout configuration results in the lowest overall intersection delay of the three options.

3.6.3 No-Build and Build Two-Lane Highway Traffic Operations Analysis

Two-lane highway segments were analyzed using the 2045 No-Build and Build Conditions traffic volumes for the paved highway segments. HCM6 methodology does not currently support analysis of gravel roadway segments. Therefore, existing gravel roadways were not analyzed as part of this review.

Two-lane highway operational analyses for the 2045 No-Build Conditions are summarized in **Table 8**, respectively. It was observed that all analyzed segments resulted in an LOS C or better, which meets rural collector LOS goals for this Study. Segments with the greatest percentage of time a vehicle spends following another vehicle are located towards the southern Study Area boundary and exhibit higher commuter volumes to and from Rapid City.

Table 8: Two-Lane Highway Segments – 2045 No-Build Conditions

Study Two-Lane Highway Segment	Functional Classification	Peak Hour	Peak Direction of Travel	AM Peak Period LOS	PM Peak Period LOS
Erickson Ranch Road Elk Creek Road – Westridge Road	*Rural Collector*	*AM*	*SB*	*B*	
		PM	*NB*		*A*
Erickson Ranch Road Westridge Road – Peaceful Pines Road	*Rural Collector*	*AM*	*SB*	*C*	
		PM	*NB*		*C*
Haines Avenue Elk Creek Road – Virginia Lane	*Rural Collector*	*AM*	*SB*	*B*	
		PM	*NB*		*B*
Haines Avenue Virginia Lane – Pennington County	*Rural Collector*	*AM*	*SB*	*C*	
		PM	*NB*		*C*
Elk Creek Road Erickson Ranch Road – Haines Avenue	*Rural Collector*	*AM*	*EB*	*A*	
		PM	*WB*		*A*

[1] PTSF reflects analysis in the peak direction

Two-lane highway operational analysis results for the 2045 Build Conditions are summarized in **Table 9**. It was observed that all analyzed segments, including the proposed east-west collector, result in an LOS C or better. This meets rural collector LOS goals for this Study.

Table 9: Two-Lane Highway Segments – 2045 Build Conditions

Study Two-Lane Highway Segment	Functional Classification	Peak Hour	Peak Direction of Travel	AM Peak Period LOS	PM Peak Period LOS
Erickson Ranch Road Elk Creek Road – Westridge Road	*Rural Collector*	*AM*	*SB*	*B*	
		PM	*NB*		*B*
Erickson Ranch Road Westridge Road – East-West Corridor	*Rural Collector*	*AM*	*SB*	*C*	
		PM	*NB*		*B*
Erickson Ranch Road East-West Corridor – Peaceful Pines Road	*Rural Collector*	*AM*	*SB*	*C*	
		PM	*NB*		*C*
Haines Avenue Elk Creek Road – East-West Corridor	*Rural Collector*	*AM*	*SB*	*C*	
		PM	*NB*		*B*
Haines Avenue East-West Corridor – Pennington County	*Rural Collector*	*AM*	*SB*	*C*	
		PM	*NB*		*C*
Elk Creek Road Erickson Ranch Road – Haines Avenue	*Rural Collector*	*AM*	*EB*	*A*	
		PM	*WB*		*A*
East/West Corridor Erickson Ranch Road – Haines Avenue	*Rural Collector*	*AM*	*EB*	*B*	
		PM	*WB*		*B*

1 PTSF reflects analysis in the peak direction

As found in the 2045 No-Build Conditions analysis, segments exhibiting the greatest percentage of time a vehicle spends following another vehicle are located towards the southern Study Area boundary.

The proposed east-west corridor two-lane highway cross-section, paved between Erickson Ranch Road and Haines Avenue, is expected to meet LOS goals for this Study. The proposed gravel segment between Haines Avenue and 143rd Avenue was not analyzed in HCS7.

3.6.4 Roadway Segment Capacity Assessment

Another method used to estimate capacity-related needs is to compare daily segment volume forecasts to LOS-based roadway segment capacity thresholds (as presented in the *South Dakota Department of Transportation Road Design Manual,* Table 15-10). These thresholds, shown in **Table 10**, represent a planning-level guide to cross-sectional needs in terms of through lanes and potential turn lanes based on traffic volumes.

Table 10: Estimated Number of Lanes Based on Daily Traffic Volumes

Total Number of Lanes	Description	Total Design Year ADT [1]	
		Rural Level	Urban
2	1 lane in each direction	< 8,000	< 2,500
3	1 lane in each direction plus center turn lane	--[2]	2,500 to 16,000
4	2 lanes in each direction	8,000 to 20,000 [3]	--[3]
5	2 lanes in each direction plus center turn lane	--[2]	16,000 to 30,000
6	3 lanes in each direction	> 20,000 [4]	> 30,000 [4]

Source: *South Dakota Department of Transportation Road Design Manual*, Table 15-10 (as of 4/26/19)

1 Construction or Reconstruction projects are designed based on a typical 20 year ADT projection beyond the anticipated year of project construction.

2 Continuous left turn lanes may be considered based on left turn volumes, when intersections or approaches are closely spaced together, or both.

3 Undivided sections may be used if left turn movements are low and there is no crash history, otherwise consider installing a median or 5 lane section.

4 Medians should be used.

All roadways within the study exhibit a 2045 daily traffic volume forecast of less than 8,000 vehicles per day, which is the Rural Level threshold for a two-lane roadway. As Rapid City continues to grow northward and the southern areas of Meade County becomes more urbanized, a 3-lane urban cross-section may be applicable. This would provide one lane in each direction plus a center turn lane.

3.6.5 Proposed East-West Corridor Intersection Turn Lanes

A turn lane warrant evaluation was conducted using 2045 Build Conditions traffic forecasts for north-south free movements at the proposed east-west corridor intersections with Erickson Ranch Road, Haines Avenue, and 143rd Avenue. Turn lanes for the proposed east-west corridor stop-controlled approaches are typically dictated by operational (delay) needs, as all vehicles are required to stop at the intersection.

This evaluation serves as a tool to aid conceptual design. Conclusions from this evaluation do not require installation, or non-installation, of a turn lane. Turn lanes to crossroads and driveways provide operational and safety benefits to arterial roadway traffic by minimizing through traffic hazards and interference.

Engineering judgment and other factors, such as lane balance, access density, route continuity, and sight distance, contribute to the ultimate determination whether a turn lane is constructed. Additionally, future development intensity, timeframe, and desired access play a role in the level of demand for these future minor street intersections and driveways.

Turn lane warrant criteria for the free intersection movements used in this analysis are based on standards for turn lanes presented in the SDDOT Road Design Manual. These standards consider the relationship between traffic volumes, posted (or future) speed limits, and the number of lanes on a facility to determine whether a turn lane is warranted.

Table 11 shows the results of the turn lane analysis for north-south free movements at the proposed intersections with the east-west corridor.

Table 11: Proposed East-West Corridor Intersection Turn Lane Volume Warrant Review

Future East-West Corridor Intersection	*Turn Movement*	*2045 Turn Lane Volume Warrant Satisfied*
Erickson Ranch Road	*NB RT*	*No*
	SB LT	*No*
Haines Avenue	*NB LT*	*Yes (AM & PM)*
	NB RT	*No*
	SB LT	*No**
	SB RT	*No*
143rd Avenue	*NB LT*	*No*
	NB RT	*No*
	SB LT	*No*
	SB RT	*No*

Analysis Methodology Source: *South Dakota Department of Transportation Road Design Manual*, Figures 15-2 and 15-3 (as of 7/11/19)
* Consider LT lane when opposing direction includes warranted left-turn lane.

The primary turn lane need, based on forecasted volumes for this Study, is the high volume northbound to westbound left-turn movement at the intersection of the proposed east-west corridor and Haines Avenue. A turn lane at this location would remove left-turning vehicles from the through movement and allow them to wait for a gap in southbound traffic. While not warranted, a complimentary southbound left-turn lane is also recommended. This would remove left-turning traffic from the free through movement and also provide better sight angles when there is a turning vehicle in the opposing left-turn lane.

While turn lanes are not warranted at other locations, further consideration should be given during design due to the operational and safety benefits turn lanes provide.

4.0 Alternatives Development

Alternatives development began with a preliminary screening process where 12 preliminary alternatives were narrowed down to three feasible build alternatives. The no-build alternative and the three feasible build alternatives were scrutinized further during the alternatives analysis process. Ultimately, one alternative was recommended based on the purpose and need, landowner impacts, safety, constructability, and cost.

4.1 Preliminary Alternatives Screening

For the preliminary alternatives development of the proposed east-west Southern Meade County connector, a total of 12 build alternatives were considered. From these alternatives, the SAT selected three build alternatives to study further, referred to as “feasible build alternatives” within this report.

The following factors were considered when selecting the list of possible build alternatives to screen:

- Connectivity of existing roadways to provide additional egresses and methods of travel to fragmented neighborhoods prevalent north of Rapid City.
- Alignment with section lines, which is the preference of the County.
- Following the existing topography in order to reduce construction costs.

Each alternative was broken down into three segments. Segment A is between Erickson Ranch Road and Haines Avenue. Segment B is between Haines Avenue and 143rd Avenue. Segment C is between 143rd Avenue and Elk Vale Road. This was done so that each alternative could be disassembled and reassembled with other alternative segments if desired.

Initially, the alternative alignments presented only contained Segments A and B. However, per concerns raised during the first public meeting, the alignments of each alternative were extended to Elk Vale Road, designated as “Segment C”. Elk Vale Road is not part of the Study Area, but has been included in the preliminary analysis because of its regional importance to future connectivity along the eastern edge of the Study Area. Elk Vale Road provides a direct north-south connection to I-90 (Exit 61) and the US-16 Bypass. The Segment C analysis only provides a cursory review to determine if the corresponding Segment A or B alignments could easily facilitate a future Segment C connection.

4.1.1 Screening Methodology

The developed alternatives were further screened to explore potential impacts and construction feasibility. The following methodology was used to compare the alternatives and determine the feasibility of each.

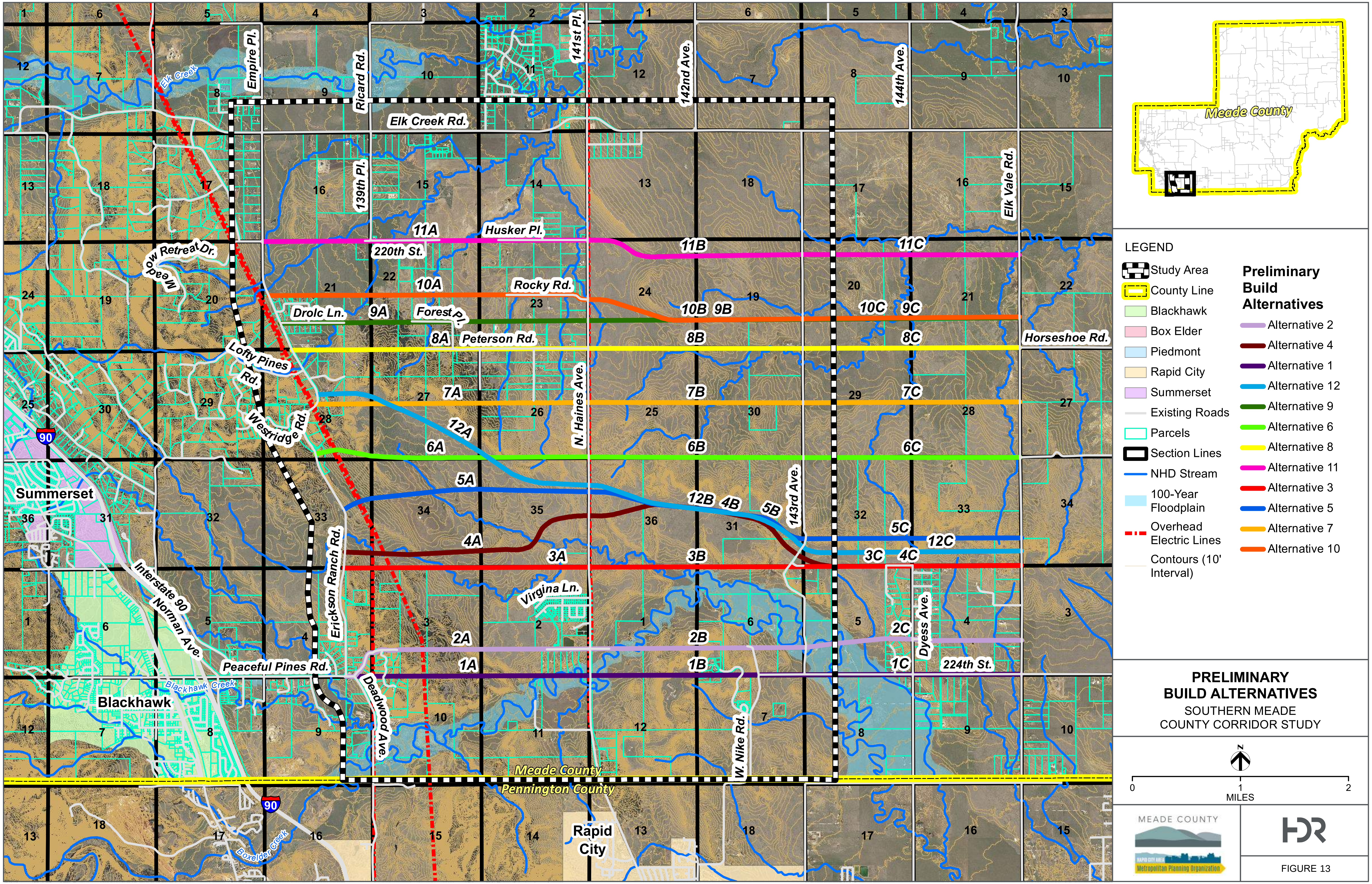
Table 12 contains a summary of the scoring categories and their relative weights. The alternatives were scored in the different categories and summarized in **Table 13**. A red score indicates that the alternative scored low in a particular category, yellow indicates the alternative scored in the middle or average in a category compared to the other alternatives; and green indicates an alternative scored high in a category compared to the other alternatives. The score of each category was added together for each alternative. The highest score an alternative could receive was 210.

Refer to the Alternatives Development Screening Technical Memorandum in **Appendix H** for further details on the screening methodology.

Table 12. Summary of Category Weights

Category	*Weight*
East-West Travel Demand	*30*
Cultural & Historic Sites	*20*
Floodplain Impacts	*20*
Structures & Buildings	*20*
Wetlands & Drainages	*10*
Intersection Geometrics at Erickson Ranch Road	*10*
Intersection Geometrics at Haines Avenue	*10*
Intersection Geometrics at 143rd Avenue	*10*
Intersection Geometrics at Elk Vale Road	*10*
Connectivity to Existing Development	*10*
Section Line Alignment	*10*
Topography	*10*
Earthwork	*10*
Utilities	*10*
Feasibility of Future Connectivity to Arterial Network (Interstate 90 West)	*10*
Feasibility of Future Connectivity to Arterial Network (Elk Vale Road)	*10*
Total	***210***

Figure 13 illustrates the locations of each alternative, the topography, existing roadway connectivity, transmission line locations, drainage crossings, and floodplain encroachment.



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4.1.2 Summary of Preliminary Alternative Screening Findings

The scores of the preliminary alternatives analysis can be found below in **Table 13**.

Table 13. Summary of Alternative Scorings

Preliminary Alternative #	*Color on Figures*	*East-West Travel Demand*	*Floodplain Impacts*	*Cultural & Historic Sites*	*Structures & Buildings*	*Wetlands & Drainages*	*Intersection Geometrics Erickson Ranch Rd*	*Intersection Geometrics Haines Ave*	*Intersection Geometrics 143rd Ave*	*Intersection Geometrics Elk Vale Rd*	*Connectivity to Existing Development*	*Section Line Alignment*	*Topography*	*Earthwork*	*Utilities*	*Feasibility of Future Connectivity to Arterial Network (I-90 West)*	*Feasibility of Future Connectivity to Arterial Network (Elk Vale Rd)*	*Final Score*
Weight		*30*	*20*	*20*	*20*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*10*	*Total Out of 210*
No Build		*0*	*20*	*20*	*20*	*10*	*N/A*	*N/A*	*N/A*	*N/A*	*0*	*0*	*N/A*	*N/A*	*10*	*0*	*0*	*N/A*
1	*Dark Purple*	*30*	*0*	*20*	*0*	*0*	*5*	*10*	*5*	*5*	*10*	*10*	*0*	*0*	*5*	*10*	*0*	*110*
2	*Light Purple*	*30*	*0*	*20*	*0*	*0*	*5*	*5*	*10*	*10*	*10*	*0*	*0*	*0*	*5*	*10*	*0*	*105*
3	*Red*	*30*	*10*	*10*	*0*	*5*	*0*	*5*	*0*	*5*	*10*	*10*	*0*	*5*	*5*	*10*	*0*	*105*
4	*Brick Red*	*30*	*20*	*20*	*20*	*5*	*10*	*5*	*10*	*5*	*5*	*0*	*5*	*5*	*5*	*10*	*10*	*165*
5	*Blue*	*30*	*20*	*20*	*20*	*5*	*10*	*10*	*5*	*10*	*0*	*0*	*5*	*5*	*5*	*10*	*10*	*165*
6	*Light Green*	*30*	*20*	*20*	*20*	*5*	*0*	*5*	*10*	*10*	*5*	*10*	*0*	*0*	*5*	*10*	*10*	*160*
7	*Gold*	*15*	*20*	*20*	*10*	*0*	*5*	*10*	*10*	*5*	*5*	*0*	*0*	*5*	*5*	*0*	*10*	*120*
8	*Yellow*	*15*	*20*	*20*	*10*	*0*	*10*	*10*	*10*	*10*	*10*	*10*	*5*	*10*	*5*	*0*	*10*	*155*
9	*Dark Green*	*0*	*20*	*10*	*10*	*0*	*10*	*10*	*10*	*10*	*10*	*0*	*10*	*10*	*5*	*0*	*0*	*115*
10	*Orange*	*0*	*20*	*10*	*20*	*0*	*10*	*10*	*10*	*10*	*10*	*0*	*10*	*10*	*5*	*0*	*0*	*125*
11	*Pink*	*0*	*20*	*20*	*20*	*5*	*10*	*10*	*5*	*10*	*10*	*5*	*10*	*10*	*5*	*0*	*10*	*150*
12	*Light Blue*	*15*	*20*	*20*	*20*	*10*	*5*	*10*	*5*	*5*	*0*	*0*	*10*	*10*	*5*	*0*	*10*	*145*

4.1.3 Screened Feasible Build Alternatives

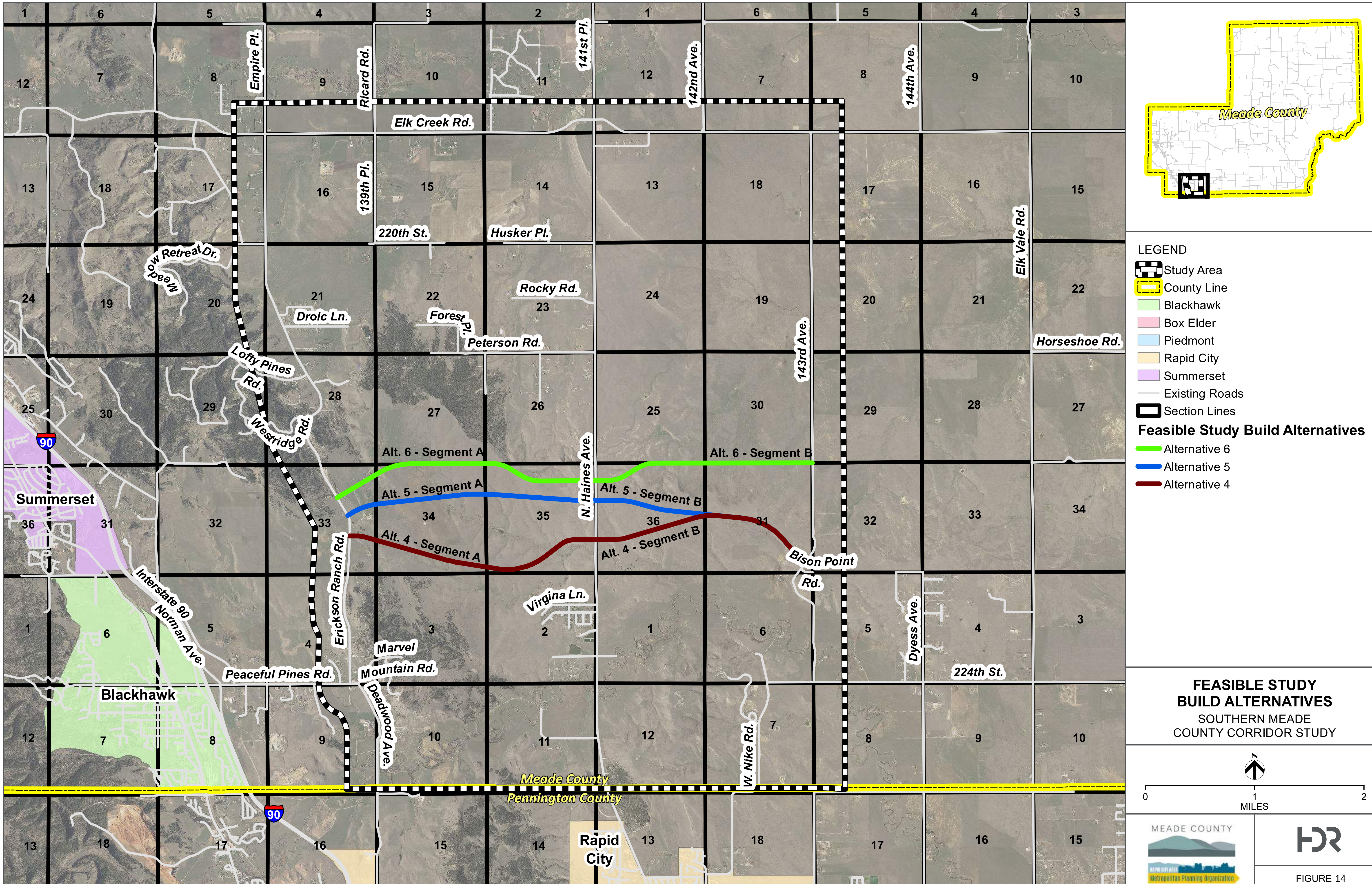
Alternatives 4, 5, and 6 ranked the highest of all the alternatives included in the preliminary alternative screening analysis. Three build alternatives were brought forward to study in further detail.

The SAT met on May 13, 2019 to determine which alternatives merited further investigation. The SAT discussed each alternative and selected Alternatives 4, 5, and 6 to study further. The build alternatives chosen, along with slight modifications, are illustrated in **Figure 14**. The modifications to the alignments were as follows:

- Alternative 4 – Alternative 4 was shifted slightly to avoid steep terrain in certain locations and intersect Haines Avenue at a more optimal location.
- Alternative 5 – The east half of segment 5B was revised to match the east half of segment 4B. The reasoning behind this was to better align the intersection at 143rd Avenue within a tangent section.
- Alternative 6 - Alternative 6 was modified at the intersection with Erickson Ranch Road in order to shift it to the tangent section of Erickson Ranch Road. The intersection at Haines Avenue, and a significant portion of the alignment, was also shifted south to avoid steep terrain and intersect Haines Avenue at a more optimal location.

Alternatives 8, 11, and 12 received relatively high scores, but they did not make the final selection for the following reasons:

- Alternative 8 would likely be unfeasible for future connectivity to the arterial network to the west. It also has fairly rough terrain between Erickson Ranch Road and Haines Avenue. According to a member of the SAT, a connection between Peterson Road and Erickson Ranch Road has been studied before and found to be unfeasible due to the steep terrain. For these reasons, Alternative 8 was not carried forward for further study.
- Alternative 11 does not appear to offer much benefit since Elk Creek Road runs parallel and is only 1 mile to the north. For this reason, Alternative 11 was not carried forward for further study.
- Alternative 12 generally runs northwest and southeast, which the SAT decided would require cut through traffic to backtrack for northeast and southwest travel. The skew of the roadway alignment also lengthens the amount of roadway required, which would increase the cost to build this roadway. Three out of the four intersections on this alignment, specifically at Erickson Ranch Road, 143rd Avenue, and Elk Vale Avenue, tie into horizontal or vertical curves. For these reasons, Alternative 12 was not carried forward for further study.



FEASIBLE STUDY BUILD ALTERNATIVES
SOUTHERN MEADE COUNTY CORRIDOR STUDY

FIGURE 14

PATH: Z:\PROJECTS\10151083 - RCMPO MEADE CTY CORRIDOR STUDY\GIS\HDR\CORRIDOR REPORT\FIGURE X SELECTED STUDY BUILD ALTERNATIVES.MXD - USER: SSLOWEY - DATE: 10/9/2019

4.2 Alternatives Analysis

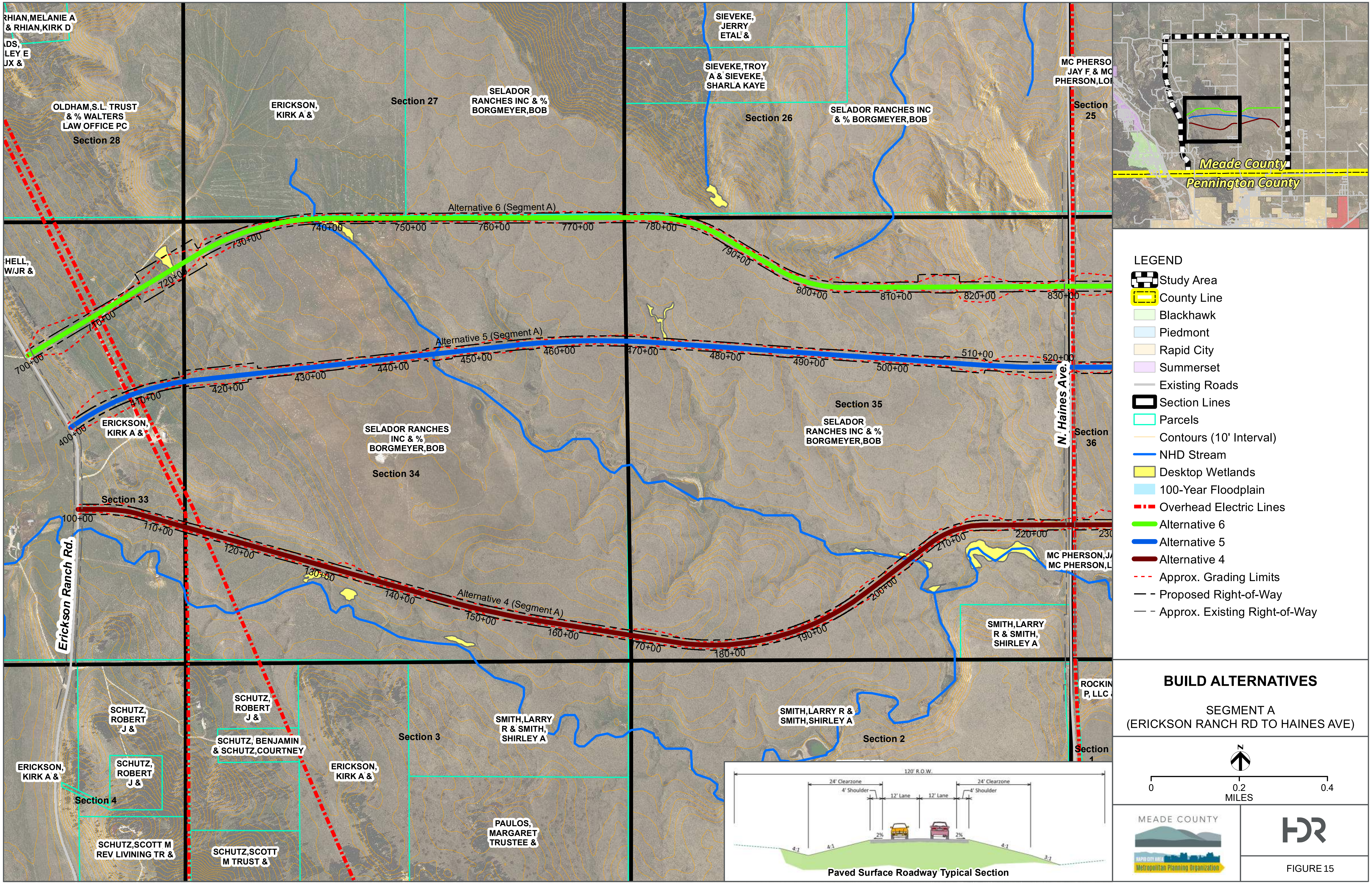
4.2.1 Background

As described above, a total of 12 build alternatives were considered during the preliminary alternatives screening process. Each of the 12 build alternatives were scored based on topography, earthwork, preliminary intersection geometrics, number of wetlands or drainage crossings, proximity to cultural or historic sites and structures or buildings, section line alignment, connectivity to existing development, east-west travel demand, utilities, and feasibility of future connectivity to Interstate 90 to the west and Elk Vale Road to the east. During the screening process, the study alternatives were narrowed down to a total of three build alternatives. These build alternatives were selected based upon the ranking of the scores associated with the criteria noted above. The SAT selected Alternatives 4, 5, and 6 to examine further, as shown in **Figure 14**.

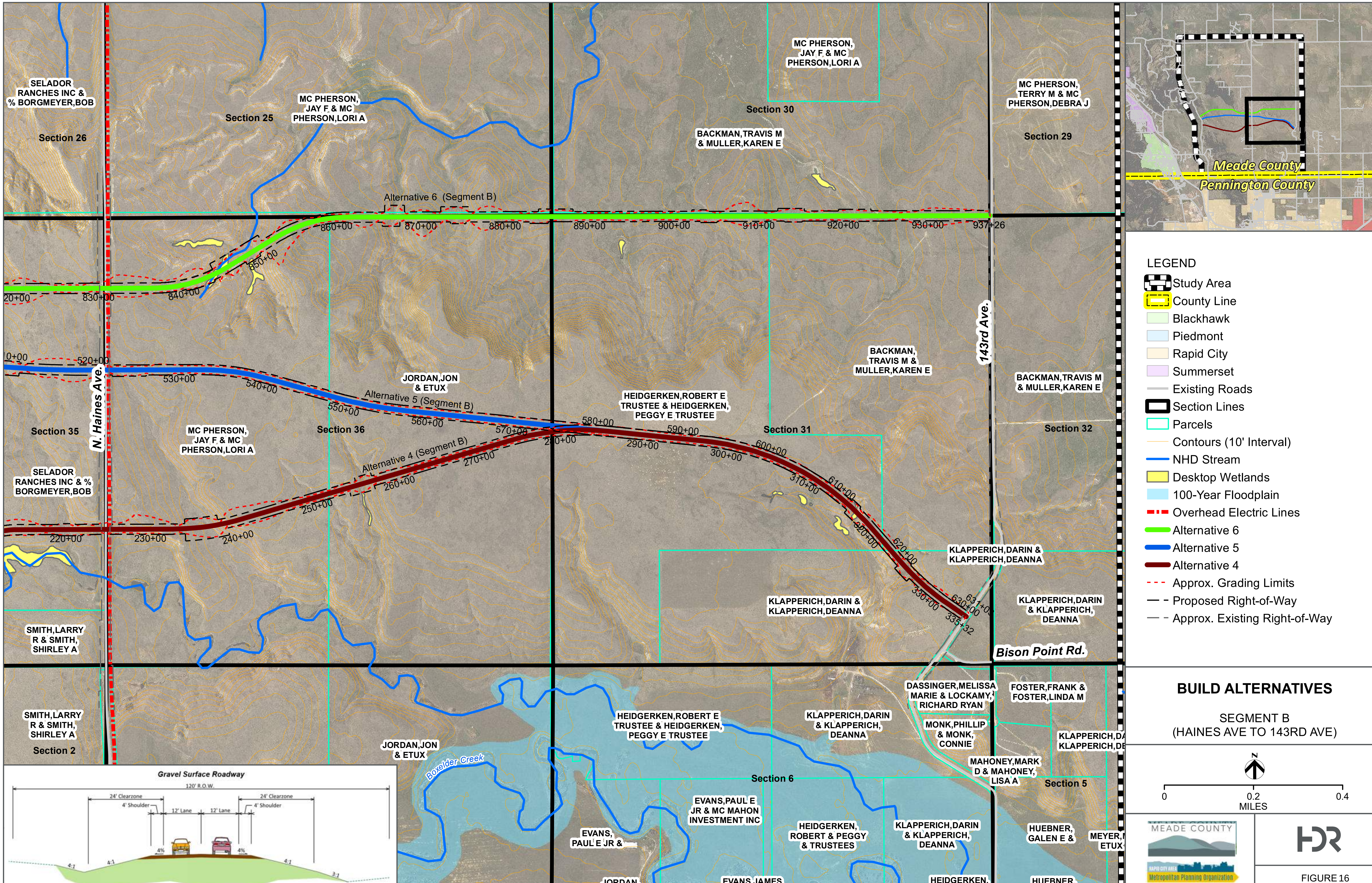
4.2.2 Analysis Methodology

The three build alternatives were studied further to explore impacts on private property, connectivity to existing developments, the purpose and need, environmental impacts, preliminary intersection geometrics, estimated construction costs, right-of-way acquisition costs, utility impacts, and impact on existing property operations. At the conclusion of this analysis, the main advantages and disadvantages of each alternative were listed and compared against one another.

Figure 15 and **Figure 16** display the alignments, grading limits, proposed right-of-way, and other physical project constraints for Segments A and B within each feasible build alternative.



PATH: Z:\PROJECTS\10151083 - RCMPO MEADE CTY CORRIDOR STUDY\GIS\HDR\CORRIDOR REPORT\FIGURE X - SEGMENT A - PLAN VIEW OF SELECTED BUILD ALTERNATIVES.MXD - USER: SSLOWEY - DATE: 10/9/2019



LEGEND

- Study Area
- County Line
- Blackhawk
- Piedmont
- Rapid City
- Summerset
- Existing Roads
- Section Lines
- Parcels
- Contours (10' Interval)
- NHD Stream
- Desktop Wetlands
- 100-Year Floodplain
- Overhead Electric Lines
- Alternative 6
- Alternative 5
- Alternative 4
- Approx. Grading Limits
- Proposed Right-of-Way
- Approx. Existing Right-of-Way

BUILD ALTERNATIVES

SEGMENT B
(HAINES AVE TO 143RD AVE)

N

0 0.2 0.4
MILES

MEADE COUNTY
RAPID CITY AREA Metropolitan Planning Organization

HDR

FIGURE 16

PATH: Z:\PROJECTS\10151083 - RCMPO MEADE CTY CORRIDOR STUDY\GIS\HDR\CORRIDOR REPORT\FIGURE X - SEGMENT B - PLAN VIEW OF SELECTED BUILD ALTERNATIVES.MXD - USER: SSLOWEY - DATE: 10/9/2019

PRIVATE PROPERTY, STRUCTURES, AND BUILDINGS

Aerial imagery (2018) was used to determine potential impacts on structures or buildings. Due to the importance of avoiding impacts on private property, structures were avoided as much as possible during the process of developing the alignments. Based on aerial imagery (2018), none of the build alternatives are known to impact existing structures or buildings.

CONNECTIVITY TO EXISTING DEVELOPMENTS

Many of the existing neighborhoods in the Study Area are fragmented and only provide one ingress or egress. It would be advantageous for the future corridor to provide connectivity to existing developments and provide the opportunity for the neighborhoods to meet Meade County's egress codes. However, none of the top three ranking build alternatives selected during the preliminary alternative screening process provides direct connectivity to existing development.

PURPOSE AND NEED

Whether the selected alternatives meet the purpose and need of this Study, described within Section 1.2 of this report, is discussed below.

No-Build Alternative

Development is expected to continue within and surrounding the Study Area. All intersections and roadway segments within the Study Area during No-Build 2045 Conditions are expected to operate at acceptable levels of service (LOS C or better). Therefore, traffic operations will likely not drive the need for this east-west corridor. For more detailed information, refer to the No-Build Future Conditions Traffic Operations section of this report.

The no-build alternative does not encourage orderly, efficient land development. Likewise, it does nothing to discourage sprawl or leapfrog development. While the no-build alternative preserves agricultural lands and the splitting of agricultural parcels in the short term, these farming and ranching lands will continue to be become more fragmented as disjointed neighborhood communities continue to develop in a scattered manner away from existing, incorporated communities.

In the long term, the no-build alternative does not align with Meade County's goals and does not meet the purpose and need of this Study.

Build Alternatives

In the long term, the three build alternatives align with the purpose and need of the Study and will meet all of Meade County's goals. Each alternative will provide a corridor that will accommodate planned growth, which can be preserved for orderly and efficient development.

ENVIRONMENTAL SCAN

A summary of potential environmental impacts associated with the proposed improvements is included in **Table 14**. Potential impacts have been separated by each build alternative.

Table 14. Environmental Impacts Summary

Build Alternative	Threatened and Endangered Species: Northern Long-Eared Bat	Threatened and Endangered Species: Whooping Crane	Threatened and Endangered Species: Least Tern & Rufa Red Knot	Archaeological/ Historical (One Mile Radius)	Section 4(f)/6(f)	Wetlands and Other Waters of the U.S.	Floodplains	Right-of-Way (Acres)	Hazardous Material
Alternative 4	✓ May affect, not likely to adversely affect.	✓ May affect, not likely to adversely affect. However, most likely alignment for the whooping crane due to the most wetlands being present here.	✓ No anticipated effect	7 SHPO previous surveys 2 SHPO previous structures 1 SHPO previous bridge	✓ No anticipated impacts	✓ Low Wetland Impacts	✓ No anticipated impacts	7 unique landowners 66.59 acres of impact	✓ No anticipated impacts
Alternative 5	✓ May affect, not likely to adversely affect.	✓ May affect, not likely to adversely affect.	✓ No anticipated effect	7 SHPO previous surveys 2 SHPO previous structures 1 SHPO previous bridge	✓ No anticipated impacts	✓ Low Wetland Impacts	✓ No anticipated impacts	7 unique landowners 66.16 acres of impact	✓ No anticipated impacts
Alternative 6	✓ May affect, not likely to adversely affect.	✓ May affect, not likely to adversely affect.	✓ No anticipated effect	4 SHPO previous surveys 1 SHPO previous structures 0 SHPO previous bridge	✓ No anticipated impacts	✓ Moderate Wetland Impacts	✓ No anticipated impacts	6 unique landowners 53.66 acres of impact	✓ No anticipated impacts

PRELIMINARY INTERSECTION GEOMETRICS

Three intersections per corridor alternative were reviewed to determine the preliminary intersection geometrics where the corridor would intersect Erickson Ranch Road, Haines Avenue, and 143rd Avenue. In terms of having adequate sight distance, it is ideal for the intersections of the future corridor to be located on the horizontal and vertical tangent sections of the intersecting roadways.

Intersection sight distance was evaluated in the field based on visual observations. Potential intersection locations were determined using the best information available without field survey data to try and provide adequate sight distance based on where vertical crest curves, approximately, began and ended. Further investigation should be performed when preliminary and final design occurs. Some portions of Erickson Ranch Road, Haines Avenue, or 143rd Avenue may need to be reconstructed if adequate intersection sight distance cannot be provided by solely adjusting the intersection location.

As summarized in the **Table 15**, two of the build alternatives are expected to have adequate preliminary intersection geometrics. Due to topographical constraints and a large stream crossing, the intersection of Haines Avenue and Alternative 4 could not be located far enough away from a crest vertical curve that didn't impede the intersection sight distance. Therefore, a short length of Haines Avenue will likely need to be reconstructed to provide adequate intersection sight distance. This reconstruction length is included in the cost estimate for Alternative 4.

Table 15. Preliminary Intersection Geometrics

Build Alternative	*Erickson Ranch Road Intersection*	*Haines Avenue Intersection*	*143rd Avenue Intersection*
Alternative 4	✓	✘	✓
Alternative 5	✓	✓	✓
Alternative 6	✓	✓	✓

✓= Intersection location is expected to have adequate intersection geometrics and will not likely require reconstruction of the intersecting existing roadway.

✘= Due to frequent crest vertical curves along the intersecting existing roadway, the intersection could not be situated to provide adequate intersection geometrics and will likely require reconstruction of a certain length of existing roadway.

CONCEPTUAL CONSTRUCTION COST ESTIMATE COMPARISONS

A conceptual cost estimate was compiled to provide relative comparisons of the estimated construction costs between the different alternatives. Bid items that were able to be estimated at this conceptual level of design were quantified and listed in the estimate. Some bid items could not be quantified and the associated costs are assumed to be included in the 40% contingency. Since it is undetermined when this roadway would likely be constructed, construction costs were not escalated to a future construction year and are presented in 2019 dollars. The costs provided in **Table 16** are for the approximated construction costs of each build alternative. For the purposes of this cost estimate, and based on forecasted traffic volumes, the segment between Erickson Ranch Road and Haines Avenue was assumed to be paved and the segment between Haines Avenue and 143rd Avenue was assumed to be gravel. Alternative 5 is estimated to have the lowest construction cost and Alternative 6 is estimated to have the highest construction cost. Alternative 4 is expected to have the second lowest construction cost. A full conceptual cost estimate, with itemized bid items and a cost breakdown between Segment A (Erickson Ranch Road and Haines Avenue) and Segment B (Haines Avenue and 143rd Avenue), can be found in **Appendix I**.

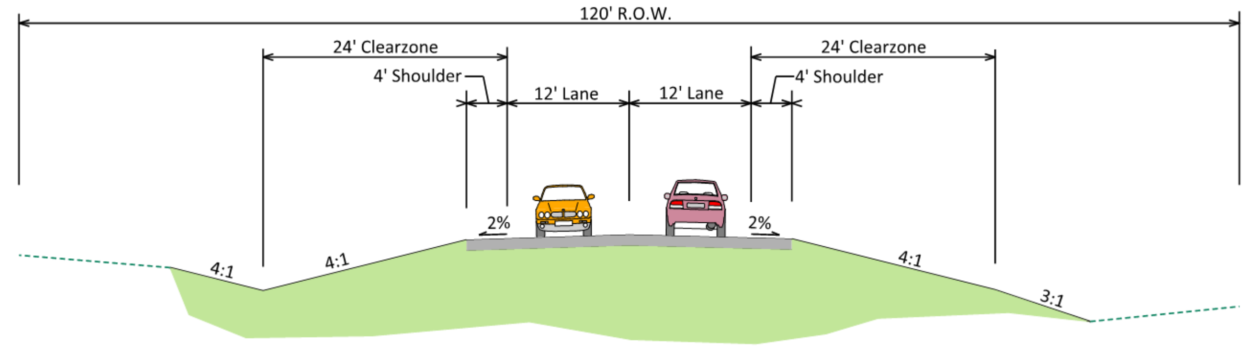
Table 16. Conceptual Construction Cost Estimate

Build Alternative	*Construction Cost Estimate (2019$)*
Alternative 4	*$7.9 M*
Alternative 5	*$6.9 M*
Alternative 6	*$10.4 M*

PROFILE OPTIMIZATION AND EARTHWORK

In order to generate an earthwork number, the build alternatives were designed utilizing a 55 mph design speed and modeled at a conceptual level to obtain approximate earthwork quantities and preliminary grading limits. The typical sections used to conceptually model the alternatives are shown in **Figure 17**. The grading limits of each alternative can be found in **Figure 15** and **Figure 16**. Representative cross sections can be found in **Appendix I**.

Paved Surface Roadway



Gravel Surface Roadway

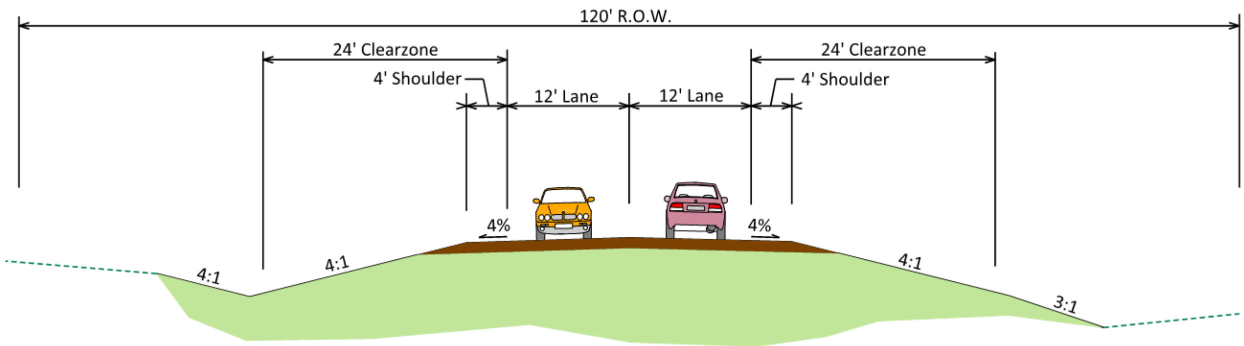


Figure 17. Typical Roadway Sections

The earthwork was balanced to the extent feasible in order to minimize earthwork transported across Haines Avenue. The earthwork values are preliminary in nature, because the topography used for the roadway modeling efforts is not of survey quality. A summary of the estimated unclassified excavation required by each alternative is summarized in **Table 17**.

Table 17. Estimated Grading Summary

Build Alternative	*Unclassified Excavation (CY)*
Alternative 4	*254,801*
Alternative 5	*300,376*
Alternative 6	*769,439*

HYDRAULICS

There are no known major stream or river crossings that would require a bridge or box culvert on any of the build alternatives. Likewise, there are no known houses or structures near the build alternatives that would cause concern about water backing up from the new road embankment. Since the floodplain is not being encroached upon, none of the alternatives are anticipated to have floodplain permitting effort required.

Culverts should be installed at drainage crossings of the potential new roadway. A preliminary calculation was performed for what appeared to be the largest stream crossing, and it is likely that a 36” culvert should be able to accommodate a 25-year rainfall event. For the purposes of this Study, and to be conservative, it was assumed that a 36” reinforced concrete pipe (RCP) and two flared end sections would be used at each culvert crossing.

RIGHT-OF-WAY ACQUISITION AND TEMPORARY CONSTRUCTION EASEMENT ESTIMATE

As illustrated in **Figure 17**, Typical Roadway Sections, a right-of-way width of 120' was assumed for each of the alternatives. Additional right-of-way width was supplemented near drainage crossings for culvert maintenance access. Other than drainage crossings, grading limits that extended beyond the 120’ right-of-way were only included as temporary construction easement and not included in the right-of-way acquisition estimate.

For the purposes of this Study, an average price of $3,500 per acre was used for right-of-way acquisition and $210 per acre for temporary easement.

It should be noted that the average price used for the purposes of this Study is only a rough estimate and an appraisal would be needed during the right-of-way acquisition process. Values did not include costs for the appraisal and acquisition process. **Table 18** summarizes the estimated right-of-way and easement requirements and the costs for each alternative.

Table 18. Estimate of Right-of-Way/Easement Requirements and Costs

Build Alternative	*Right-of-Way Required (Ac)*	*Right-of-Way Acquisition Cost*	*Temporary Construction Easement Required (Ac)*	*Temporary Construction Easement Cost*
Alternative 4	*66.6*	*$233,100*	*5.9*	*$1,239*
Alternative 5	*66.2*	*$231,700*	*6.0*	*$1,260*
Alternative 6	*53.7*	*$187,950*	*14.8*	*$3,108*

UTILITIES

GIS datasets were used to locate known utilities. While there is very little utility infrastructure, or utility master plans, within the Study Area, there are known natural gas pipelines and communication lines. However, the three build alternatives do not appear to impact known gas or communication lines. The only known utilities that cross paths with the build alternatives include two Black Hills Energy (BHE) transmission lines running north-south near Erickson Ranch Road and a West River Electric (WRE) north-south power distribution line near Haines Ave. Overhead electric line locations are presented in **Figure 15** and **Figure 16**. Anticipated costs are summarized in **Table 19**.

Table 19. Anticipated Utility Impacts

Build Alternative	*BHE Transmission Line Pole Relocation Costs (Near Erickson Ranch Road)*	*WRE Power Distribution Pole Relocation Costs (Near Haines Ave)*
Alternative 4	*$80,000*	*$14,000*
Alternative 5	*--*	*$14,000*
Alternative 6	*$30,000*	*$14,000*

IMPACTS ON EXISTING PROPERTY OPERATIONS

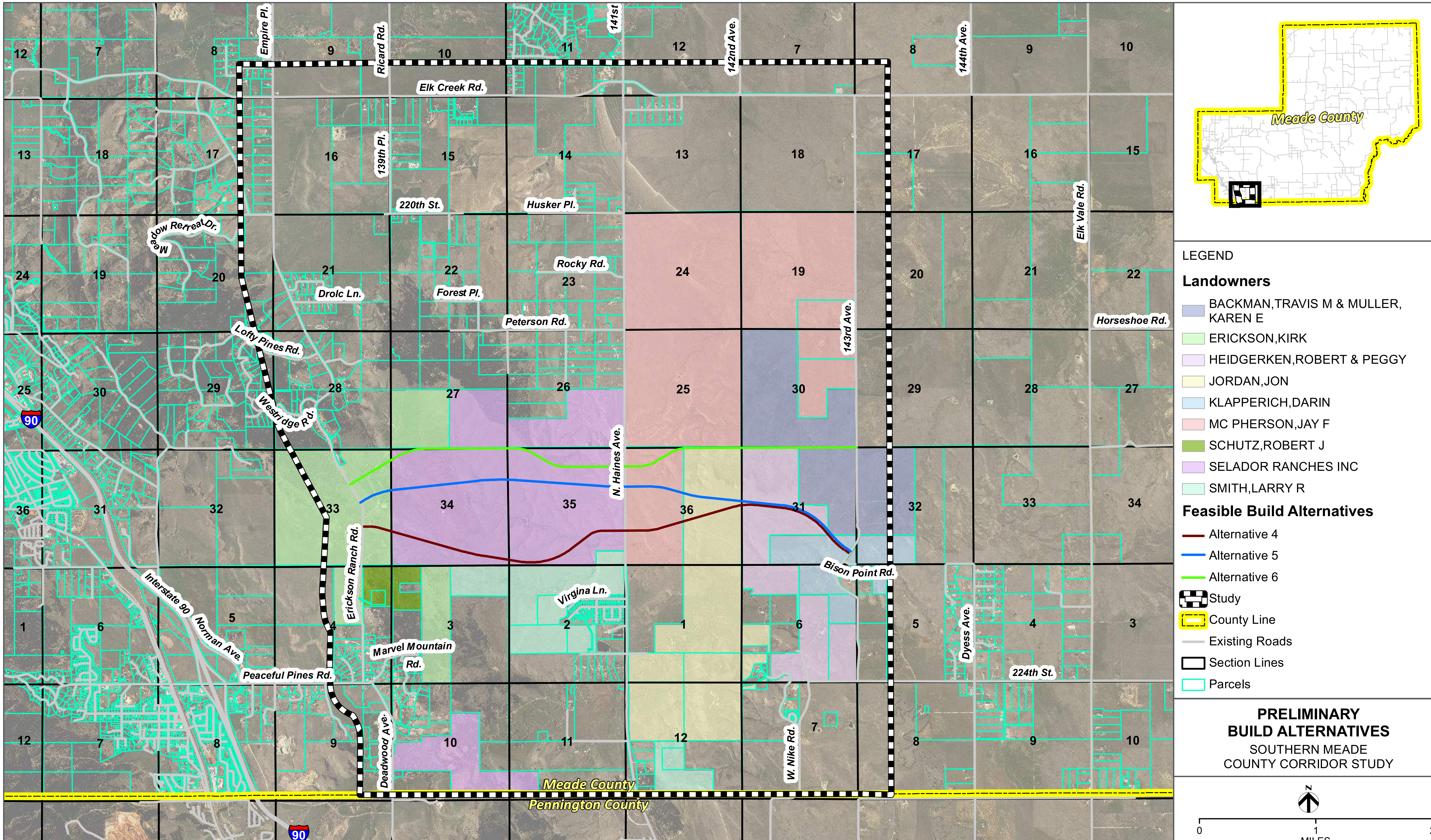
The proposed alternatives traverse lands that are primarily used for cattle ranching. Portions of the land within the Study Area are expected to transition to residential land use within the next 20 years. It should be noted that if the proposed roadway is built while the land is being utilized for agriculture, damages will likely be reviewed and assessed as part of a right-of-way acquisition process.

Landowner meetings were held on July 24th, 2019. During these meetings, landowners provided feedback of the proposed alternatives. The most common concern was the impacts the proposed roadway would impose on existing property operations. Many landowners own multiple parcels. **Figure 18** shows the connectivity of these landowner's parcels and how the different alternatives would cross with them. The following additional context and feedback was provided during the meetings:

- Kirk Erickson owns the majority of Section 33. He uses the land east of Erickson Ranch Road as summer pasture on the north end and bull pasture on the south end. Alternative 4 would divide his bull pasture and Alternatives 5 and 6 would divide his summer pasture. Kirk Erickson prefers the no-build alternative.
- Selador Ranches did not have a strong preference on the different alternatives and has indicated that the land may be sold for development in the future. All three build alternatives divide this land, but concerns were not identified at this time. Alternative 4 would have the least disruption to the current land operation.
- Jay McPherson indicated that all alternatives would have a negative effect on the current operation of his property. The majority of his land is located to the north of section 36

and all of the alternatives divide his contiguous land. Alternative 4 leaves the most amount of land to the north of its alignment. He did indicate that he prefers an alternative that would traverse his land over flat ground to deter the public from dumping trash on his property or using it as a shooting range. Jay McPherson prefers the no-build alternative. However, if he had to choose between the build alternatives, Alternative 5 would be his preference because it stays out of the rugged terrain.

- Robert Heidgerken's property operation is impacted the most by Alternatives 4 and 5. The large draw that Alternative 4 and 5 cross on his property is not a good location for cattle to cross. His cattle use the draws on the north end of his property for shelter in adverse weather. Alternative 6 would have the least impact on his current property operation and would not divide his parcel.
- Darin Klapperich indicated that all the alternatives would have very little impact on the current operation of his property.
- Travis Backman (brother) and Karen Muller (sister) co-own their land near 143rd Avenue.
    - Travis and Judy Backman didn't believe that any of the alignments would significantly affect their current property operation. However, they prefer the no-build alternative. If they had to choose an alignment, Alternatives 4 and 5 would be preferred. They own land north and south of Alternative 6, so these roadway alignments would divide their two parcels.
    - Karen Muller does not believe the alignments significantly impact her land. However, she would prefer the no-build alternative. This undeveloped land has intrinsic value to her and her family. The house on the land can only be seen from the top of Bison Pass. Karen believes that the increased traffic near her land will make it feel less secluded.



PRELIMINARY BUILD ALTERNATIVES
SOUTHERN MEADE COUNTY CORRIDOR STUDY

FIGURE 18

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4.2.3 Summary of Findings

COST ESTIMATE COMPARISONS

The overall costs for each of alternative is summarized in **Table 20**. Alternative 5 has the lowest overall cost, while Alternative 6 has the highest overall cost. Even though Alternative 6 has the lowest cost in terms of expected right-of-way acquisition requirements, the cost of the earthwork required is much greater than the other alternatives. It should be noted that Alternative 4 would be cost comparative to Alternative 5 if the reconstruction of Haines Avenue for increased sight distance was not a concern.

Table 20. Summary of Estimated Cost per Alternative

Alternative	*Wetland Mitigation*	*Construction*	*Right-of-Way Acquisition*	*Temporary Construction Easement*	*Utility Relocation*	*Total Estimated Costs*
No-Build Alternative	--	--	--	--	--	--
Build Alternative 4	*$5,985*	*$7,873,550*	*$233,100*	*$1,239*	*$94,000*	*$8,207,874*
Build Alternative 5	*$5,130*	*$6,911,303*	*$231,700*	*$1,260*	*$14,000*	*$7,163,393*
Build Alternative 6	*$29,925*	*$10,375,304*	*$187,950*	*$3,108*	*$44,000*	*$10,640,287*

ALTERNATIVES ADVANTAGES AND DISADVANTAGES

The advantages and disadvantages of each alternative is summarized in **Table 21**.

Table 21. Summary of Alternatives Advantages and Disadvantages

Alternative	*Advantages*	*Disadvantages*
No-Build	• *No cost* • *No impacts on existing property or parcels*	• *Does not meet the purpose and need for this Study and thereby does not meet the overall land use goals of Meade County* • *Does not plan for future growth* • *In the long term, further fragmentation of agricultural land with scattered neighborhoods will continue*
Alternative 4	• *Low amount of anticipated wetland impacts* • *Least amount of earthwork* • *Meets the purpose and need of the corridor Study*	• *Likely impacts on costly BHE transmission line, and possible service outages during construction* • *Impacts on WRE power distribution line* • *24% more right-of-way acquisition costs than Alternative 6* • *Total overall costs are expected to be over a million dollars more than Alternative 5* • *Issues with preliminary intersection geometrics at Haines Avenue. Adequate intersection sight distance likely to not be able to be provided under existing conditions. Likely will require a length of Haines Avenue to be reconstructed to flatten a crest curve. The reconstruction on Haines will cause increased delay on busy existing roadway as new corridor is constructed* • *Impacts four landowners' current property operations (Kirk Erickson, Robert Heidgerken, Jon Jordan, and Jay McPherson)*
Alternative 5	• *Expected to be the least expensive alternative* • *Least amount of anticipated wetland impacts* • *Limited delay during construction to existing north-south corridors* • *No impacts on costly BHE transmission line, and thereby likely no service outages during construction* • *No known issues with preliminary intersection geometrics, adequate intersection sight distance expected* • *Meets the purpose and need of the corridor Study*	• *Approximately 18% more earthwork required than Alternative 4* • *Impacts on WRE power distribution line* • *Approximately 23% more right- of- way acquisition costs than Alternative 6* • *Impacts four landowners' current property operations (Kirk Erickson, Robert Heidgerken, Jon Jordan, and Jay McPherson)*
Alternative 6	• *Limited delay during construction to existing north-south corridors* • *Lowest right-of-way acquisition costs because it follows the section line for a portion of its alignment. Additionally, this alternative causes the fewest parcels to be split into two* • *Likely to have adequate preliminary intersection geometrics, however, the future intersection at Haines Avenue might cause issues* • *Meets the purpose and need of the corridor Study*	• *Extensive cuts and fills and large amount of total earthwork. Three times the amount of earthwork as compared to Alternative 4* • *Expected to be the most expensive alternative. Total overall costs are expected to be 3.5 million more than Alternative 5* • *Impacts on BHE transmission line and WRE power distribution line* • *Largest amount of wetland impacts* • *Impacts two landowners' current property operations (Kirk Erickson and Jay McPherson)*

5.0 Conclusions and Recommendations

5.1 Recommended Alternative(s)

The SAT met on July 17th, 2019, to discuss the findings of the alternatives analysis. The findings of the alternatives analysis was also presented to the public and landowners on July 24th, 2019. Following the public and landowner meetings, the SAT reconvened on August 12th, 2019, to discuss the feedback received from these meetings and select the recommended alternative(s).

Even though the County does not foresee the proposed connector road being constructed in the near future, unless financing outside of Meade County taxes becomes available, the County believes the No-Build alternative is not a viable option from a planning perspective. The County would like to put a plan in place rather than be reactive to development occurring in the future. Meade County has a long list of immediate roadway needs, and building a new road is not at the top of the immediate needs list. However, the County does see the importance of having a plan in place for the future connector road. During the years between concept and construction, this route gives future developers one more factor to consider in their planning decisions.

All three alternatives have impacts on landowners in different ways. Since there wasn't a consensus, or one alternative that was preferred by landowners, the recommended alternative came down to safety, constructability, and cost. The SAT recommended the following:

- Eliminating Alternative 6 because of poor constructability, high construction cost, and utility impacts.
- Eliminating Alternative 4 because of safety issues with the intersection at Haines Avenue. There were also concerns with the safety of the intersection at Erickson Ranch Road. Although it meets the minimum intersection sight distance requirements, drivers headed northbound cannot see the intersection quite as well as they would with Alternative 5. Utility impacts with both the BHE transmission lines are anticipated as well.
- Alternative 5 is the recommended alternative. Alternative 5 has the most optimal intersection geometrics and is the least expensive of the alternatives. It also has the least amount of wetland and utility impacts.

5.2 Extended Roadway Network

Elk Vale Road provides a direct north-south connection to I-90 (Exit 61) and the US-16 Bypass. Due to the regional significance of Elk Vale Road, it is recommended that Meade County plan for a connection to be made between 143rd Avenue and Elk Vale Road. If a connection is not planned, 143rd Avenue between the future roadway and 224th Street should be upgraded to an arterial roadway typical section. The bridge over Box Elder Creek should be evaluated for the additional traffic volumes. In addition, the horizontal curve and longitudinal grades should be reconstructed to meet design criteria.

5.3 Access Management Recommendations

As per the access management guidelines found in MEADE Moving Forward 2040 Transportation Plan and the Meade County Comprehensive Plan, accesses should be at least

500 feet from other existing, or future, accesses or intersections. For example, the existing field access located less than 500 feet south of the intersection between Alternative 5 and Haines Avenue should be relocated. Relocation should occur along either Erickson Ranch Road or the new corridor at a distance of 500 feet, or more, from another intersection. Future developments that occur adjacent to the future corridor should follow these access management guidelines as well.

5.4 Traffic Operations Recommendations

5.4.1 2045 No-Build

Intersection traffic operations for the 2045 No-Build Conditions scenarios all measure delay within acceptable LOS thresholds (LOS B or better) for this study. Similarly, the two-lane highway analysis measures are all within the acceptable LOS thresholds for rural collector highways (LOS C or better).

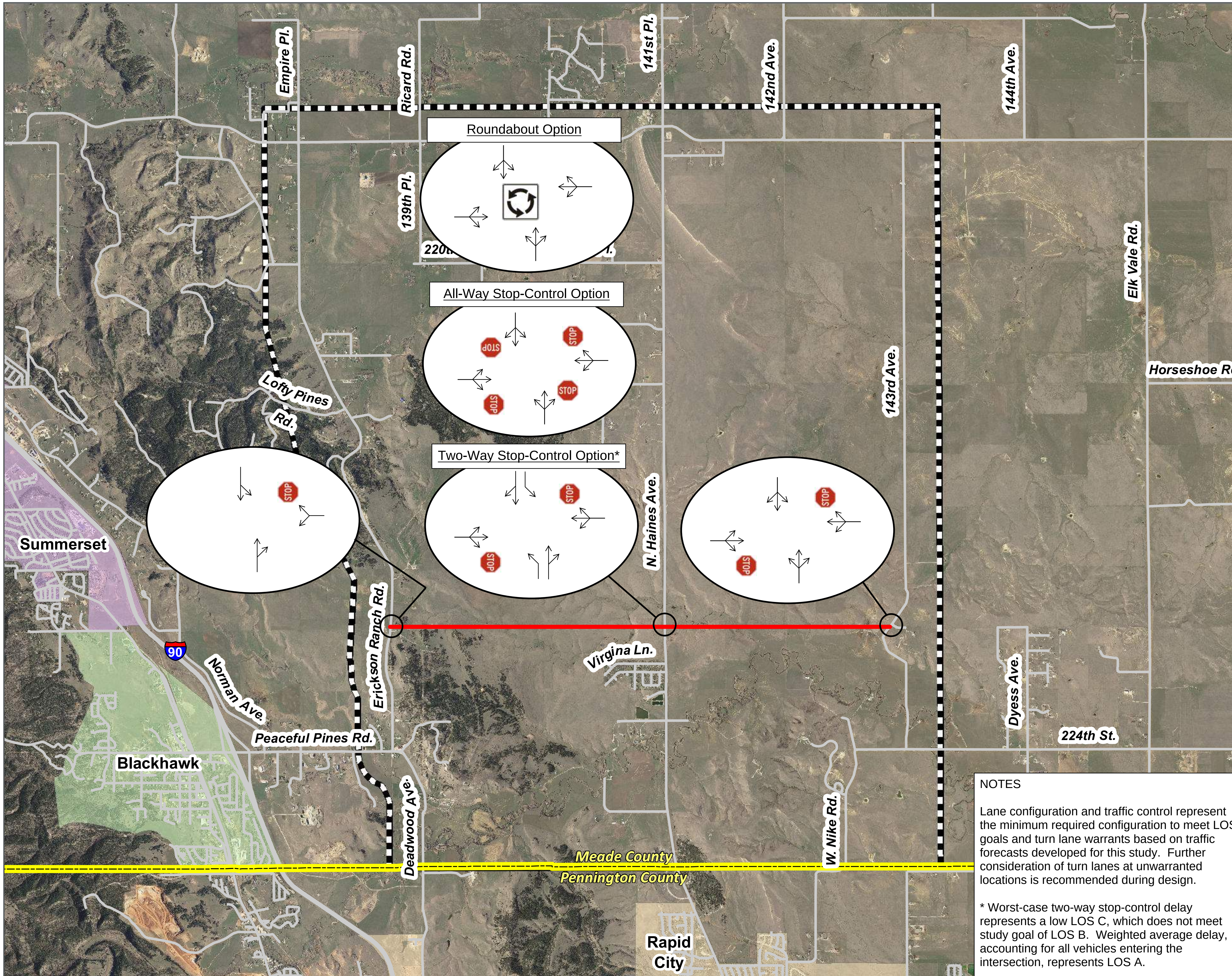
A review of daily traffic forecasts and segment capacity observed that all existing two-lane roadways are expected to accommodate traffic volumes through the 2045 Planning Horizon if the Study Area stays predominantly rural. As the area becomes more urbanized, particularly areas along the Meade County border, a three-lane cross-section may be appropriate at the next time of reconstruction.

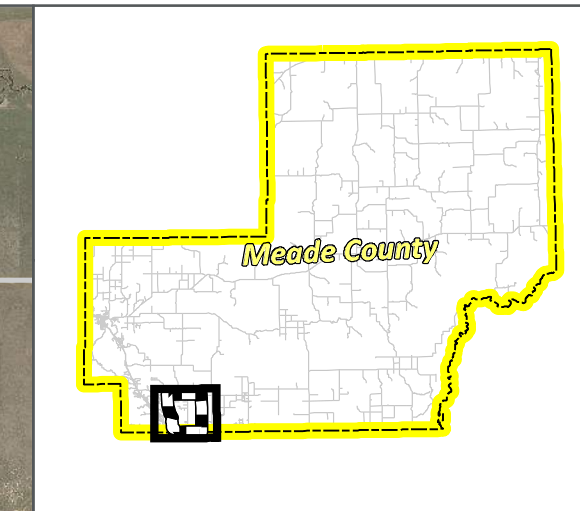
5.4.2 2045 Build

The two-lane highway section for the proposed east-west corridor roadway meets LOS goals for this study. The recommended lane configurations at intersections for the proposed east-west corridor are illustrated in **Figure 19** and described as follows:

- Proposed Erickson Ranch Road Intersection - LOS goals can be achieved with shared left/through/right lane configurations, assuming stop-control from the proposed east-west corridor approach.
- Proposed Haines Avenue Intersection - The worst-case stop-controlled approach does not meet LOS goals for this Study. At this intersection, a northbound left-turn lane is warranted and an opposing southbound left-turn lane is recommended, assuming stop-control from the proposed east-west corridor approach. Alternatively, this intersection could be converted from a two-way stop controlled intersection to an all-way stop-control intersection with shared left/through/right configuration or a single lane roundabout. Both of these alternative options achieve LOS goals for this Study.
- Proposed 143rd Avenue Intersection - LOS goals can be achieved with shared left/through/right lane configurations assuming a stop-control from a proposed east-west corridor approach.

It is recommended that turn lanes be considered at other unwarranted locations based on the operational and safety benefits they provide, particularly when removing turning traffic from high-speed through movements. One example is at the Erickson Ranch Road intersection.





LEGEND

- Study Area
- Existing Roads
- County Line

City Limits

- Blackhawk
- Box Elder
- Piedmont
- Rapid City
- Summerset
- Analysis Alignment for Proposed East/West Corridor

TRAFFIC LEGEND

- Intersection Approach Lane Configuration
- STOP Intersection Control

NOTES

Lane configuration and traffic control represent the minimum required configuration to meet LOS goals and turn lane warrants based on traffic forecasts developed for this study. Further consideration of turn lanes at unwarranted locations is recommended during design.

* Worst-case two-way stop-control delay represents a low LOS C, which does not meet study goal of LOS B. Weighted average delay, accounting for all vehicles entering the intersection, represents LOS A.

MINIMUM REQUIRED LANE CONFIGURATIONS TO MEET STUDY LOS AND TURN LANE WARRANT GOALS

SOUTHERN MEADE COUNTY CORRIDOR STUDY

N

0 0.5 1
MILES

MEADE COUNTY
RAPID CITY AREA Metropolitan Planning Organization

HDR

FIGURE 19

PATH: Z:\PROJECTS\10151083 - RCMPO MEADE CTY CORRIDOR STUDY\GIS\HDR\CORRIDOR REPORT\FIGURE X TURN LANE REQS.MXD - USER: SSLOWEY - DATE: 10/9/2019

5.5 Safety Recommendations

A potential east-west corridor between Erickson Ranch Road and 143rd Avenue will likely function similarly to the existing county roads in the area. The crash trends observed throughout the Study Area are likely to translate to this proposed corridor.

In consideration of the crash trends identified in this crash history review, the following considerations are recommended to be carried forward to the proposed east-west corridor:

- Speed is a frequent causal factor in crashes throughout the area. Countermeasures to be incorporated into the proposed corridor include:
  - Design horizontal and vertical curves to an appropriate design speed.
  - Design a forgiving roadside, with a clear zone that meets design guidelines, is free of fixed objects, and has recoverable side slopes.
- Design the proposed corridor commensurate with the intended function, such as:
  - Shoulders
  - Appropriate roadway surfacing
  - Intersection traffic control supporting route priority in the area
- Intersections and access points:
  - Develop an access management plan for the proposed corridor that includes the following:
    - Identifies future access points
    - Establishes access guidelines and requirements for future access based on guidelines presented in the *Meade County Comprehensive Plan* and the *MEADE Moving Forward 2040 Transportation Plan*

Avoid access points and intersections on horizontal or vertical curves where intersection sight distance and stopping sight distance needs are compromised.

6.0 Steps Moving Forward

6.1 Community Integration

Once endorsed, the concepts within the plan can be incorporated into local transportation and land use planning documents and processes. Meade County will update their master transportation plan and the City of Rapid City will update their major street plan with the location of the proposed minor arterial.

6.2 Potential Funding Sources

The following grant programs may be available as potential funding sources for this project.

- Federal Funding Programs
  - Better Utilizing Investments to Leverage Development (BUILD) https://www.transportation.gov/BUILDgrants/about
  - Infrastructure for Rebuilding America (INFRA) https://www.transportation.gov/buildamerica/infragrants
- State Funding Programs
  - State Infrastructure Bank (SIB) Loan
- Local Funding Programs
  - Meade County's Transportation Fund
  - Meade County's Capital Improvement Program (CIP)
  - General Obligation (GO) Bonds
- Private Funding Programs
  - Cost Sharing with Developers
  - Private Donations

7.0 Appendices

Appendix A – Public Meeting Summary Reports

Appendix B – Methods and Assumptions

Appendix C – Environmental Scan Technical Memorandum

Appendix D – Crash History Review Technical Memorandum

Appendix E – Traffic Forecasts Technical Memorandum

Appendix F – Existing and 2045 No-Build Conditions Traffic Operations Technical Memorandum

Appendix G – 2045 Build Conditions Traffic Operations Technical Memorandum

Appendix H – Alternatives Development Screening Technical Memorandum

Appendix I – Alternatives Analysis Technical Memorandum

Southern Meade County **Corridor Study**

October 2019

MEADE COUNTY

RAPID CITY AREA Metropolitan Planning Organization