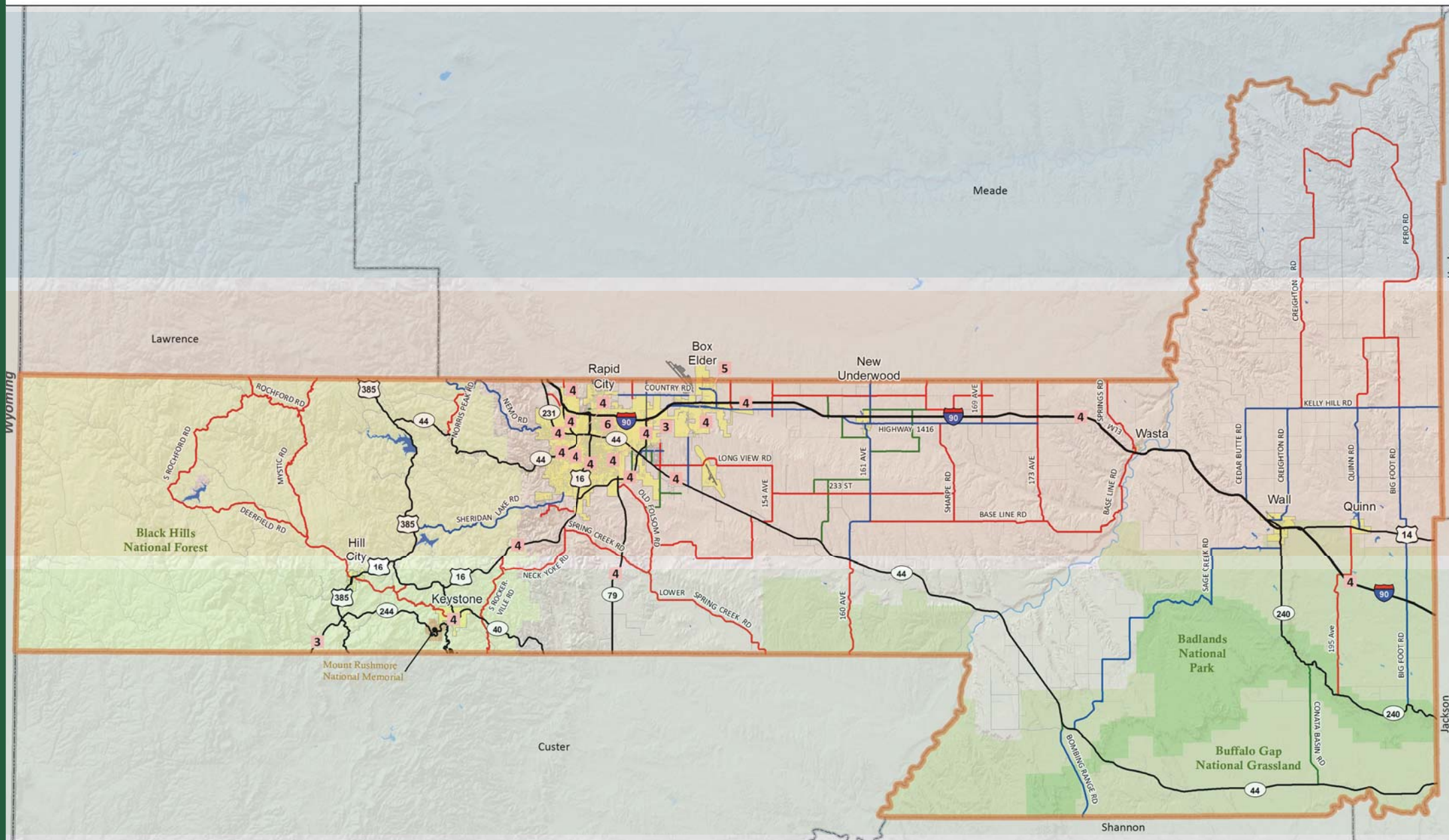


# Pennington County Master Transportation Plan

June 2012



Kadmas Lee & Jackson

SDDOT | Pennington County, South Dakota | The Rapid City Metropolitan Planning Organization | Federal Highway Administration





# PENNINGTON COUNTY MASTER TRANSPORTATION PLAN

## CONNECTING HILLS AND PLAINS STUDY

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## EXECUTIVE SUMMARY

### Introduction

#### Background

Pennington County is a community of approximately 101,000 residents located along the Interstate 90 (I-90) corridor in western South Dakota. Rapid City is the county seat and the largest city in the county with approximately 68,000 residents, with the remaining 33,000 residents residing in small towns and rural locations throughout the rest of the County. The County was formed in 1875. Home to Mount Rushmore National Memorial, Badlands National Park, Black Hills National Forest, Buffalo Gap National Grassland, and Wall Drug, the County is both an attractive place to live and a desirable tourist destination. Recent Census Bureau data show that the County’s population has increased 14 percent from 2000 to 2010, indicating steady growth in both residential and commercial development will continue in the foreseeable future.

Tourism in Pennington County peaks during the summer months when recreational opportunities are the highest. Tourism places travel demands on the primary corridors that access recreational and tourist destinations throughout the county. The travel needs of the various users of the transportation network increase the importance of providing a balanced network of complete arterial, collector and local roads and streets, and paths that serve drivers, pedestrians, bicyclists, transit riders, and the disabled population.

Use of the roadway network by bicyclists, pedestrians, transit, and freight users highlights the need for roads and streets that accommodate multimodal needs. The Pennington County Master Transportation Plan, entitled *CHAPS – Connecting Hills and Plains Study*, serves to identify the existing needs to better serve current resident and visitors, while serving as a blueprint for the transportation system, providing a clearly defined future for the network. As development occurs in Pennington County, it is important to have a documented plan for the future transportation system that clearly defines the County’s expectations of developers, as well as providing a basis for its own long and short term capital projects

#### Purpose and Objectives

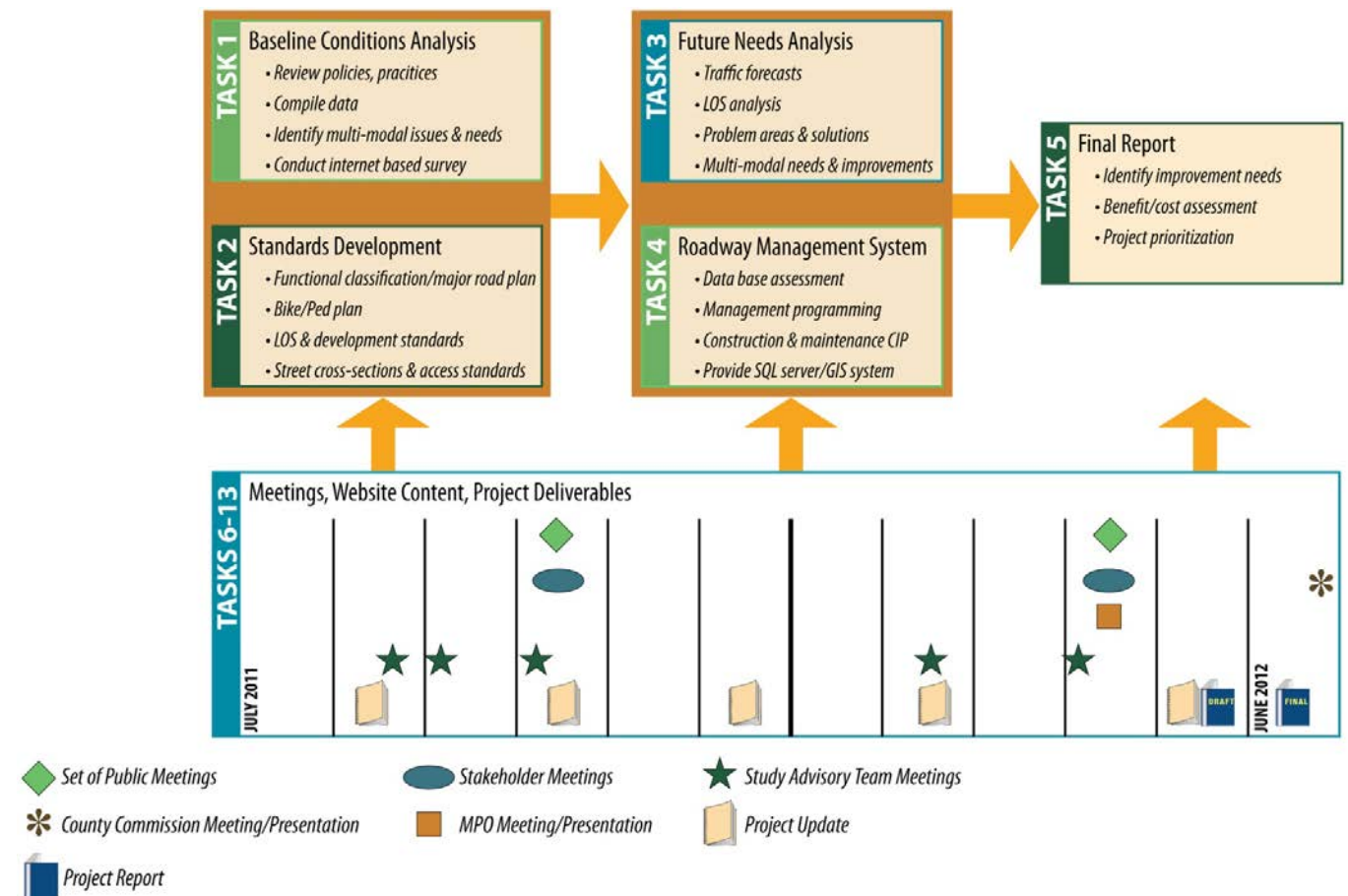
The Pennington County Master Transportation Plan, *CHAPS*, was initiated by the South Dakota Department of Transportation (SDDOT), the Federal Highway Administration (FHWA) and Pennington County, South Dakota. The threefold purpose of the project is to:

1. Complete a list of transportation issues and needs facing Pennington County
2. Develop feasible solutions to address those issues and needs that meet current design standards and/or traffic Level of Service (LOS) expectations under both the current and predicted future traffic conditions.
3. Create final products for use by Pennington County and the SDDOT which will provide guidance to implement recommended improvements and anticipate future development plans within the area.

### Approach

As illustrated below, the project was organized into five tasks. The project began with a comprehensive review of baseline conditions to identify current needs throughout the Pennington County transportation system. Task 2, Standards Development, provides a policy framework for the transportation plan and provides the County with a set of tools for addressing future development and roadway improvements. Task 3 addressed the anticipated influence of growth on the system, identifying projects needed to keep people moving into the future. Task 4 details the development of a Roadway Management System, designed to utilize existing pavement databases maintained by the County to aid in the management, construction, and maintenance of the transportation system. Task 5 provides the completion of this report, including a list of prioritized projects and policy guidelines.

Figure S-1. Work Flow Diagram







The major work tasks 1 through 5 were supported throughout by an extensive Public Involvement Process. Major public involvement activities are described as follows:

- **Initial Public Open Houses and Stakeholder Meetings** – The first open house public meetings and stakeholder meetings were held in October of 2011 at three locations throughout Pennington County and provided attendees with an overview of existing transportation conditions, future growth expectations and initial transportation issues. Public input was gathered from individual conversations and comment sheets. Results are provided in **Appendix A**.
- **Web-based Community Survey** – This online survey was made available to all members of the community, and was announced at the public meetings, through notice in three local newspapers, and through the project website, in the fall of 2011 to ask questions about roadway, pedestrian, bicycle and transit travel. Fifty-three residents responded and provided useful information. Results are provided in **Appendix B**.
- **Draft Report Open Houses and Stakeholder Meetings** – A series of three open houses and sets of stakeholder meetings were held in April of 2012 to present initial findings of the Transportation Planning process. The meeting began with a brief presentation and display boards allowed people an up-close look at the proposed Major Road Plan, Bicycle/Pedestrian/Transit plan, and draft project listing and map. At these meetings, attendees were provided a final opportunity to provide public input to the study team. Results are provided in **Appendix C**.

### Elements of the Transportation Plan

The elements of the plan include:

- Inventory of Existing Conditions
- Future Needs Analysis
- Long Range Transportation Plan
- Standards
- Summary and Recommendations

### Inventory of Existing Conditions

#### Traffic Conditions

- The inventory of existing traffic conditions included current traffic volumes, roadway and intersection capacity analyses, and traffic crash experience.
- It was found that traffic volumes along County Highways currently vary between 500 and 10,000 vehicles per day, with the highest traffic volumes observed in the vicinity of the City of Rapid City. There is currently sufficient roadway capacity available to accommodate these volumes. Operational analyses were completed for 10 selected unsignalized intersections, of which four were found to have at least one approach operating at an unacceptable Level of Service, including:

- Sheridan Lake Road / Dunsmore Road
- Sturgis Road / Merritt Road
- Concourse Drive / Twilight Drive
- SD 44 / Covington Street

#### Safety Concerns

A review of crashes occurring between July of 2008 and June of 2011 at all County intersection was conducted to identify top crash frequency locations. Top crash locations involving County Highways included:

- Sheridan Lake Road / Dunsmore Road (7 crashes)
- Sheridan Lake Road / Mountain Park Road (4 crashes)
- SD 44 / Covington Street (5 crashes)
- Sturgis Road / Universal Drive (7 crashes)
- US Highway 16 / Busted Five Court (5 crashes)
- US Highway 16 / Neck Yoke Road (6 crashes)
- SD 44 / Jolly Lane (9 crashes)

#### Intersection Concerns

The project team conducted an evaluation of intersection concerns to identify locations where roadway design deficiencies may contribute to the occurrence of or potential for traffic crashes. Ten intersections were selected by the project Study Advisory Team (SAT) for evaluation. A variety of concerns were noted at these intersections, including limited sight distance, skewed approaches, closely spaced accesses/intersections, proximity to railroad tracks, and significant horizontal and vertical curvature along intersection approaches. Intersections reviewed are summarized below in **Table S-1**.

**Table S-1. Intersection Concerns**

Intersection	Concerns Identified
154 <sup>th</sup> Avenue / 233 <sup>rd</sup> Street	Multiple closely-spaced intersections, sharp approach angles
Sturgis Road / Merritt Road	Proximity of railroad tracks, 3 crashes reported
Nemo Road / Norris Peak Road	Large open paved area, sharp turning movements
Silver Mountain Road / Boulder Hill Road	Limited sight distance
Silver Mountain Road / US Highway 16	Sharp turning movements
Rockerville Road / Neck Yoke Road	Sight distance limitations
US Highway 385 / Silver City Road	Sight distance limitations
Deerfield Road / Mystic Road	Sight distance limitations
SD 40 / Rockerville Road	Sight distance limitations, closely spaced driveway, 1 crash
Concourse Drive / Twilight Drive	Horizontal and vertical curvature along approaches



## Transit Conditions

The project team conducted a review of current transit conditions in Pennington County, focused on the existing operation of transit agencies currently operating within the County, including River Cities Transit, Prairie Hills Transit, and Rapid Transit. Based on conversations with each agency, the team found that call-n-Ride services are being provided throughout the County, primarily for medical and shopping trips. Transit funding is dependent upon a local match for federally-provided dollars, and transit operations are limited by limited funding.

## Non-motorized Conditions

- Travel by non-auto modes is becoming increasingly popular along Pennington County's highways. Because the County Highway system is primarily rural, bicyclists and pedestrians are often forced to travel within the vehicular travel lanes, creating safety hazards for all travel modes. Some roadways provide wide shoulders, but no continuous network of wide-shouldered roadways is currently in place. Of note, a majority of survey respondents gave travel by bicycling or walking in Pennington County a poor rating.
- A number of County highways were noted by the public as ideal locations for additional shoulder width. Non-motorized needs noted by respondents to the online survey included additional sidewalks, widened shoulders along Upper and Lower Spring Creek Roads, Sheridan Lake Road, Nemo Road, and Highway 40 from Playhouse Road into Keystone, and an off-road path between Wall and Quinn.

## Air Transportation

The anchor of the air transportation system in Pennington County is the Rapid City Regional Airport (RCRA), which provides commercial air service to a variety of destinations within the region. As of May 2012, flights to and from the airport occurred to Denver, Las Vegas, Minneapolis, Salt Lake City, Phoenix, Houston, Dallas/Fort Worth, and Chicago. The airport served a total of approximately 539,500 passengers in 2011, a slight decline from previous years. Growth in RCRA passenger traffic has been steady over the past ten years and the *Rapid City Regional Airport Master Plan Update* (RS&H, May 2005) projects annual future growth of 1.3 percent in aviation activity. There are two additional airports in Pennington County, Wall Municipal and Ellsworth Air Force Base (EAFB). No other air facilities are anticipated to develop in Pennington County in the near future.

## Freight Transportation

The majority of freight travel through Pennington County occurs along I-90, which, as an Interstate roadway, serves cross-country freight patterns. A second tier of freight travel occurs along State highways through Pennington County. County highways play the important role of circulating freight traffic to and from important destinations within the County. Important freight components include logging traffic through the Black Hills National Forest and railroad facilities, including the Transload facility near Box Elder.

## Future Needs Analysis

### Land Use

Pennington County has experienced steady growth during the last several decades, and growth is anticipated to continue into the future. In order to fully understand anticipated future growth in the county, three different resources were used to establish growth trends for the County. Historic Census Data

between 2000 and 2010 showed an average growth rate of 1.3% per year for unincorporated areas in the County. In addition to historic growth patterns, forecasts completed for the Pennington County Comprehensive Plan and forecasts maintained by the Rapid City MPO were also referenced. The Pennington County Comprehensive Plan completed in July, 2003, anticipated growth of 1.5% per year in new housing and the Rapid City MPO forecasts growth of 1.2% per year. Combining historic growth rates with recent growth projections, this plan used a growth rate of 1.3% per year in developing 2035 traffic forecasts.

Following the determination of the generalized growth rate anticipated for unincorporated portions of the county, locations of known future development was sought. During SAT meetings and stakeholder interviews conducted during each of the public meeting periods, the consultant team solicited information about known developments so that if particular locations in the county are anticipated to develop at faster rates than the general growth, that information could be included in the future traffic volume development. In the end, no known specific developments were identified within Pennington County, and therefore, uniform growth throughout the county was assumed to occur between now and 2035.

## Future Traffic Volumes

The future traffic forecasts were developed for all county and state highways in Pennington County. The focus of this transportation plan is to determine transportation needs on County roads, but the interdependence of the County road system in conjunction with state highways made it important to show future volumes on all of these roadways. This distinction is especially true in the west portion of the County where few parallel routes exist and travel often relies on county roads just as significantly as state roads.

## Volume-to-Capacity Ratios

Based on the capacity values, the v/c ratios for all county roads were calculated on the highways within Pennington County. Based on future v/c ratios, the only locations with poor v/c ratios are located on state highways within Rapid City. These results suggest that traffic congestion will not be a principal concern on County highways in the future and there is no need to recommend highway widening projects to accommodate 2035 forecast traffic volumes.

Based on the 2035 forecast traffic volumes anticipated, there are however, some low volume locations in the County where upgrading the roadway from gravel to a paved surface is recommended. County Staff follows a general rule, that when a roadway reaches 250 vehicles per day, it is evaluated to determine if paving should occur. Three segments have been identified based on this rule of thumb for paving: Rochford Road between Mystic Road and the Lawrence County Line, Mystic Road between Rochford Road and Deerfield Road, and Longview Road between Rapid City Regional Airport and 154<sup>th</sup> Avenue.

## Intersection Operations

The ten intersections identified by the SAT were reevaluated to determine if any capacity problems are anticipated to occur with build out of the development areas and the addition of future background traffic. The complete analysis for these intersections was used develop projects for inclusion in the Transportation Master Plan.



## Long Range Transportation Plan

### Roadway and Intersection Improvements

Recommendations for improvements to the Pennington County transportation system have been consolidated into a complete project listing. The goal for this listing was to compile improvements discussed during the public input process, projects identified through traffic forecasting, intersection analysis, and other studies completed by the Consultant Team, projects previously included in the Pennington County Transportation Improvement Plan and South Dakota Department of Transportation Statewide Transportation Improvement Program, and projects identified by the Study Advisory Team and County Staff.

In order to develop a project listing which provides the entire study area with the best future operations, while accounting for funding limitations, comments received during the public input process have been reviewed to determine what remedies would provide the greatest benefit. Typically, the projects included in the listing were identified by several members of the community and all projects were vetted by the Consultant Team and Study Advisory Team to ensure the recommendations are consistent with the goal for this Master Transportation Plan.

A map of project locations is shown on **Figure S-2**. The complete project listing has been provided as **Table S-2**. The project improvement plan figure includes all projects described within the project listing. The different project types have been separated in the listing into three categories: Road Facilities, Intersections, and Bicycle/Pedestrian Facilities.

### Project Prioritization

Each category has been separated due to the use of different funding mechanisms and budgets for the project classification. By identifying the public projects, even greater attention was given to these projects with the goal of creating a prioritized funding list for each category.

Short term projects are those anticipated to be funded and built within the next four years (2012-2015). Projects which have been included in this category are the most vital to the immediate workings of the transportation system. Mid-term projects are those anticipated to be funded and built not immediately but within the next fifteen years (2015-2025). Long term projects are those anticipated to be funded and built in the long term (2025-2035).

### Project Cost

In addition to providing the project type, a project cost has been developed for each of the projects in the complete listing. Projects previously identified by the Pennington County Transportation Improvement Plan and South Dakota Department of Transportation Statewide Transportation Improvement Program have been included listing the costs developed for those planning processes. For roadway segments new to the project listing, the cost has been based on the construction of the appropriate rural arterial or rural collector sections as defined on the Roadway Classification map. In addition, all of the intersection projects have had costs prepared based on the needed improvements, which includes potential signalization, tree removal, intersection realignment, and intersection reconstruction to increase sight distance. These cost opinions include only items which are considered construction-related and are based on 2012 unit costs. No right of way costs have been included since these can be highly variable, depending on the current use and zoning of the adjacent property.

### Transit Plan

A number of issues and needs related to transit in Pennington County were raised in conversations with transit providers and users. Pennington County is currently not involved in providing transit services to its residents, nor do any County funds go toward providing a local match for federal transit funding.

It is recommended that Pennington County begin to allocate a portion of its annual budget to transit in the County. As discussed, a number of transit agencies are currently providing services and additional funding will help these agencies continue to serve the demand for transit and provide necessary services, particularly for the transit-dependent population in Pennington County.

### Pedestrian & Bicycle Master Plan

The Pedestrian and Bicycle Master Plan for CHAPS, shown on **Figure S-3**, outlines a number of efforts recommended for the County to enhance the transportation network to serve multimodal travel and recreational needs. Recommended Bicycle and Pedestrian improvements fall into three general categories: shoulder projects, paths, and Rapid City projects which are described in detail in the main report.

## Standards

### Road Classification

A key component to the Pennington County Master Transportation Plan as it relates to the road network is the development of the Roadway Classification map. The Roadway Classification map provides a framework for how the road network should be constructed in order to provide access throughout the County. The plan labels the roadway classification of all roadways so that as future reconstruction and paving projects occur, these roadways can be constructed to meet County standards.

The Roadway Classification map is a high-level planning document which details the eventual roadway classification of all County highways. That is not to say that all of these roadways are currently constructed in alignment with these standards, but over the next 20-50 years as these roadways are reconstructed effort should be taken to be consistent with this document. As the county grows, it is recommended that the road classification map be revised. Future roadway alignments should be identified in advance of development so that property developers know to preserve Right-of-way along key routes.

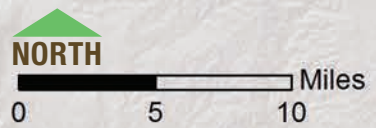
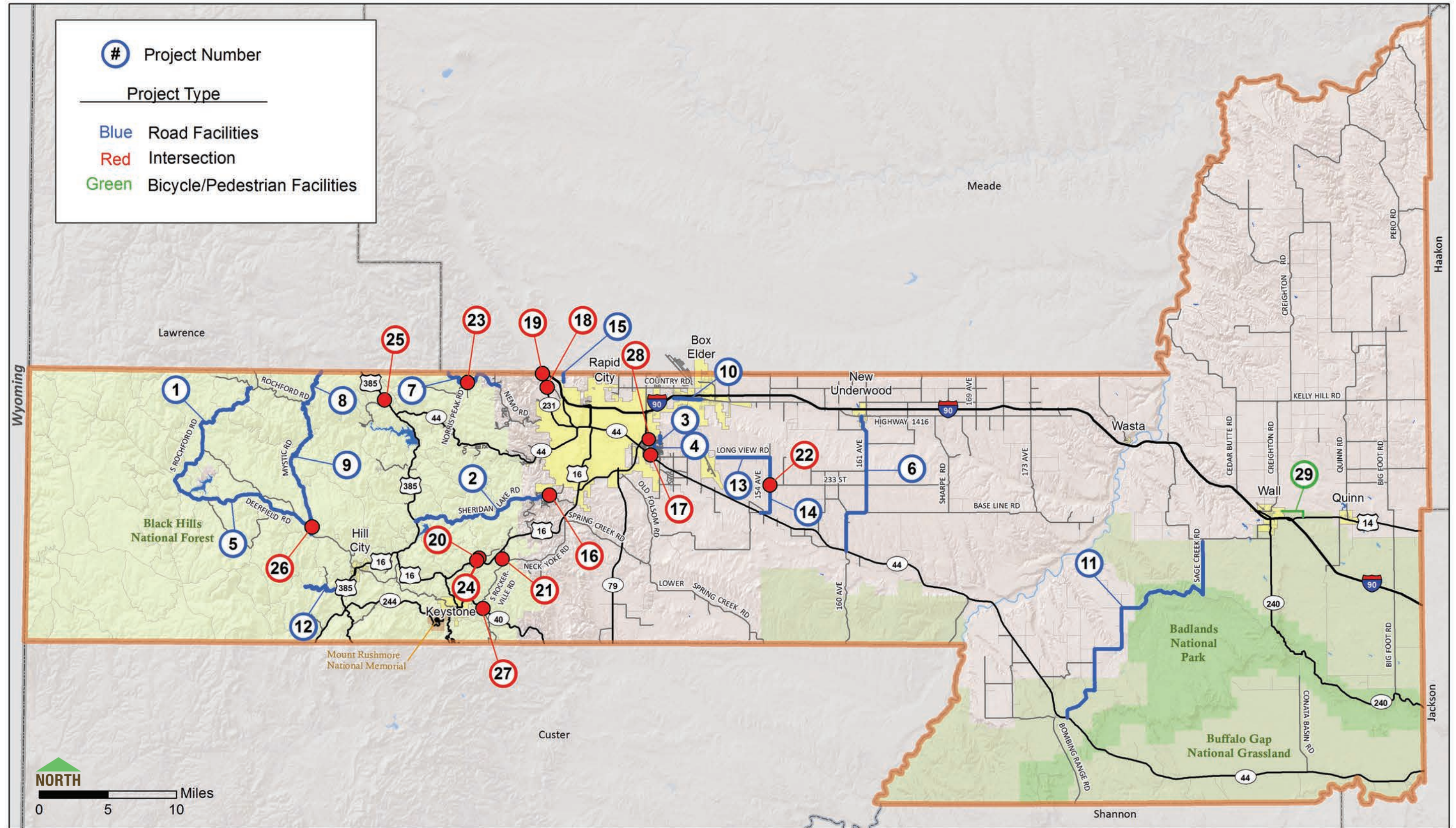
The Roadway Classification map is provided as **Figure S-4**. This plan distinguishes the roadways as Interstate, US/State highways, Arterials, Minor Arterials, Collector and Local roadways. This classification plan is based on the road classification provided in the 2005 Pennington County *Comprehensive Plan*.

### Other Standards

Additionally, this Master Transportation Plan identifies several other standards important as the County continues growth and development to ensure consistent transportation facilities, including proposed roadway cross sections, the assessment of development traffic impacts, access management guidelines, roadway surface standards, special events, guardrail, and roadway management systems.



Figure S-2 | Project Summary Map



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**Table S-2. Prioritized Project Listing**

Project Number	Project Location	Project Description	Cost (in Year of Expenditure)	Time Horizon
<b>Road Facilities</b>				
1	S. Rochford Rd between Rochford Rd and Deerfield Rd	Pave roadway <sup>1</sup> (2015)	\$10,200,000	Short Term
2	Sheridan Lake Rd between Alberta Dr and Victoria Lake Rd	Reconstruct roadway <sup>1</sup> (2014)	\$8,000,000	Short Term
3	Reservoir Rd between Twilight Dr and Meadow Ridge Dr	Reconstruct roadway <sup>1</sup> (2013)	\$1,950,000	Short Term
4	Plateau Ln between Twilight Dr and Williams St	Reconstruct roadway <sup>1</sup> (2013)	\$1,950,000	Short Term
5	Deerfield Rd (1.5 mile NE of Deerfield to FR 304)	Resurface roadway <sup>1</sup> (2014)	\$2,300,000	Short Term
6	From 228th St at New Underwood, south 7 miles on 161 Ave, west 1.5 miles and south 2.5 miles on Base Line Road to SD 44	Resurface roadway <sup>1</sup> (2017)	\$1,867,750	Mid-Term
7	Nemo Rd from the North County Line E/SE for 6.1 mile (to between Palmer Rd and Schmitz Trail)	Resurface roadway <sup>1</sup> (2019)	\$1,035,750	Mid-Term
8	Rochford Rd from Rochford east to the Lawrence County Line	Pave roadway <sup>2</sup>	\$6,403,700	Mid-Term
9	Mystic Rd from Rochford Rd south to Tigerville Junction	Pave roadway <sup>2</sup>	\$11,372,050	Mid-Term
10	County Road 1416 between Westgate Rd and Ellsworth Rd	Reconstruct roadway <sup>3</sup> (2016)	\$3,572,050	Mid-Term
11	Sage Creek Rd between 237th St and SD 44	Pave roadway	\$49,275,950	Long Term
12	Reno Gulch Rd between Reno Gulch Park and US 385	Pave roadway	\$7,654,300	Long Term
13	Long View Rd between Rapid City Regional Airport and 154th Ave	Pave roadway	\$9,599,250	Long Term
14	154th Ave between Long View Rd and SD 44	Pave roadway	\$10,759,050	Long Term
15	Deadwood Ave between Calamity Rd and Meade County Line	Reconstruct Roadway	\$1,182,050	Mid-Term
<b>Intersections</b>				
16	Dunsmore Road / Sheridan Lake Road	Signalize Intersection	\$243,550	Mid-Term
17	SD 44 / Covington Street	Signalize Intersection	\$243,550	Mid-Term
18	Sturgis Road (SD 231) / Universal Drive	Signalize Intersection	\$296,900	Long Term
19	Sturgis Road (SD 231) / Merritt Road	Signalize Intersection	\$737,500	Short Term
20	Boulder Hill Road / Silver Mountain Road	Remove trees at intersection causing poor sight distance	\$184,050	Mid-Term
21	South Rockerville Road / Neck Yoke Road	Remove trees at intersection causing poor sight distance	\$36,750	Short Term
22	154th Avenue / 233rd Street	Realign approaches to create single 90-degree intersection	\$278,500	Short Term
23	Nemo Road / Norris Peak Road	Realign approaches to soften turn angles	\$25,500	Short Term
24	Silver Mountain Road / Highway 16	Realign Silver Mountain Road approach to reduce skew	\$29,250	Mid-Term
25	US 385 / Silver City Road	Reconstruct intersection to improve sight distance looking south	\$102,850	Mid-Term
26	Deerfield Road / Mystic Road	Reduce curvature along Mystic Road approach	\$14,300	Short Term
27	SD 40 / Rockerville Road	Remove trees causing poor sight distance, realign skewed driveway	\$55,100	Short Term
28	Concourse Drive / Twilight Drive	Add intersection warning signs along curved approaches	\$9,200	Short Term
<b>Bicycle/Pedestrian Facilities</b>				
29	Wall trail extension	Extend Wall Loop Trail east to provide US 14 connection	\$434,100	Mid-Term

<sup>1</sup> Project included in March 6, 2012 Pennington County Transportation Improvement Plan, <sup>2</sup> Project included in March 16, 2010 Pennington County Transportation Improvement Plan, <sup>3</sup> Project included in current South Dakota Department of Transportation Statewide Transportation Improvement Program



Figure S-3 | **Pedestrian and Bicycle Master Plan**

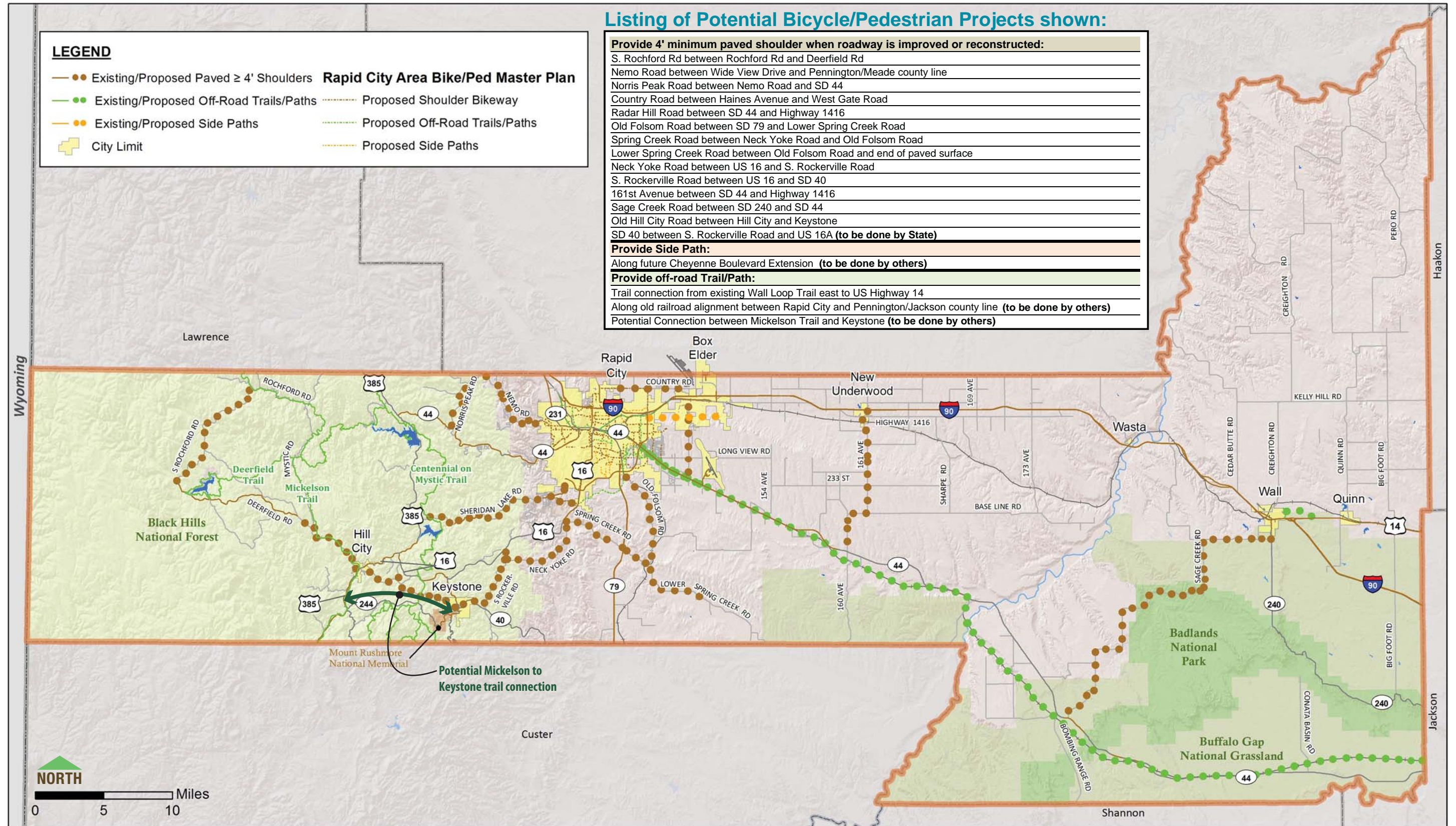
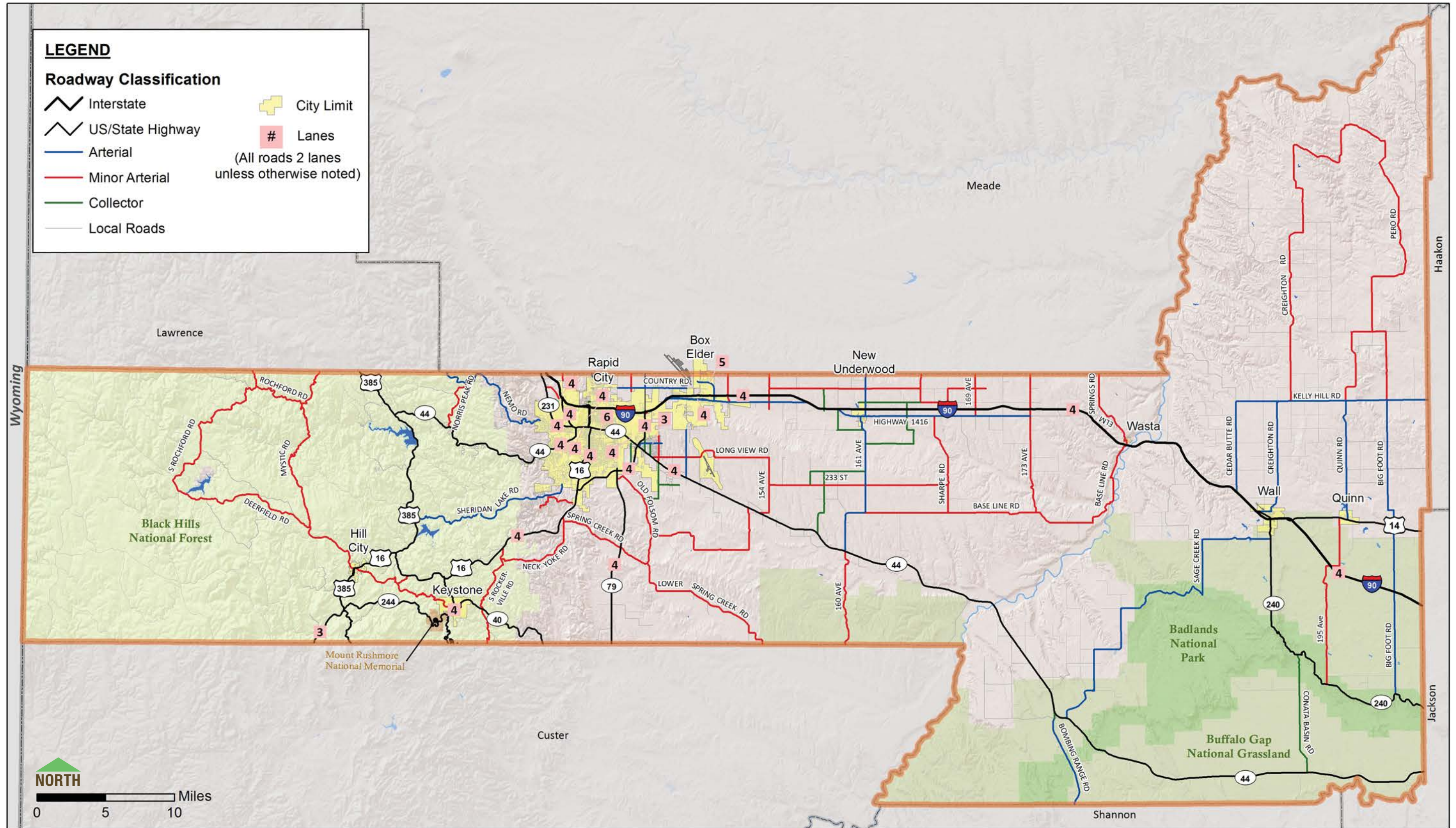




Figure S-4 | Roadway Classification



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## Summary of Recommendations

The intent of this Master Transportation Plan, *CHAPS*, is to ensure that Pennington County has a plan in place to effectively upgrade the transportation system and a list of standards by which to make decisions as future development occurs. The prioritized project summary listing includes roadway and intersection improvements that are designed to be implemented over the next 25 years. The Transit Plan and Pedestrian & Bicycle Master Plan include guidance for future improvements to the multi-modal transportation system over the same timeline. The projects discussed in detail in Section IV focus on a variety of multi-modal projects, which will be the responsibility of public agencies and will require coordination between Pennington County, local cities, and SDDOT.

The following list provides a summary of actions Pennington County should consider taking to ensure that the needed transportation improvements are funded:

### Transportation Improvement Projects

- It is recommended that Pennington County begin to plan and budget for completion of the five roadway improvements (all identified in the County's current Transportation Improvement Plan) and 7 intersection improvements identified for the Short Term. The total estimated construction cost of the Short Term projects is \$27.3 Million.
- The Mid-Term projects total \$26.7 Million and Long Term projects reach a total estimated construction cost of \$77.6 Million. It is recommended that Pennington County Staff initiate planning now for these projects, to refine the estimated costs and complete preliminary studies to set the stage for implementation.
- A total of approximately \$129.8 Million in transportation improvement projects is identified in *CHAPS*, approximately \$27.1 Million of which is comprised of projects already identified in the County's current Transportation Improvement Plan.

### Transit

It is recommended that Pennington County allocate \$3,000 annually to transit in the County. The funds should initially be provided to River Cities Transit (RCT), to help increase RCT's Federal matching grant amount. River Cities Transit is currently providing services and additional funding will help continue to serve the demand for transit in Eastern Pennington County and provide necessary services, particularly for the transit-dependent population in Pennington County.

### Bicycle and Pedestrian

*CHAPS* includes a number of recommendations for bicycle and pedestrian improvements. A total of 14 roadway segments were identified for 4-foot minimum shoulders. Shoulder widening projects would not be implemented as standalone efforts. Rather, these projects would be built when the roadway itself is being reconstructed or resurfaced. A new shared-use path is recommended to be constructed extending the Wall Loop trail farther east to connect to US Highway 14 and facilitate additional bicycle connectivity between the City of Wall and Town of Quinn.

In addition to the County improvements, it is recommended that Pennington County provide support for implementing bicycle and pedestrian improvements identified in the *Rapid City Bicycle and Pedestrian Plan*.

## Implementation of Standards

Pennington County currently possesses transportation standards related to access management, road classification and typical roadway sections. The *CHAPS* process has documented these standards and provided additional information and support where needed. The following recommendations relate to implementation of transportation standards:

- **Access Management** – The County has indicated that the current approach permitting process will remain sufficient for current needs. However, as population and commerce continue to grow in Pennington County, access requests will increase and county standards should be expanded to include recommended spacing of accesses along roadways of various classifications.
- **Road Classification** – The road classification system provided in *CHAPS* should be used by the County to maintain an organized hierarchy of highways and ensure that roads of each classification are built to appropriate standards. As the county grows, it is recommended that the road classification map be revised. Future roadway alignments should be identified in advance of development so that property developers know to preserve Right-of-way along key routes.
- **Traffic Impact Studies** – A standard for Traffic Impact Studies is provided in *CHAPS*. It is recommended that the county use this guidance to assess the traffic impacts of individual development proposals and reach agreement on appropriate cost sharing for infrastructure improvements.
- **Typical Sections** – Typical sections are provided in *CHAPS* for arterial and collector roadways. It is recommended that all new construction and roadway reconstruction projects on County highways utilized these sections as an initial standard.





## I. INTRODUCTION

### A. Background

Pennington County is a community of approximately 101,000 residents located along the Interstate 90 (I-90) corridor in western South Dakota. Rapid City is the county seat and the largest city in the County with approximately 68,000 residents, with the remaining 33,000 residents residing in small towns and rural locations throughout the rest of the County. The County was formed in 1875. Home to Mount Rushmore National Memorial, Badlands National Park, Black Hills National Forest, Buffalo Gap National Grassland, and Wall Drug, the County is both an attractive place to live and a desirable tourist destination. Recent Census Bureau data show that Pennington County's population has increased 14 percent from 2000 to 2010, indicating steady growth in residential development. The County expects to see both residential and commercial development continue in the foreseeable future.

Tourism in Pennington County peaks during the summer months when recreational opportunities are the highest. Tourism places travel demands on the primary corridors that access recreational and tourist destinations throughout the County. The travel needs of the various users of the transportation network increase the importance of providing a balanced network of complete arterial, collector and local roads and paths that serve drivers, pedestrians, bicyclists, transit riders, and the disabled population.

Pennington County had previously completed a Comprehensive Plan dated July, 2003. This report focused on key concerns for the County including population statistics and anticipated growth, environmental resources, transportation, and future land use. This document was used as a starting point when considering the future needs of the County as well as to steer initial discussion about transportation improvements.

Use of the roadway network by bicyclists, pedestrians, transit, and freight users highlights the need for roads and streets that accommodate multimodal needs. The Pennington County Master Transportation Plan, entitled *CHAPS – Connecting Hills and Plains Study*, serves to identify the existing needs to better serve current resident and visitors, while serving as a blueprint for the transportation system, providing a clearly defined future for the network. As development occurs in Pennington County, it is important to have a documented plan for the future transportation system that clearly defines the County's expectations of developers, as well as providing a basis for its own long and short term capital projects.

### B. Purpose

The Pennington County Master Transportation Plan, *CHAPS - Connecting Hills and Plains Study*, was initiated by the South Dakota Department of Transportation (SDDOT), the Federal Highway Administration (FHWA) and Pennington County, South Dakota. The threefold purpose of the project is to:

1. Complete a list of transportation issues and needs facing Pennington County.
2. Develop feasible solutions to address those issues and needs that meet current design standards and/or traffic Level of Service (LOS) expectations under both the current and predicted future traffic conditions.

3. Create final products for use by Pennington County and the SDDOT which will provide guidance to implement recommended improvements and anticipate future development plans within the area.

A Transportation Plan is a useful tool for many reasons. It defines the function (a combination of mobility and access) that roadways within a system should be planned to provide. A transportation plan also provides the design characteristics (cross-section and geometric standards) which roadways should exhibit given their function and it defines the right-of-way which should be preserved to ultimately construct the roadway. Generally, the plan is a tool that provides direction for a roadway improvement program as well as identifying current deficiencies, future needs, and prioritization thereof.

*CHAPS* serves as a basis for the implementation of roadway, bicycle, pedestrian, and transit improvement projects. Not only is it important to identify the future needs of the transportation system, but also to prioritize those needs. As with most communities in South Dakota, it is unrealistic to expect that all of the desired transportation improvements in Pennington County can be funded. A well defined and prioritized set of transportation improvements will help the County in developing Capital Improvement Program (CIP) priorities that most efficiently address the transportation needs of the community.

### C. Transportation Objectives

The Study Advisory Team designated to oversee the project developed a series of objectives to address in accomplishing the project purpose, as follows:

- Evaluate and prioritize roadway system improvements.
- Confirm and supplement current County access management standards for the appropriate locations of accesses to roadways of various types.
- Emphasize use of AASHTO roadway design standards.
- Identify the need for safety related improvements, including noting locations where guardrail is needed.
- Identify possible bicycle routes.
- Ensure that development approvals keep roads and streets built to standards, e.g. sidewalks in subdivisions. Emphasize importance of building roads initially to standards rather than having to retrofit later to meet pressing needs.
- Consider the needs of major destinations in the County, such as existing and future potential new trailheads, national parks, and Rally Week.

### D. Approach

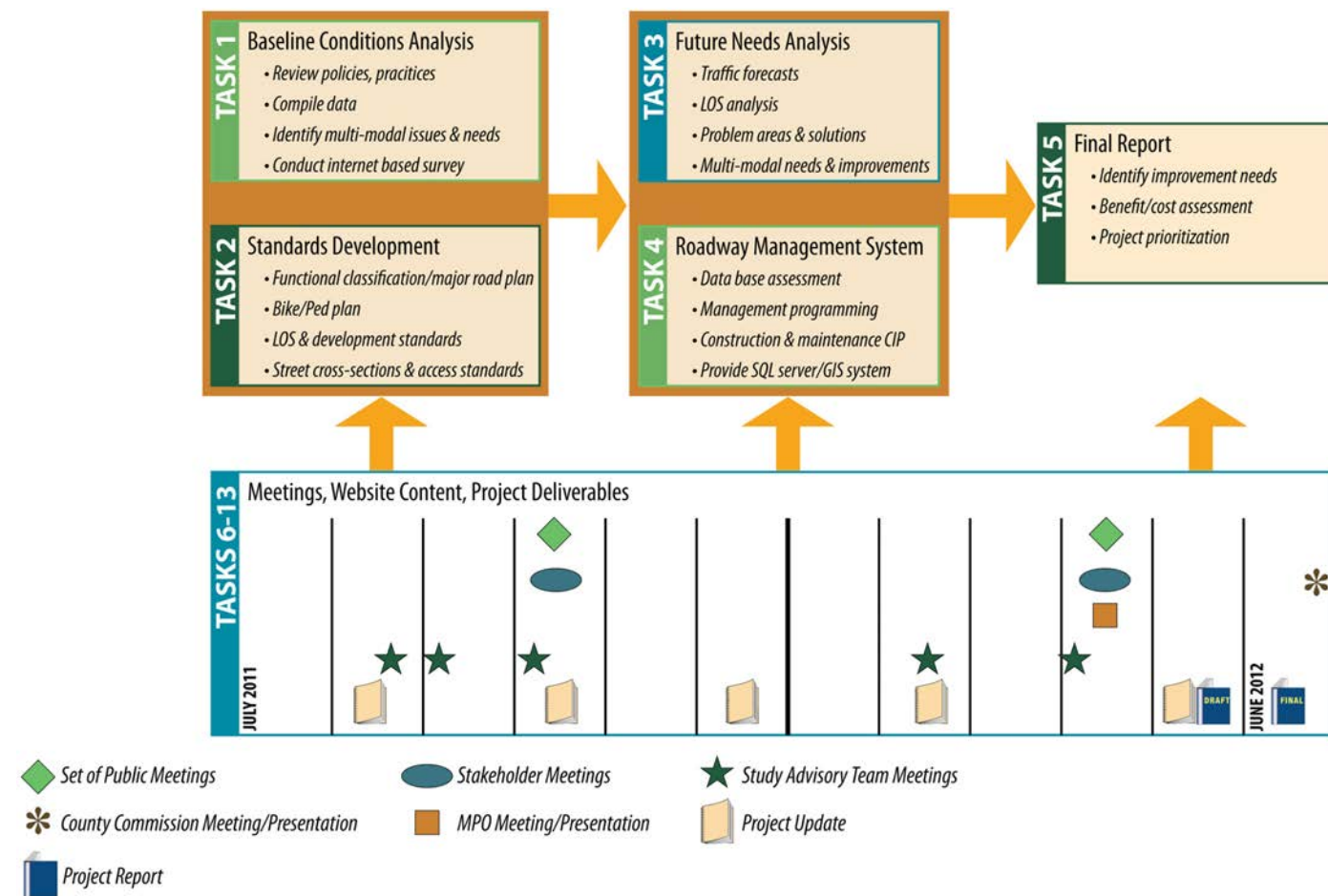
As illustrated below, the project was organized into five tasks. The project began with a comprehensive review of baseline conditions to identify current needs throughout the Pennington County transportation system. Task 2, Standards Development, provides a policy framework for the transportation plan and provides the County with a set of tools for addressing future development and roadway improvements. Task 3 addressed the anticipated influence of growth on the system, identifying projects needed to keep people moving into the future. Task 4 details the development of a Roadway Management System, designed to utilize existing pavement databases maintained by the County to aid in the management,



construction, and maintenance of the transportation system. Task 5 provides the completion of this report, including a list of prioritized projects and policy guidelines.

Project coordination began in August of 2011 with a face-to-face project kickoff meeting to confirm project goals and objectives and identify critical concerns for the project. Three more Study Advisory Team (SAT) meetings were held throughout the project, along with a series of meetings regarding the Roadway Management System development, which gave attendees an early look at the components of the plan. The first public meeting provided all attendees with a forum to express their concerns about the transportation network. Online material was provided to support the public involvement process via the SDDOT project website.

**Figure 1. Work Flow Diagram**



The major work tasks 1 through 5 were supported throughout by an extensive Public Involvement Process. Major public involvement activities are described as follows:

- **Initial Public Open Houses and Stakeholder Meetings** – The first open house public meetings and stakeholder meetings were held in October of 2011 at three locations throughout Pennington County and provided attendees with an overview of existing transportation conditions, future growth expectations and initial transportation issues. Public input was gathered from individual conversations and comment sheets. Results are provided in **Appendix A**.
- **Web-based Community Survey** – This online survey was made available to all members of the community, and was announced at the public meetings, through notice in three local newspapers, and through the project website, in the fall of 2011 to ask questions about roadway, pedestrian, bicycle and transit travel. Fifty-three residents responded and provided useful information. Results are provided in **Appendix B**.
- **Draft Report Open Houses and Stakeholder Meetings** – A series of three open houses and sets of stakeholder meetings were held in April of 2012 to present initial findings of the Transportation Planning process. The meeting began with a brief presentation and display boards allowed people an up-close look at the proposed Major Road Plan, Bicycle/Pedestrian/Transit plan, and draft project listing and map. At these meetings, attendees were provided a final opportunity to provide public input to the study team. Results are provided in **Appendix C**.

**E. Elements of the Transportation Plan**

The elements of the plan include:

- Inventory of Existing Conditions
- Future Needs Analysis
- Long Range Transportation Plan
- Plan Implementation
- Standards
- Summary and Recommendations



## II. INVENTORY OF EXISTING CONDITIONS

In order to understand how Pennington County's residents, businesses and visitors interact with the transportation system, the project team conducted an analysis of existing transportation conditions in the County. The analyses addressed:

- **Traffic Conditions**, including current traffic volumes, roadway and intersection capacity analyses, and traffic crash experience,
- **Roadway Design Issues**, identifying locations where roadway design deficiencies may contribute to the occurrence of traffic crashes,
- **Transit Conditions**, focused on existing operation of transit agencies currently operating within Pennington County, including River Cities Transit, Prairie Hills Transit, and Rapid Transit,
- **Non-motorized facilities**, identifying accommodations for bicycle and pedestrian travel,
- **Air Transportation**, providing a brief review of current needs served by airports in Pennington County, and
- **Freight Transportation**, describing key patterns for freight movements through the study area.

The CHAPS study area is depicted on **Figure 2**. The area covers all of Pennington County, an area of 1.8 Million Acres, and includes only highways under the jurisdiction of Pennington County, not State highways or roadways within City limits. The County Highway Department is responsible for 835 miles of roadway and 141 bridges. (<http://www.co.pennington.sd.us/highway/hwy.html>). Roadways are depicted as US/State and County roadways in **Figure 2**.

Pennington County covers a broad variety of urban and rural terrain, including the Black Hills in the western portion of the County and Badlands National Park in the eastern portion of the County. Cities and towns located in Pennington County include Rapid City, Hill City, Keystone, Box Elder, New Underwood, Wall, Rapid Valley, Quinn, and Wasta. **Figure 2** depicts the 3-mile platting jurisdictions surrounding Rapid City, Box Elder, New Underwood, Hermosa, and Summerset, within which those municipalities possess authority to review and approve land planning.

### A. Traffic Conditions

#### Roadway Network

Pennington County's transportation system is centered upon the roadway network, which serves automobile, freight, transit, bicycle and pedestrian movements throughout the study area and complements the local and state roadway networks. The large majority of County highways within the study area provide two travel lanes (one in each direction). A number of County highways are described as follows:

**Rochford Road** - Rochford Road extends north-south through the Black Hills through and beyond Pennington County. A mix of paved and gravel surfaces are provided along its length.

**Deerfield Road** – Deerfield Road connects Hill City with Deerfield Lake. It is a paved road for this length, and is posted at 50 Miles Per Hour (mph).

**Old Hill City Road** – Old Hill City is a windy road that connects the City of Hill City to the Town of Keystone, near Mount Rushmore National Park. The roadway alignment crosses the historic Black Hills Central Railroad track multiple times along its length. Old Hill City Road is posted at 35 mph.

**Sheridan Lake Road** – Sheridan Lake Road extends east-west between Rapid City and US Highway 385, which extends across the Black Hills and multiple states. Sheridan Lake Road possesses significant horizontal and vertical curvature along its alignment due to hilly terrain. Sheridan Lake Road is posted between 35 mph and 50 mph along its length and serves a regional travel route as well as a direct access to a number of residences along its length.

**Highway 1416** – Highway 1416 is a divided four-lane roadway extending east-west through the City of Box Elder, then becomes a two lane highway east of Box Elder and continues east through the City of New Underwood to beyond 173<sup>rd</sup> Avenue. Highway 1416 parallels Interstate 90 on its south side, and is posted at 65 mph through areas beyond city limits.

**Sage Creek Road** – Sage Creek Road connects South Dakota Highway (SD) 240 and encircles Badlands National Park on its northwest edge, eventually connecting with SD 44. It is a gravel surfaced road and is posted at 50 mph.

**State Highways** – The State Highway network in Pennington County is anchored by Interstate 90, which extends east-west across the United States and through the County. Additional State highways support I-90, including I-190, SD 40, SD 44, SD 79, SD 87, SD 240, SD 244, SD 231, SD 445, US Highway (US) 14, US 16, US 16A, US 16B, and US 385.

#### Traffic Volumes

**Figure 3** illustrates the existing daily traffic volumes along County highways and State highways (State highways shown for comparative reference purposes), gathered from traffic counts provided by the Pennington County Highway Department and SDDOT. County highway traffic counts were taken between 2009 and 2011 and State Highway traffic counts were taken in 2006.

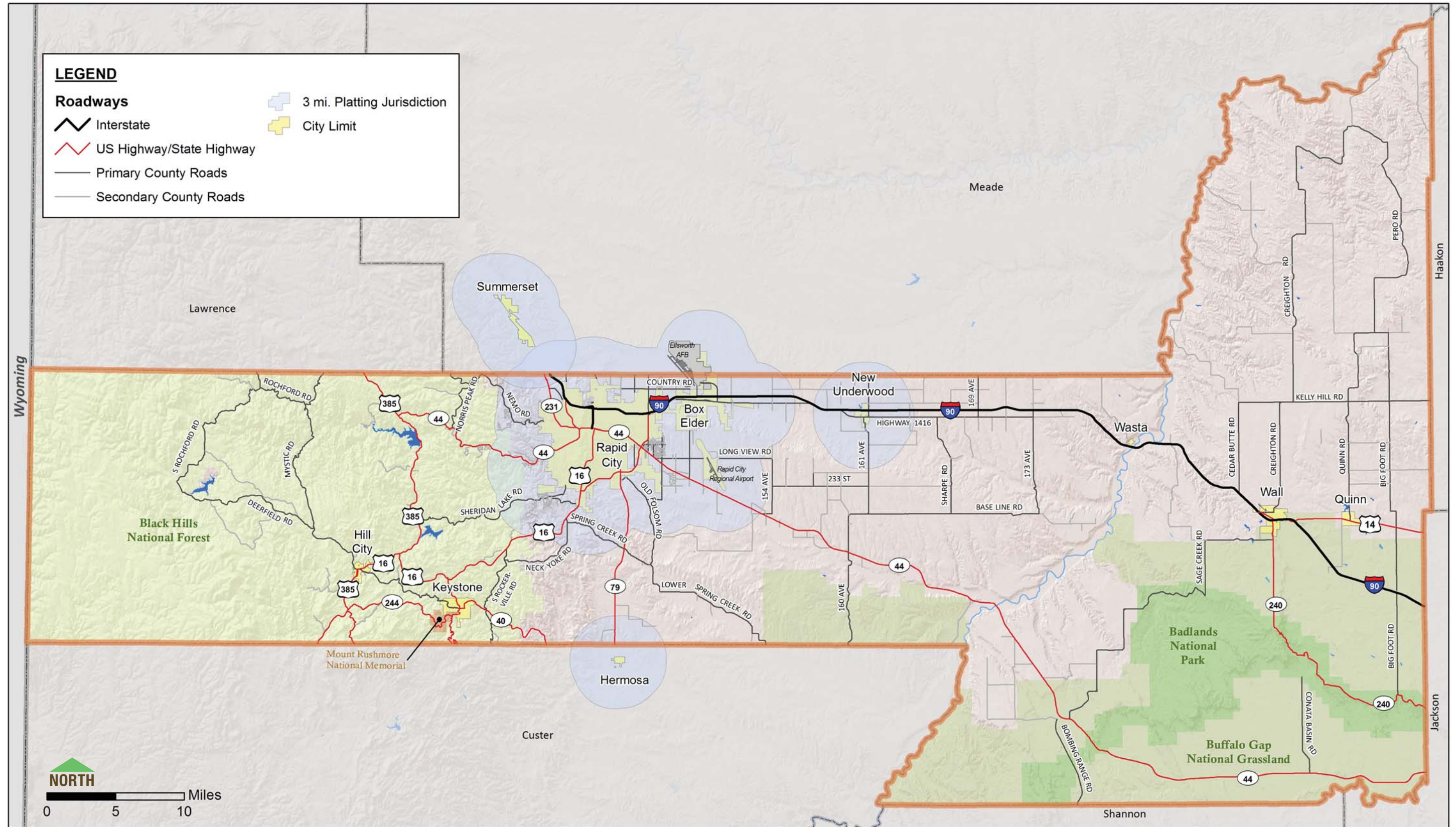
As shown, current traffic volumes are lower in the more rural portions of Pennington County and increase closer to developed areas. Traffic levels along I-90 vary from 3,000 vehicles per day (vpd) to over 10,000 vpd. Highway 1416 and Liberty Boulevard in Box Elder are the highest-volume County highways, carrying more than 3,000 vpd along specific segments. Most of the other County highways carry less than 1500 vpd, with the exception of sections of Nemo Road, Sheridan Lake Road, Deerfield Road, Radar Hill Road and a number of roadways within the Rapid Valley subdivision located southeast of Rapid City.

#### Volume-to-Capacity Ratios

One measure that is used to define operational characteristics is volume to capacity ratio (v/c). This ratio compares the existing traffic with the actual design of the roadway. A v/c ratio of 1.0 means that there is roughly an equal balance between the roadway design and the vehicular traffic on it. This analysis compares the capacity of the road as it is designed and constructed to the volume of traffic it carries. The planning level daily capacity thresholds shown in **Table 1** are the basis for the v/c ratios developed in CHAPS. These thresholds are the maximum planning level capacities in vehicles-per day (vpd) for various roadway types and travel lanes.



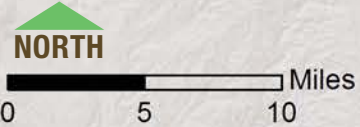
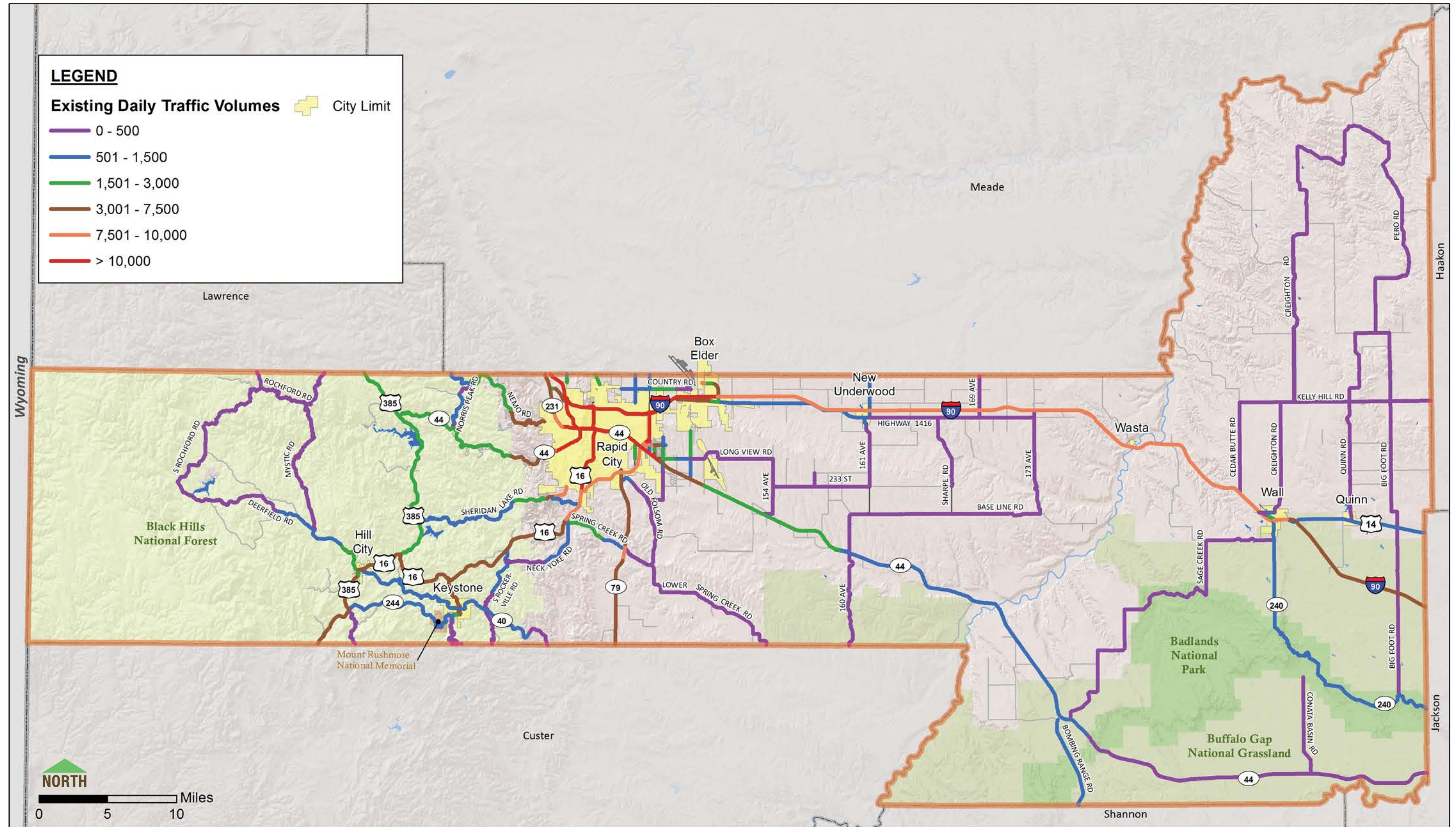
Figure 2 | Study Area



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Figure 3 | Existing Daily Traffic Volumes



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**Table 1** provides maximum planning level capacities in vehicles per day (vpd) for various roadway types and laneages.

**Table 1. Planning Level Roadway Capacities**

Roadway Classification	Number of Lanes	Maximum Capacity
Interstate 90	4-Lane	80,000 vpd
Arterial	2-Lane	16,000 vpd
Collector	2-Lane	10,000 vpd

The v/c ratios calculated on the roads within the planning area with existing count data are depicted graphically on **Figure 4**. The red segments represent roadways that carry traffic volumes in excess of the planning level roadway capacity (v/c ≥ 1.0). The yellow segments represent roadways that are operating at near capacity conditions (v/c between 0.80 and 1.0).

Based on the existing v/c ratios, current traffic volumes are well within the carrying capacity of the Pennington County highway system. State highway segments within Rapid City along SD 44 and US 16 included in the analysis currently show v/c ratios near or above 1.0.

### Intersection Operations

Ten intersections were identified for operational study by the Study Advisory Team. These intersections were identified based on their known congestion or potential for future growth/congestion, and public comment. The goal of the analysis was to determine what, if any, lane geometry or signing changes need to be made at the study intersections in order to provide acceptable Levels of Service (LOS) during the peak hour. Level of service analyses have been completed for the following selected intersections:

1. Highway 1416 / 161<sup>st</sup> Avenue
2. 154<sup>th</sup> Avenue / 233<sup>rd</sup> Street
3. Elk Vale Road / Country Road
4. SD 44 / Covington Street
5. Sturgis Road / Merritt Road
6. Sturgis Road / Universal Drive
7. Dunsmore Road / Sheridan Lake Road
8. Nemo Road / Norris Peak Road
9. Silver Mountain Road / Boulder Hill Road
10. Concourse Drive / Twilight Drive

The project team conducted peak hour vehicular traffic counts at these intersections on a weekday in February 2012. Existing operational conditions were analyzed at each of the intersections based on the procedures documented in the Highway Capacity Manual, (Transportation Research Board, 2010). This analysis procedure provides a LOS, which is a quantitative measure based on the average delay per vehicle at a controlled intersection. Levels of service are described by a letter ranging from “A” to “F”. LOS A represents minimal delay, while LOS F represents excessive congestion and delay. The ten intersections are all currently unsignalized (STOP sign control). Individual AM and PM peak LOS are provided for individual movements at stop-sign controlled intersections. The existing intersection turning movement volumes and LOS results are illustrated on **Figure 5**.

Many agencies and municipalities publish standards for acceptable intersection LOS during peak hour traffic conditions. The SDDOT accepts intersection operations of LOS C or better during peak hours at all facilities other than interchange ramps. The City of Rapid City seeks to provide LOS C or better intersection operations during peak hours. For the purposes of this analysis, LOS C or better is considered acceptable and LOS D or worse is indicative of operational deficiencies. It is important to note that it is not uncommon for stop controlled minor approaches to experience LOS D or worse at the intersection of major uncontrolled roadways.

In addition to LOS analyses, the project team conducted preliminary signal warrant checks at selected intersections. Warrant checks were based upon standards outlined in the 2009 Manual on Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration. The scope of this study only included data collection during the AM and PM peak hours. As a result, only the warrants based upon peak hours were studied. These warrants included Warrant 3 (Peak Hour) and Warrant 9 (Intersection Near a Grade Crossing). Warrant 3 was studied where delays correlate to LOS “D” or worse. This warrant is only applicable to peak hours on a typical day, and is only applicable to “unusual” cases, defined in the MUTCD as facilities that attract or discharge large numbers of vehicles over a short time. Warrant 9 was applied at intersections within 140 feet of a railroad crossing where the approach traversing the crossing is either stop and or yield controlled. Operational and signalization warrant results are described as follows by intersection:

**Highway 1416 / 161<sup>st</sup> Avenue** – Minimal traffic volumes at this intersection result in LOS A for all approaches during current AM and PM peak periods, acceptable operations.

**154<sup>th</sup> Avenue / 233<sup>rd</sup> Street** – Minimal traffic volumes at this intersection result in LOS A for all approaches during current AM and PM peak periods, acceptable operations.

**Elk Vale Road / Country Road** – Minimal traffic volumes at this intersection result in LOS B or better for all approaches during current AM and PM peak periods, acceptable operations.

**SD 44 / Covington Street** – Movements entering SD 44 from Covington Street currently operate at LOS E during the AM peak hour, an unacceptable result based on SDDOT standards. A check of Warrant 3 indicates that current conditions at the intersection meet threshold values for signalization.

**Sturgis Road / Merritt Road** – The westbound stop controlled approach experiences unacceptable LOS during the PM peak hour, and queues extend east across the nearby at-grade railroad crossing. A warrant check indicated that conditions meet warrants 3 and 9. In addition to signalization, installation of an exclusive westbound left turn lane could improve operations.

**Sturgis Road / Universal Drive** – Currently, all movements at this intersection operate acceptably. The westbound PM peak hour delay is currently within a single second of experiencing LOS D operations.

**Dunsmore Road / Sheridan Lake Road** – The southbound approach currently operates at LOS F during the AM peak hour. Based upon current traffic levels and intersection characteristics, this intersection meets Warrant 3 thresholds for signalization.

**Nemo Road / Norris Peak Road** – Minimal traffic volumes at this intersection result in LOS A for all approaches during current AM and PM peak periods, acceptable operations.



Figure 4 | Existing Volume to Capacity Ratios - Roadway Segments

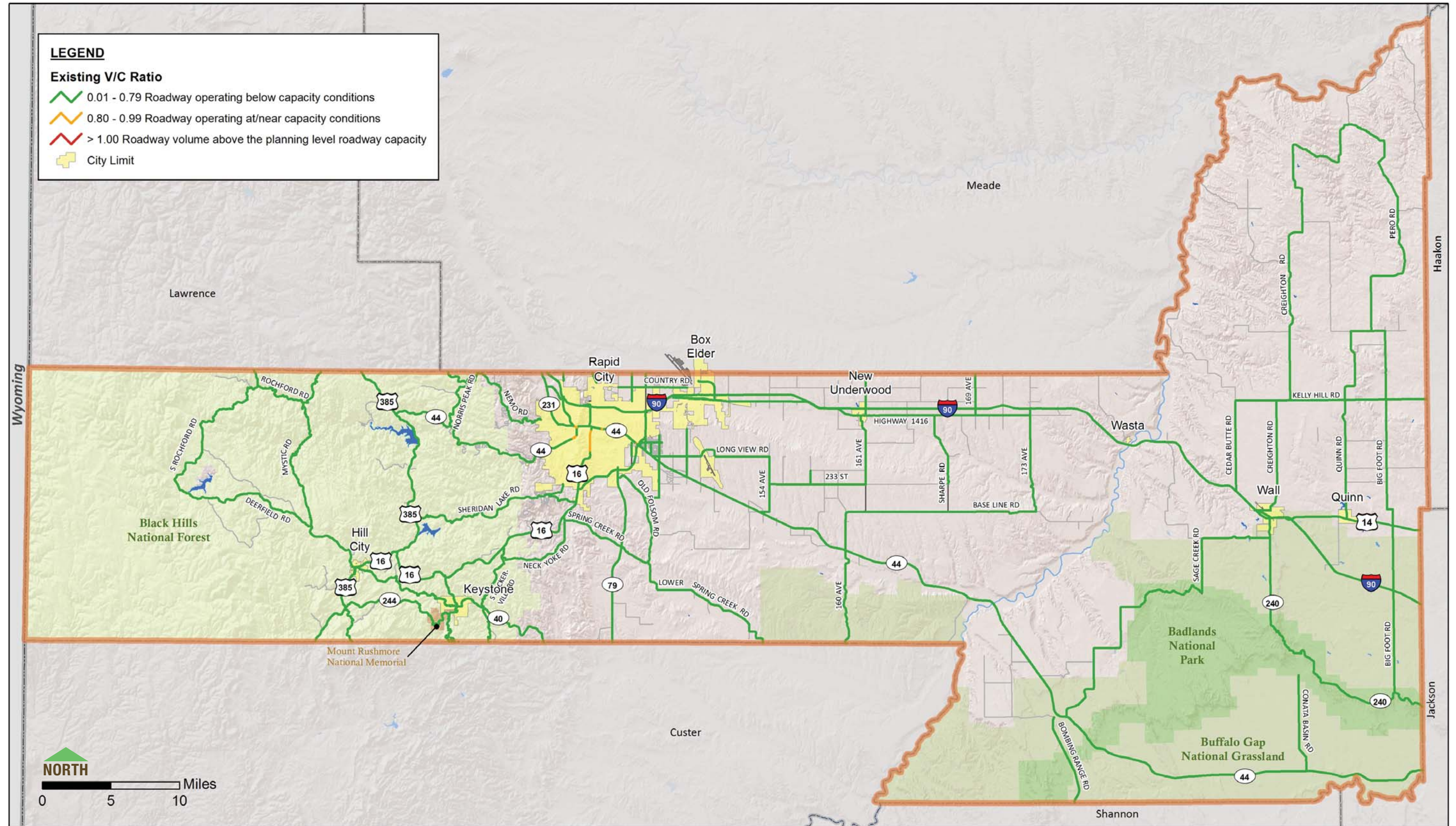
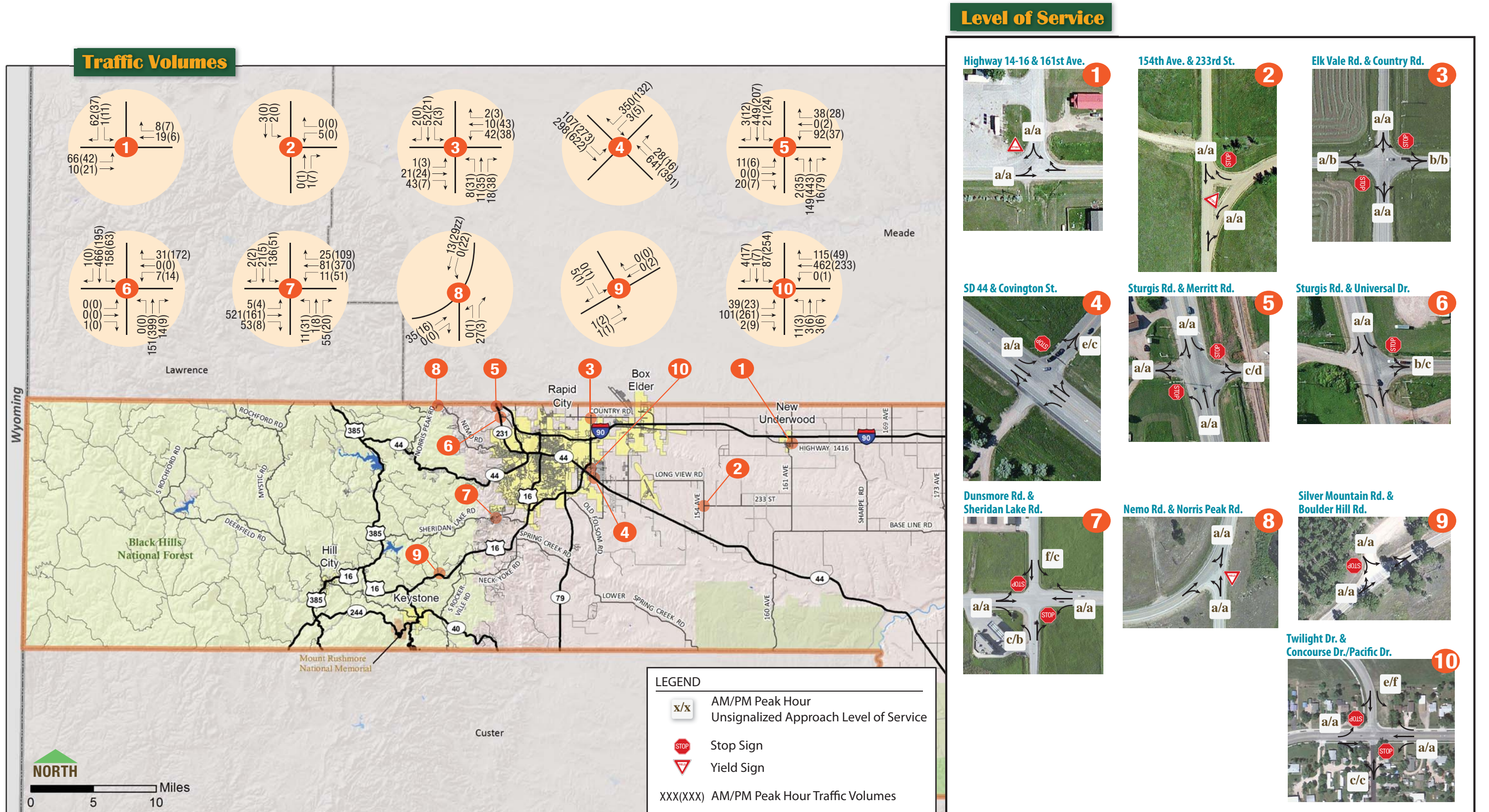




Figure 5 | Existing Intersection Traffic Forecasts and Levels of Service







**Silver Mountain Road / Boulder Hill Road** – Minimal traffic volumes at this intersection result in LOS A for all approaches during current AM and PM peak periods, acceptable operations.

**Concourse Drive / Twilight Drive** – The Concourse Drive / Twilight Drive intersection currently experiences high traffic volumes because it is the most direct point of access to Rapid Valley for vehicles traveling along Elk Vale Road. The southbound approach currently operates at LOS E/F in the AM/PM peak hour. The primary reason for this excessive delay is the magnitude of the southbound left turn movement during peak hours, particularly the PM peak hour, when traffic volumes exceed 250 vehicles per hour.

**Appendix D** provides a technical memorandum detailing intersection traffic conditions and design issues.

**Traffic Safety**

The South Dakota Department of Transportation (SDDOT) presently maintains a Geographic Information Systems (GIS) crash database designed to monitor crash trends. As part of CHAPS, the crash data were compiled for a three year period to identify the most hazardous intersections within the study area. The analysis was conducted for all crashes between July of 2008 and July of 2011.

A total of 2,115 traffic crashes were reported in the study area between 2008 and 2011. There were 16 fatal crashes within the study area and 159 crashes resulted in incapacitating injuries. Overall, approximately 6 percent of reported crashes listed alcohol or drug use as contributing factors and 24 percent listed inclement weather as a contributing factor. Nearly 30 percent of crashes involved wildlife.

In general, crash statistics compiled for Pennington County reflected values near the statewide averages. For example, the 2009 South Dakota Motor Vehicle Traffic Crash Summary (Department of Public Safety, 2009) indicated that 6 percent of all crashes involved alcohol. The Year 2010 version of the same document indicated that 28 percent of all crashes involved wild animals.

Using the SDDOT crash information, the project team developed a ranking of intersections in the study area based on the number of crashes reported within a buffer distance of 150 feet of the center of each intersection in Pennington County. Aiming to create a list of the top 15 crash frequency locations, the project team reached a list of 17 intersections shown to experience 4 or more crashes during the 2008-2011 time frame. **Figure 6** depicts the intersection locations graphically and **Table 2** lists the intersections and the number of collisions at each, providing additional commentary regarding specific issues. A few key points are provided as follows:

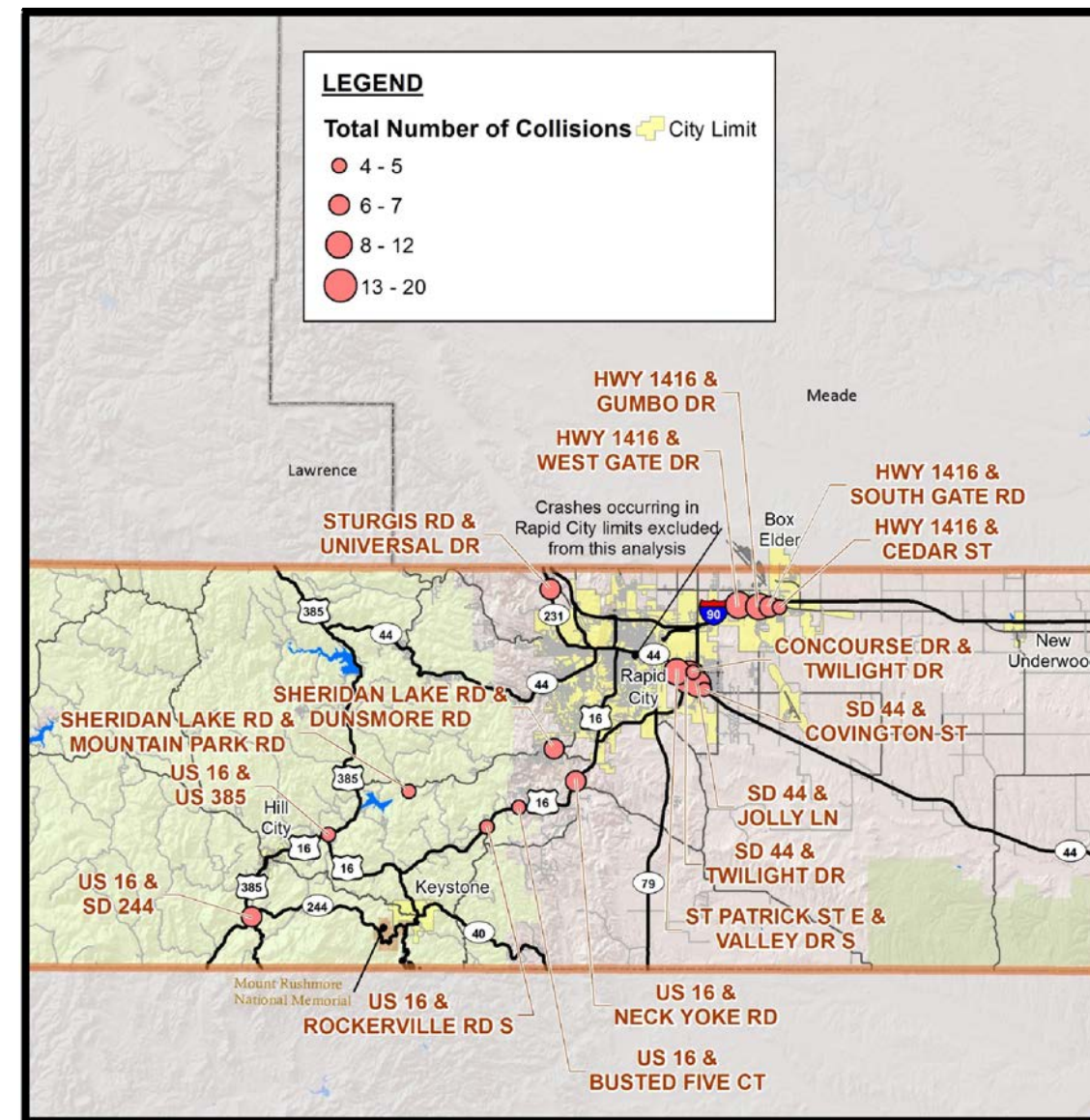
**Angle-type crashes** –Angle crashes are a typical pattern for busy unsignalized intersections, as drivers seek to enter the major road without the benefit of signalized protection. This pattern is observed at the unsignalized intersections of Sheridan Lake Road / Dunsmore Road, US 16 / Neck Yoke road, and Concourse Drive / Twilight Drive. Sight distance limitations or unclear signage may be contributing to these crashes, in addition to high traffic volumes.

Two signalized intersections also demonstrated a pattern of angle-type crashes; SD 44 / Twilight Drive and St. Patrick Street / Valley Drive. At the SD 44 / Twilight Drive intersection, a majority of the crashes happened during evening hours, indicating that poor signal head visibility may be a contributing factor. Also, 80 percent of the angle crashes happened during winter months. Poor signal head visibility may also

be a contributing factor at the St. Patrick Street / Valley Drive intersection, where the current signal installation is a span-wire type configuration.

**Highway 1416** – Multiple intersections along Highway 1416 through the City of Box Elder demonstrated higher crash frequency. This result reaffirms the findings of the Highway 1416 Corridor Study (KL&J, July 2010), which stated that a majority of crashes along Highway 1416 happened at intersections. Potential safety issues cited in the Corridor Study included failure to yield at intersections and high travel speeds.

**Figure 6. High Crash Frequency Intersections**





**Table 2. Top Crash Intersections in Study Area**

Rank	Intersection	Number of Crashes 2008-2011				Comments
		Total	PDO	INJ	FAT	
1	SD 44 / Twilight Drive / Elk Vale Ramps	20	12	8	0	Mostly angle crashes, 11 crashes happened in 2010
2	St. Patrick Street / Valley Drive	12	7	5	0	Majority angle-type crashes
3	Highway 1416 / West Gate Road <sup>1</sup>	12	5	7	0	See note (1)
4	Highway 1416 / Gumbo Drive <sup>1</sup>	11	4	7	0	See note (1)
5	SD 44 / Jolly Lane	9	5	4	0	No clear pattern
6	Sheridan Lake Road / Dunsmore Road	7	3	4	0	Majority angle-type crashes, common for busy unsignalized intersections
7	Highway 1416 / South Gate Road <sup>1</sup>	7	4	3	0	See note (1)
8	Sturgis Road / Universal Drive	7	6	1	0	Majority of crashes involved wild animal hit
9	SD 244 / US 16 <sup>2</sup>	6	4	1	1	See note (2)
10	US 16 / Neck Yoke Road	6	4	2	0	Mostly angle-type crashes
11	SD 44 / Covington Street	5	4	1	0	No clear pattern
12	US 16 / Busted Five Court	5	2	3	0	No clear pattern
13	US 16 / US 385 <sup>2</sup>	4	4	0	0	See note (2)
14	Sheridan Lake Road / Mountain Park Road	4	2	2	0	2 crashes involved alcohol, all 4 involved losing control
15	Concourse Drive / Twilight Drive	4	3	1	0	Mostly angle-type crashes
16	Highway 1416 / Cedar Street <sup>1</sup>	4	3	1	0	See note (1)
17	US 16 / Rockerville Road	4	2	2	0	No clear pattern

<sup>1</sup> Crash history along Highway 1416 has been analyzed in a previous report, so no detailed analysis is included in CHAPS.

<sup>2</sup> Intersections of two State highways were not analyzed for crash patterns, as County highways are the focus of CHAPS.

## B. Roadway Design Conditions

### Roadway Surface Types

**Figure 7** illustrates the surfacing of the Pennington County highway system. All State highways in the County are paved. The majority of County roads in the urban areas are paved, while many of the rural and mountainous roads are unpaved. **Table 3** provides a breakdown of the highway-miles and percentage of roadways of various surface types along County highways in Pennington County. As shown, the majority of County highways are gravel or unsurfaced and asphalt comprises the other portion. Only Liberty Boulevard into Box Elder is concrete.

**Table 3. Existing Roadway Surface Types - Pennington County**

Surface Type	Highway-Miles	Percentage of Highway-Miles
Gravel/Unsurfaced	500	60%
Asphalt	333	40%
Concrete	2	negligible

### Bridge Limits

**Figure 8** depicts restricted load bridges within Pennington County. This graphic serves as a reference for heavy vehicles navigating County roads. As shown, there are no load-limited bridges along the State Highway network, but a number of bridges on County highways show load limits. Routes affected in the Black Hills include South Rochford Road and Mystic Road, as well as Deerfield Road west of Hill City. Spring Creek and Lower Spring Creek Roads also show load limits.

### Intersection Concerns

**Figure 9** depicts intersections studied for design concerns. Intersections were evaluated based on the recommendation of members of the SAT. As shown, the locations were spread throughout the western portion of Pennington County, with the majority within the Black Hills, where the undulating terrain and forested surroundings can complicate intersection design.

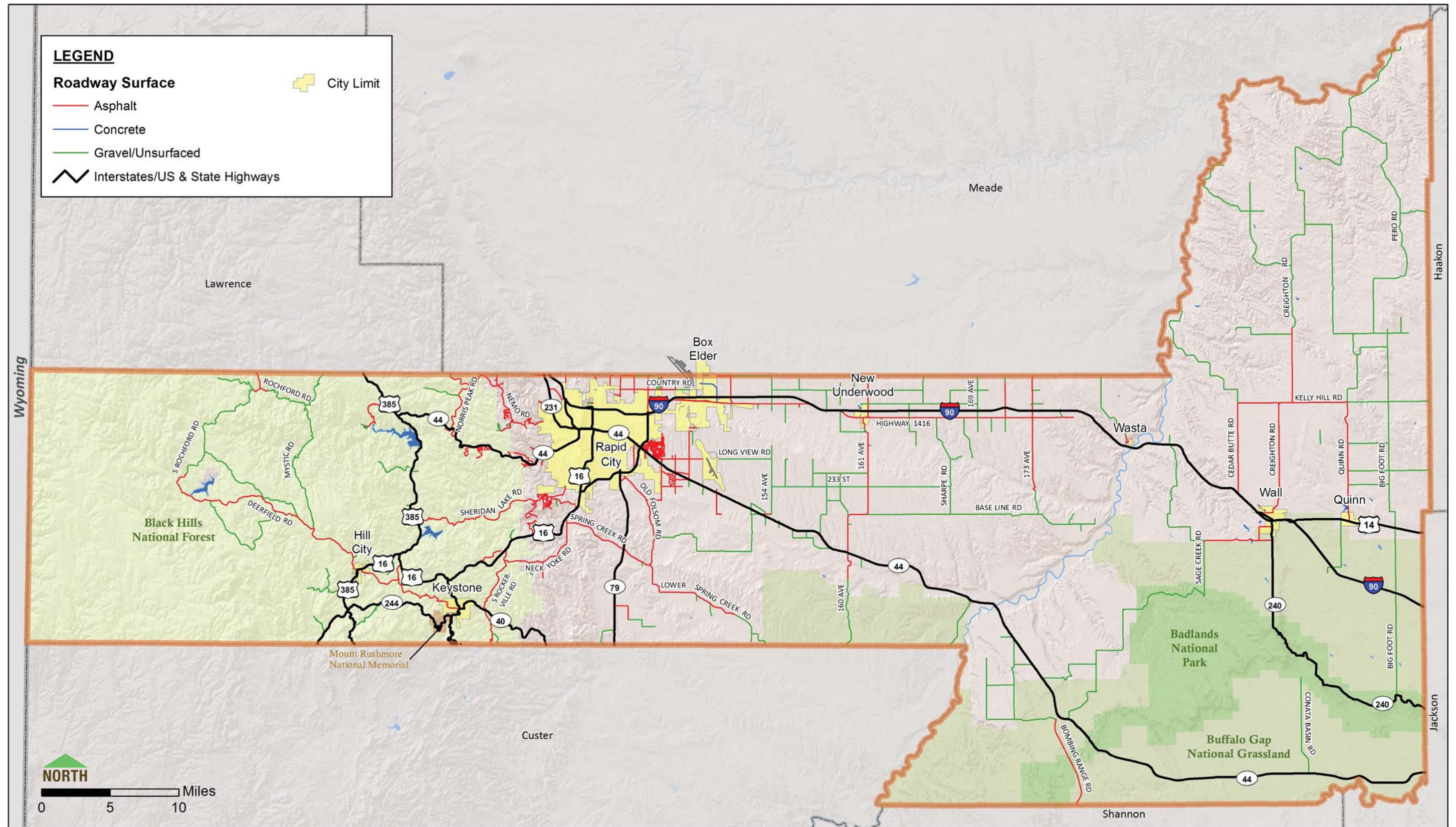
The SAT provided guidance to the project team on potential issues related to each intersection, and the project team conducted a field review of each of the ten locations to identify the presence and extent of concerns. Concerns noted included:

- Limited sight distance for entering vehicles
- Skewed angle of approaches / sharp turning movements
- Multiple closely spaced intersections
- Traffic control / signage needs

An assortment of these issues was identified at the intersections, and the concerns are listed on **Figure 9**. The technical memorandum in **Appendix D** provides additional detail.



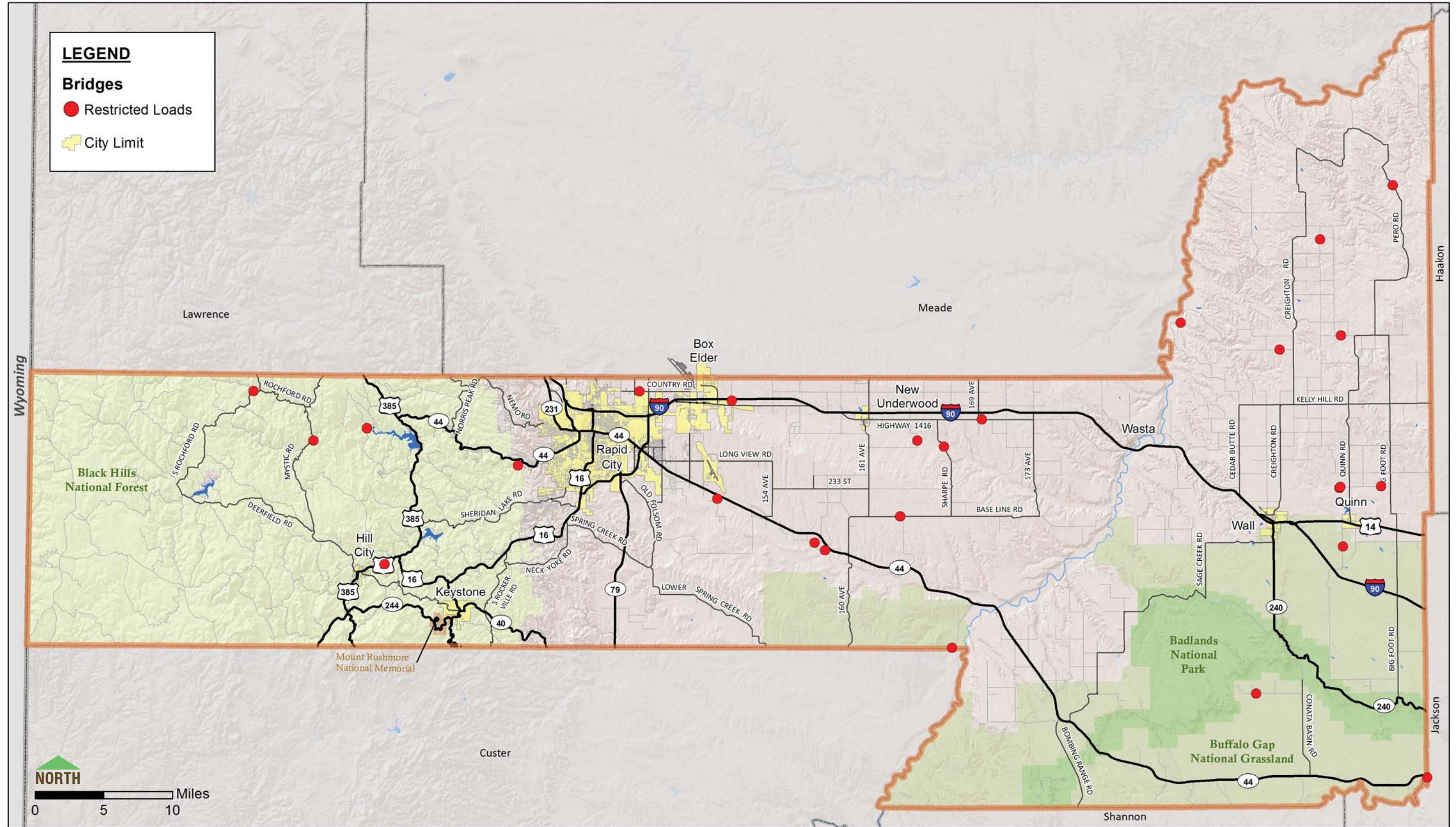
Figure 7 | Existing Roadway Surfaces



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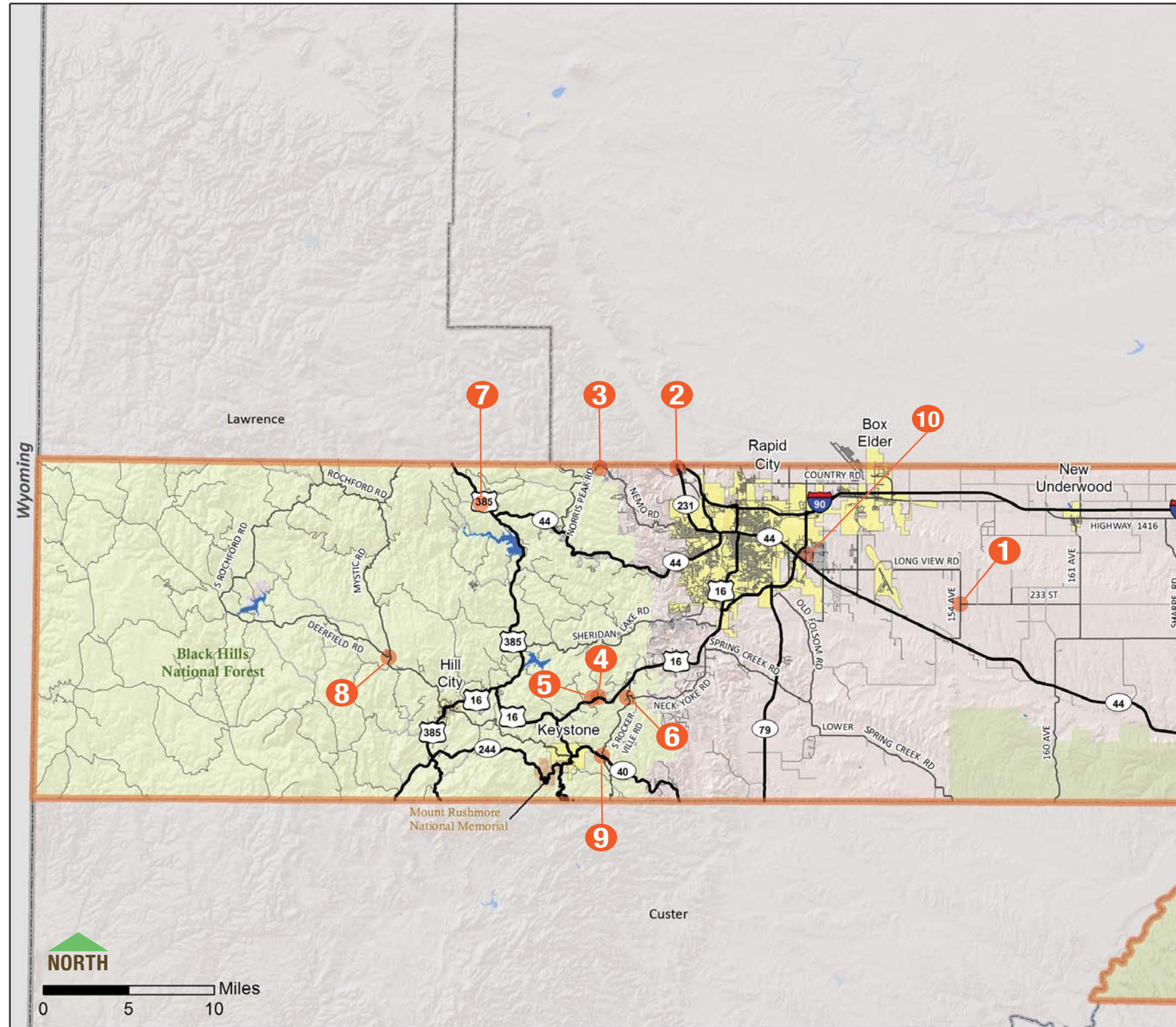


Figure 8 | **Restricted Load Bridges**



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Figure 9 | **Intersection Concerns**



**154th Ave. & 233rd St.**

- Sharp southbound angle of entry
- 4 intersections close together



**Sturgis Rd. & Merritt Rd.**

- Proximity of railroad tracks
- 3 crashes between 2008 & 2011



**Nemo Rd. & Norris Peak Rd.**

- Large open paved area
- Sharp turning movements



**Silver Mountain Rd. & Boulder Hill Rd.**

- Limited sight distance due to trees and vertical curvature



**Silver Mountain Rd. & Highway 16**

- Sharp turning movements



**Rockerville Rd. & Neck Yoke Rd.**

- Sight distance limitations



**US 385 & Silver City Rd.**

- Sight distance limitations



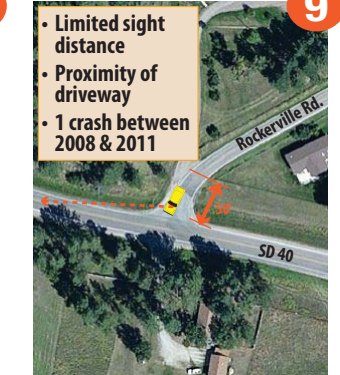
**Deerfield Rd. & Mystic Rd.**

- Sight distance limitations



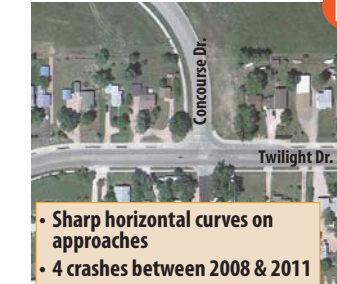
**SD 40 & Rockerville Rd.**

- Limited sight distance
- Proximity of driveway
- 1 crash between 2008 & 2011



**Twilight Dr. & Concourse Dr./Pacific Dr.**

- Sharp horizontal curves on approaches
- 4 crashes between 2008 & 2011





### C. Transit

Pennington County’s residents are served by a three primary transit agencies. The project team held discussions with each of these agencies to develop an inventory of current transit operations and issues in Pennington County. These discussions are summarized in **Table 4**.

### D. Non-motorized Facilities

The inventory of non-motorized travel conditions was compiled based on a physical review of current infrastructure. In addition, the public involvement process afforded the project team an opportunity to ask Pennington County residents and businesses about the existing non-motorized network and receive feedback about current conditions. Comments were gathered at the six public open houses, individual meetings with stakeholders, and an online survey. The survey, which covered a variety of transportation categories and issues, included several questions related to pedestrian and bicycle travel in Pennington County. Of note, a majority of survey respondents gave travel by bicycling or walking in Pennington County a poor rating.

**Figure 10** illustrates the existing non-motorized travel network in the study area. Though often considered together, the needs of bicyclists and pedestrians are distinctive and worthy of individual consideration in CHAPS. The existing condition for both is described as follows, beginning with Pedestrian conditions.

#### Pedestrian Conditions

Pennington County highways are primarily rural sections, meaning that no curb, gutter or sidewalk is typically provided along County highways. Individuals seeking to travel on foot throughout the County typically walk along the edge of the roadway or available shoulder width. This condition was reflected in the survey responses, as a number of individuals requested additional sidewalks along County highways. Responses included a request for a walkable connection between Wall and Quinn and sidewalks along Deadwood Avenue. Pedestrian improvement projects were rated second-highest in importance by survey respondents, slotting just below existing road improvements.

#### Bicycle Conditions

Bicycle use in Pennington County is on the increase. Bicyclists use the roadways and paths for social, recreational and commuting purposes. Mountain bike trails are becoming a featured attraction in the western portion of Pennington County. Road cycling aficionados are regularly found traveling County highways. The Rapid City Metropolitan Planning Organization (MPO) and the City of Rapid City recently completed the *Rapid City Area Bicycle and Pedestrian Master Plan*, which included recommendations for bike facilities throughout the Rapid City area. Bicycle conditions were evaluated by the project team based on technical review and input received from survey respondents, general public, and stakeholders. Conditions are described as follows by

**On-Street Bicycling** –The American Association of State highway and Transportation Officials (AASHTO) has published a *Guide for the Development of Bicycle Facilities (AASHTO, 1999)*, which states that in rural areas “adding or improving paved shoulders often can be the best way to accommodate bicyclists and benefit motor vehicle traffic.” The guide goes on to recommend a 4’ minimum shoulder width to accommodate bicycle travel.

**Table 4. Inventory of Transit Services in Pennington County**

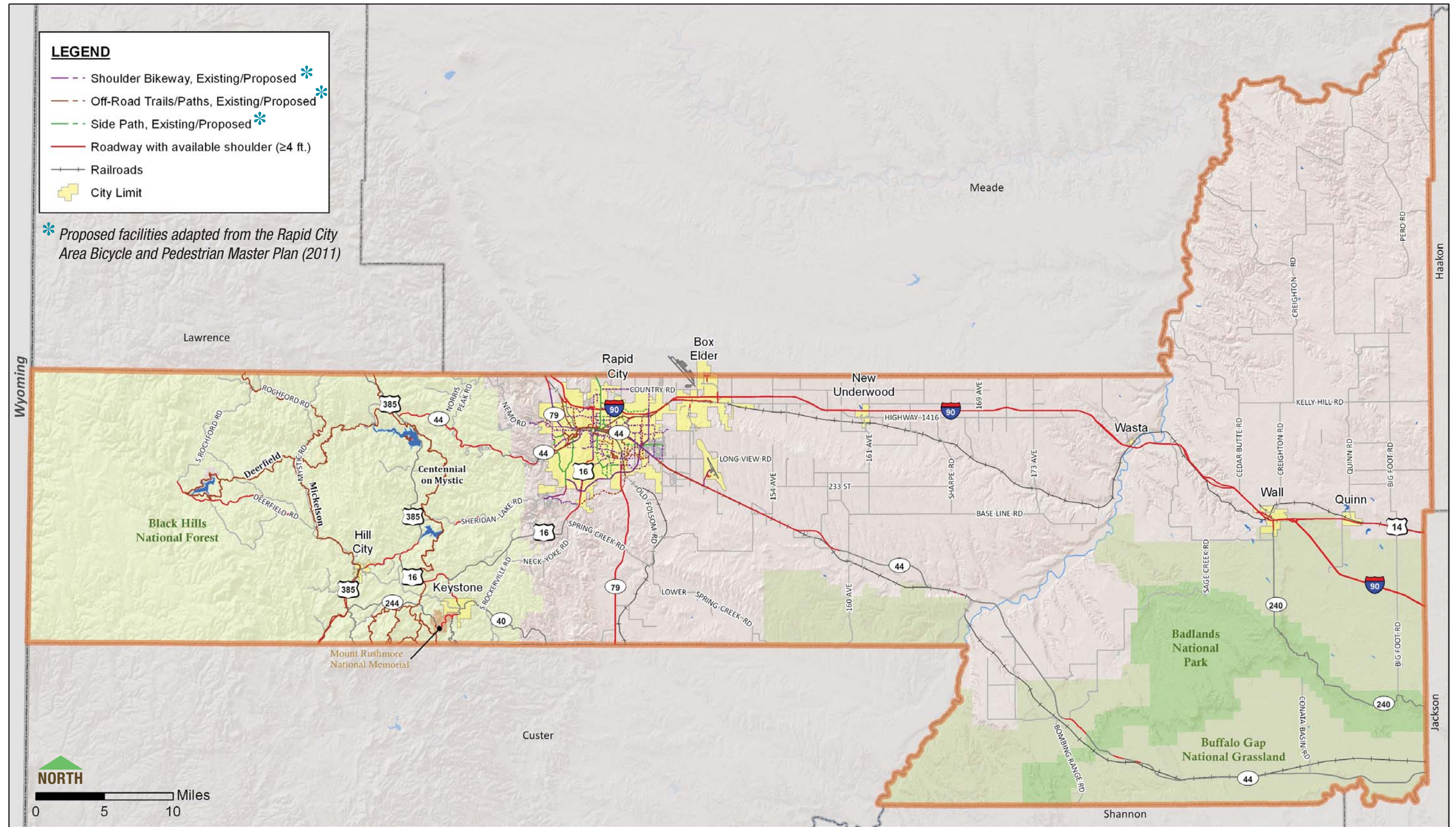
Name of Organization and Location	River Cities Transit, Pierre, SD	Rapid Transit, Rapid City, SD	Prairie Hills Transit, Spearfish, SD
Contact Individual	Ron Baumgart	Rich Sagen	Barb Cline
Type of Service	Call-n-Ride, all access public transit in Wall	Fixed-route service Monday thru Friday, ADA Call-n-Ride	Call-n-Ride, fixed-route
Current Service Area in Pennington County	East portion of County	Within only corporate limits of Rapid City with small portion of Rapid Valley, ADA Call-n-Ride service surrounding Rapid City	West portion of County
Primary destinations	Rapid City, Wall area	Various within Rapid City	Various within Rapid City
Transit Vehicles	ADA minivans, regular minivans, ADA buses, full time driver in Wall, SD	29-foot van cutaways	36 total vehicles, including ADA minivans and 24-passenger buses
Heaviest ridership route	Medical and shopping trips to Rapid City	People coming into City from County	Spearfish to Rapid City
Agencies collaborated with	Other transit agencies, local municipalities	Rapid City Metropolitan Planning Organization (MPO)	Other transit agencies, United Way
Concerns about service in Pennington County	Need for additional County funding to provide local match for Federal dollars	Funding from County needed if service is desired	Need for ongoing and additional funding for transit services to provide local match
Current transit needs	Collaborate more with Rapid City Easter Seals group and Senior Day Care	Will upgrade fleet vehicles in near future	Large population of seniors in Rapid City whose needs are not being met
Other Notes	Rides are coordinated to gather multiple riders on a given trip	Open to hearing from County if additional transit service is desired. Potential future service in Box Elder. Not likely to provide service to Mount Rushmore. If Rapid Valley service increases may need road improvements there. Potential for future Airport shuttle service.	Prairie Hills performs its own maintenance on buses at its new facility and could share this service with other agencies. Added funding would allow them to explore new services

As shown on **Figure 10**, few County highways possess minimum shoulders for accommodating cyclists, while some of the State highways in the County do possess adequate shoulder width. A number of County Highways were noted by the public as ideal locations for additional shoulder width, including Upper and Lower Spring Creek Roads, Sheridan Lake Road, Nemo Road, and Highway 40 from Playhouse Road into Keystone.

**Off-Road/Street Bicycling** – There are a number of off-street and off-road bicycling trails in rural Pennington County, particularly gravel trails throughout the Black Hills for Mountain bikes. The Mickelson and Centennial on Mystic Trails provide recreational opportunities for off-road cyclists. A paved side path currently parallels Twilight Drive for approximately 1.6 miles through Rapid Valley.



Figure 10 | Existing Pedestrian and Bicycle Network



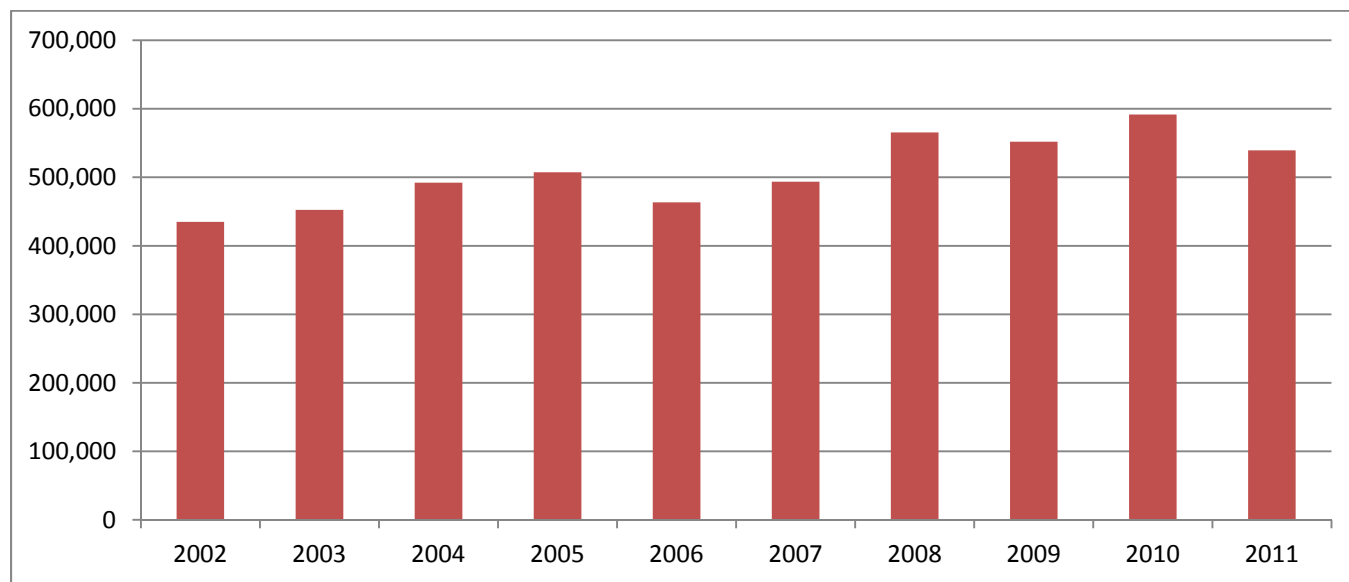


As shown on **Figure 10**, the Rapid City limits include a number of existing and proposed trails, paths and shoulder bikeways. Some of the proposed facilities extend into portions of rural Pennington County surrounding the City.

### E. Air Transportation

The anchor of the air transportation system in Pennington County is the Rapid City Regional Airport (RCRA), which provides commercial air service to a variety of destinations within the region. As of May 2012, flights to and from the airport occurred to Denver, Las Vegas, Minneapolis, Salt Lake City, Phoenix, Houston, Dallas/Fort Worth, and Chicago. The airport served a total of approximately 539,500 passengers in 2011, a slight decline from previous years. **Figure 11** depicts the total annual passenger counts at

**Figure 11. Annual Passengers served – Rapid City Regional Airport**



RCRA since 2002. Growth has been steady over the past ten years and the *Rapid City Regional Airport Master Plan Update* (RS&H, May 2005) projects annual future growth of 1.3 percent in aviation activity. The Master Plan document also identifies a number of improvement projects to accommodate current and future airport users. One of these projects, a remodel and expansion of the main terminal, is anticipated to be complete by the summer of 2012. Among the other significant upcoming RCRA projects are an extension of the main runway by 500 feet, replacement of the control tower, and additional parking capacity on site.

There are two additional airports in Pennington County, Wall Municipal and Ellsworth Air Force Base (EAFB). The Wall Municipal Airport provides General Aviation services and recorded 4,050 total aircraft operations in 2009. In January 2010, a revised *Airport Layout Plan* (ALP) was developed for the Wall airport (Brosz Engineering). The ALP identified a need to extend the main runway (Runway 31) in the near-term future, and complete additional enhancements over the next 6-20 years.

Ellsworth Air Force Base, located in the City of Box Elder, is the largest airport in Pennington County (as documented in the 2005 *Pennington County Comprehensive Plan*) and the second largest employer in South Dakota and is restricted to military use only. The base has a significant impact on the local economy, and has catalyzed recent planning efforts in the area. The *Moving Forward with Ellsworth Air Force Base – Box Elder I-90 Corridor Area Master Plan* (URS, 2009) identified transportation projects and land use considerations associated with the future of EAFB.

No other air facilities are anticipated to develop in Pennington County in the near future.

### F. Freight Transportation

The majority of freight travel through Pennington County occurs along I-90, which, as an Interstate roadway, serves cross-country freight patterns. A second tier of freight travel occurs along State Highways through Pennington County. County highways play the important role of circulating freight traffic to and from important destinations within the County. Important freight components are highlighted as follows:

**Black Hills National Forest** – The Black Hills are central to the regional logging industry. Timber sales in the forest result in a dynamic impact on the roadway network, as truck access and circulation patterns are adjusted on short notice to accommodate the temporary sales. A number of major timber operations conduct business in the Black Hills. Conversations with logging company representatives indicated that it is important to their operations to maintain open communication lines with Pennington County Highway Department regarding ongoing maintenance of County highways and construction projects. County highways utilized for logging purposes include Deerfield Road east of Hill City, South Rochford Road, and Mystic Road.

**Railroad** – The Dakota, Minnesota and Eastern RR/Canadian Pacific extends through Pennington County east-west along I-90 and north-south parallel to SD 79. The Powder River Expansion Project would extend the DM&E track around the southeast side of Rapid City to effectively reach strategic locations. An Environmental Impact Statement was completed in 2001 in support of this effort, and the project remains under consideration.

**Transload** – Also associated with freight traffic is the Transload facility located east of Box Elder along the south side of Highway 1416. This facility serves as a terminal for offloading of railcar freight onto trucks for distribution. Based on information included in the *2010 Decennial Interstate Corridor Study* (Felsburg Holt & Ullevig), the Transload facility is forecasted to generate approximately 40 truck trips per day.

### G. List of Current Issues

The public and stakeholder involvement process was designed to collect as much input as possible from the Pennington County community about existing transportation issues within the study area. This process was a valuable tool in identifying what members of the community see as the biggest issues needing attention during the development of this Master Transportation Plan. The complete issue listing is provided in **Appendix C**.

Several locations and potential improvements were identified by stakeholders, members of the public and online survey respondents. Issues mentioned in addition to those identified in the Inventory of Existing Conditions are summarized as follows by category:





- **Roadway Issues:**
  - Paving needed along Rochford Road between Mystic Road and US 385, Mystic Road between Rochford Road and Deerfield Road, and Reno Gulch Road
  - Improve the bridge to remove load limits on South Rochford Road
- **Intersection Issues:**
  - Limited sight distance at Creighton Road / Cedar Butte Road intersection
- **Bicycle and pedestrian Issues:**
  - Provide wider shoulders along Sheridan Lake Road, Upper and Lower Spring Creek Roads, Nemo Road, Deadwood Avenue, Old Hill City Road and Moon Meadows Drive
  - Provide a off-street/road bicycle path connection from Rapid City to Mountain Biking trailheads in Black Hills
- **Transit Issues:**
  - Supplement the existing transit system to include night/weekend hours of operation and service to surrounding communities. Introduce evening service on a limited basis first to test
  - Educate the entire community about available transit services
  - Need to develop a collaborative approach among service providers
  - Need more service between EAFB and Rapid City
- **Transportation Policy:**
  - Improve communications between agencies and businesses

These issues were considered during the development of *CHAPS* and recommendations were included in the future project listing in Section V where logical improvements could be identified.



### III. FUTURE NEEDS ANALYSIS

#### A. Land Use

Pennington County has experienced steady growth during the last several decades, and growth is anticipated to continue into the future. While growth in the County overall has been significant, the majority of growth has been focused in and immediately surrounding Rapid City. Generally speaking, Rapid City accounts for approximately two-thirds of the 100,000 residents in Pennington County and therefore represents a majority of the County's population. This transportation plan is focused on understanding the transportation needs for Pennington County highways and is therefore dependent on the travel relationships between Rapid City and unincorporated portions of the county, with a primary emphasis of the land use growth projections on unincorporated Pennington County development.

In order to fully understand anticipated future growth in the county, three different resources were used to establish growth trends for the County. Historic Census Data between 2000 and 2010 showed an average growth rate of 1.3% per year for unincorporated areas in the County. In addition to historic growth patterns, forecasts completed for the Pennington County Comprehensive Plan and forecasts maintained by the Rapid City MPO were also referenced. The Pennington County Comprehensive Plan completed in July, 2003, anticipated growth of 1.5% per year in new housing and the Rapid City MPO forecasts growth of 1.2% per year. Combining historic growth rates with recent growth projections, this plan used a growth rate of 1.3% per year in developing 2035 traffic forecasts.

Following the determination of the generalized growth rate anticipated for unincorporated portions of the county, locations of known future development was sought. During SAT meetings and stakeholder interviews conducted during each of the public meeting periods, the consultant team solicited information about known developments so that if particular locations in the county are anticipated to develop at faster rates than the general growth, that information could be included in the future traffic volume development. In the end, no known specific developments were identified within Pennington County, and therefore, uniform growth throughout the county was assumed to occur between now and 2035.

#### B. Future Traffic Volumes

The future traffic forecasts were developed for all county roads and state roads in Pennington County. The focus of this transportation plan is to determine transportation needs on County roads, but the interdependence of the County road system in conjunction with state highways made it important to show future volumes on all of these roadways. This distinction is especially true in the west portion of the County where few parallel routes exist and travel often relies on county roads just as significantly as state roads.

In order to develop growth forecasts that were consistent with other planning efforts already completed by the Rapid City MPO and the SDDOT, various traffic growth resources were used in the development of the county-wide 2035 traffic volumes. The basis for all of the forecasts on County highways started with an existing count database maintained by County Staff along with state highway volumes maintained by SDDOT. Growth along County highways was calculated by applying the uniform 1.3% per year growth rate discussed in Section III.A. to all county roads. The second source for the growth projections was the SDDOT Needs Book. The Needs Book establishes growth rates on all of the state's highways for a twenty year horizon. Based on the desire to establish 2035 traffic volumes, the 20 year factors provided in the Needs Book were used to develop 2035 traffic volumes on all state highways in the County. The third

resource used to develop the countywide growth rates was the Rapid City MPO Travel Demand Model. The Travel Demand Model focuses on the MPO study area and uses traffic analysis zones with land use projections to load a representative roadway network with the goal of developing future traffic forecasts in the study area. This model was used to account for localized growth within the Rapid City area to more accurately reflect anticipated traffic growth.

The resulting forecast traffic volumes have been provided on **Figure 12**. The majority of large forecast volumes are concentrated along I-90 and within the City of Rapid City in the future, which is consistent with current traffic volumes experienced in the County. Generally speaking, traffic growth on County highways is expected to be modest as future development occurs in unincorporated portion of Pennington County.

#### C. Volume-to-Capacity Ratios

Based on the capacity values discussed in Section II.A, the v/c ratios calculated on the highways within Pennington County with future forecast volumes are depicted graphically on **Figure 13**. The red segments represent roadways that carry traffic volumes in excess of the planning level roadway capacity ( $v/c \geq 1.0$ ). The yellow segments represent roadways that are operating at near capacity conditions ( $v/c$  between 0.80 and 1.0).

Based on future v/c ratios, the only locations with poor v/c ratios are located on state highways within Rapid City. These results suggest that traffic congestion will not be a principal concern on County highways in the future and there is no need to recommend highway widening projects to accommodate 2035 forecast traffic volumes.

Based on the 2035 forecast traffic volumes anticipated, there are however, some low volume locations in the County where upgrading the roadway from gravel to a paved surface is recommended. County Staff follow a general rule, that when a roadway reaches 250 vehicles per day, it is evaluated to determine if paving should occur. Three segments have been identified based on this rule of thumb for paving: Rochford Road between Mystic Road and the Lawrence County Line, Mystic Road between Rochford Road and Deerfield Road, and Longview Road between Rapid City Regional Airport and 154<sup>th</sup> Avenue.

As a result of the future roadway traffic volumes identified in this section, specific recommendations for roadway paving improvements are forthcoming in Chapter V.



Figure 12 | Long-Term Future (Year 2035) Traffic Volumes

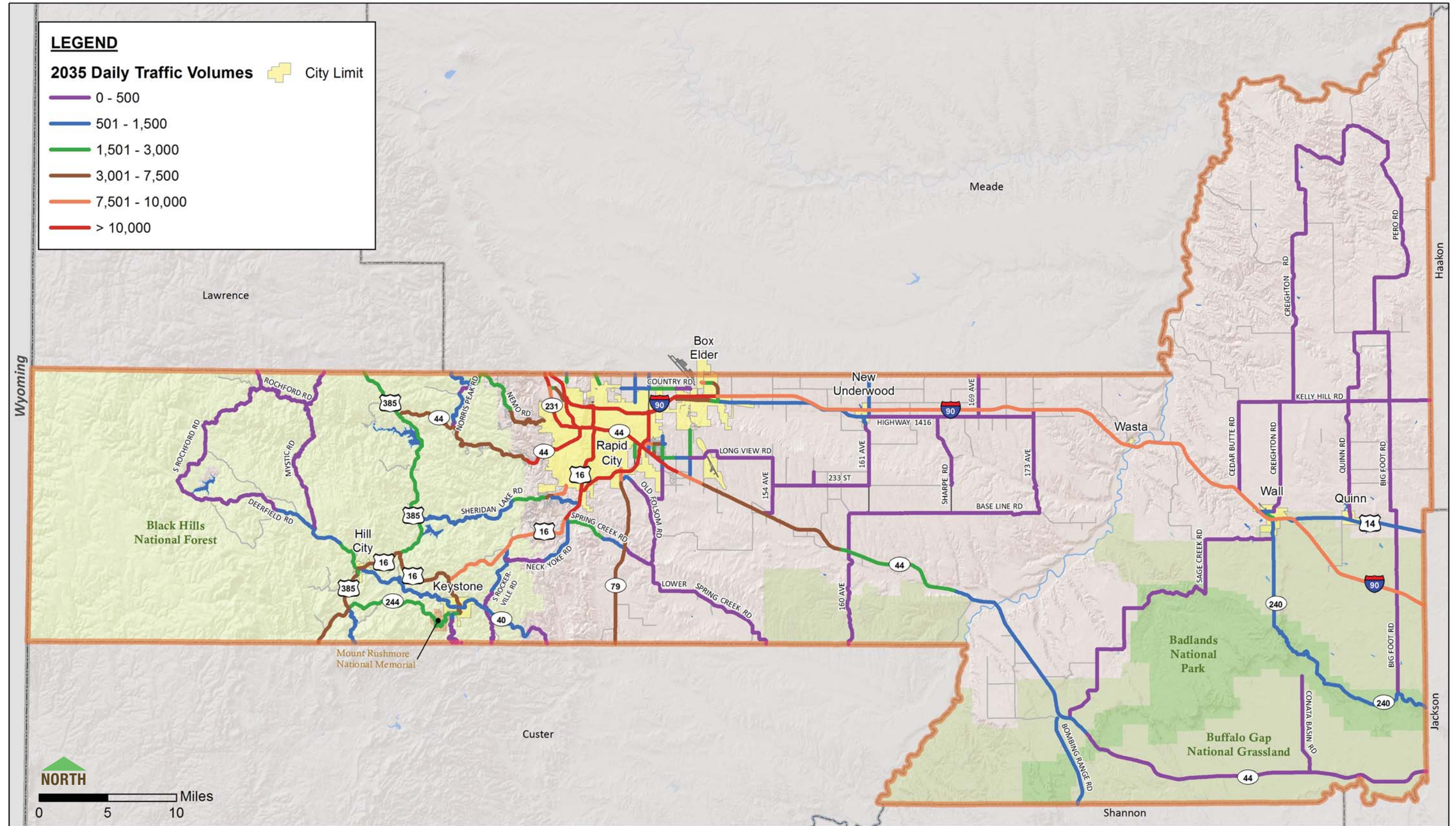
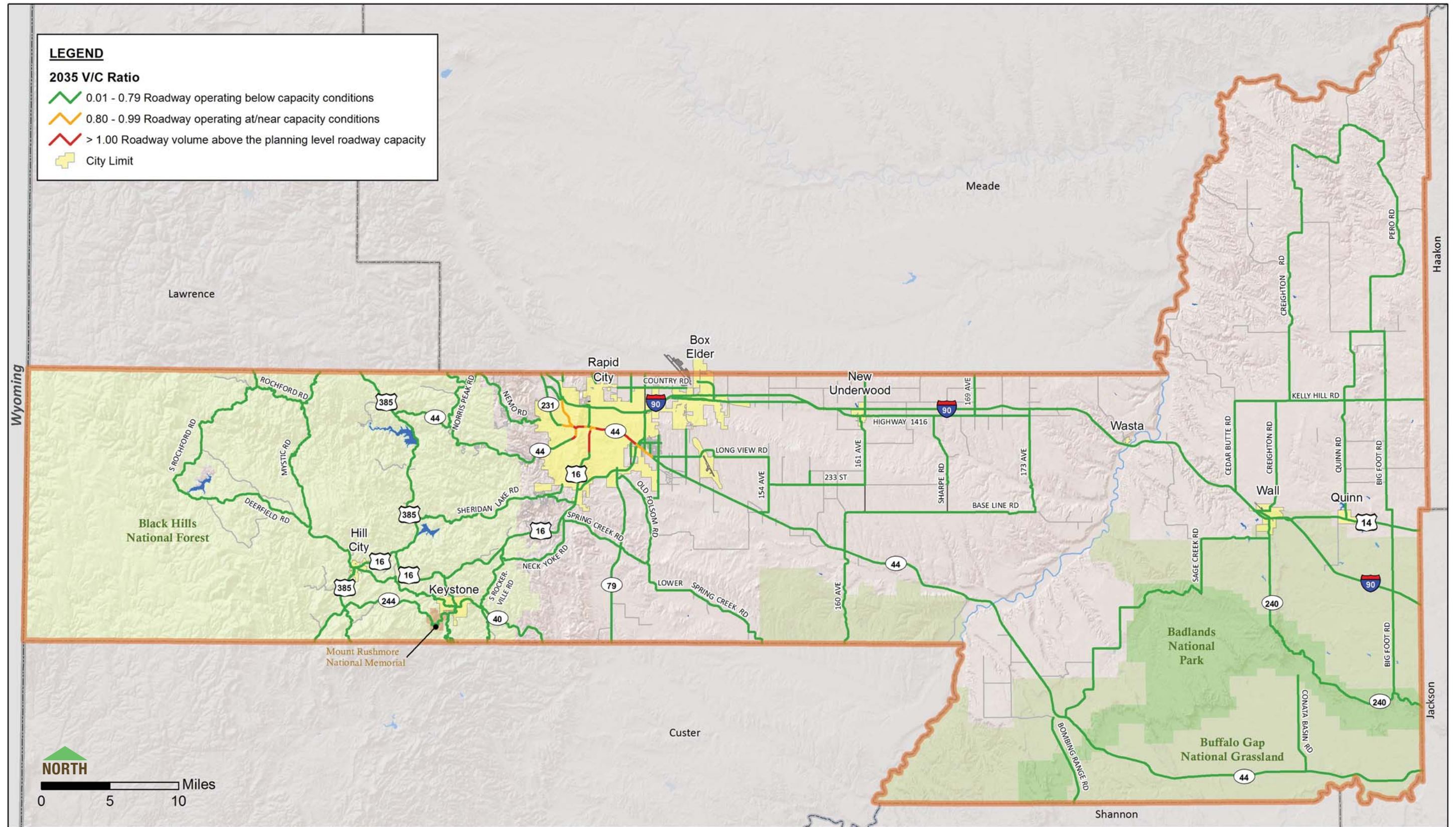




Figure 13 | Long-Term Future (Year 2035) Volume to Capacity Ratios - Roadway Segments





**D. Intersection Operations**

The ten intersections identified by the SAT were reevaluated to determine if any capacity problems are anticipated to occur with build out of the development areas and the addition of future background traffic. **Figure 14** provides the results of the level of service analysis for future conditions.

Year 2035 Operational results are described as follows by intersection, and **Table 5** summarizes current and Year 2035 LOS findings:

**Highway 1416 / 161<sup>st</sup> Avenue** – As is currently the case, all approaches would operate at LOS A during AM and PM peak periods, acceptable operations.

**154<sup>th</sup> Avenue / 233<sup>rd</sup> Street** – As is currently the case, all approaches would operate at LOS A during AM and PM peak periods, acceptable operations.

**Elk Vale Road / Country Road** – As is currently the case, the stop-sign controlled approaches would operate at LOS B or better during AM and PM peak periods, acceptable operations.

**SD 44 / Covington Street** – Movements entering SD 44 from Covington Street would operate at LOS F during the AM and PM peak hours, an unacceptable result based on SDDOT standards. A check of Warrants 1 and 2 indicate that current and future conditions at the intersection meet threshold values for signalization.

**Sturgis Road / Merritt Road** – The westbound stop controlled approach would experience unacceptable LOS during the AM and PM peak hours, and queues would continue to extend east across the nearby at-grade railroad crossing. A warrant check indicated that current and future conditions meet Warrant 9 and future conditions will meet Warrants 1 and 2.

**Sturgis Road / Universal Drive** – In the future, westbound movements onto Sturgis Road would operate at LOS F during AM and PM peak hours, unacceptable based on SDDOT standards. Year 2035 traffic conditions were found to meet Warrants 1 and 2 for signalization.

**Dunsmore Road / Sheridan Lake Road** – The southbound approach currently operates at LOS F during the AM peak hour. Based upon current and future traffic levels and intersection characteristics, this intersection meets Warrant 1 and 2 thresholds for signalization.

**Nemo Road / Norris Peak Road** – As is currently the case, all approaches would operate at LOS A during AM and PM peak periods, acceptable operations.

**Silver Mountain Road / Boulder Hill Road** – As is currently the case, all approaches would operate at LOS A during AM and PM peak periods, acceptable operations.

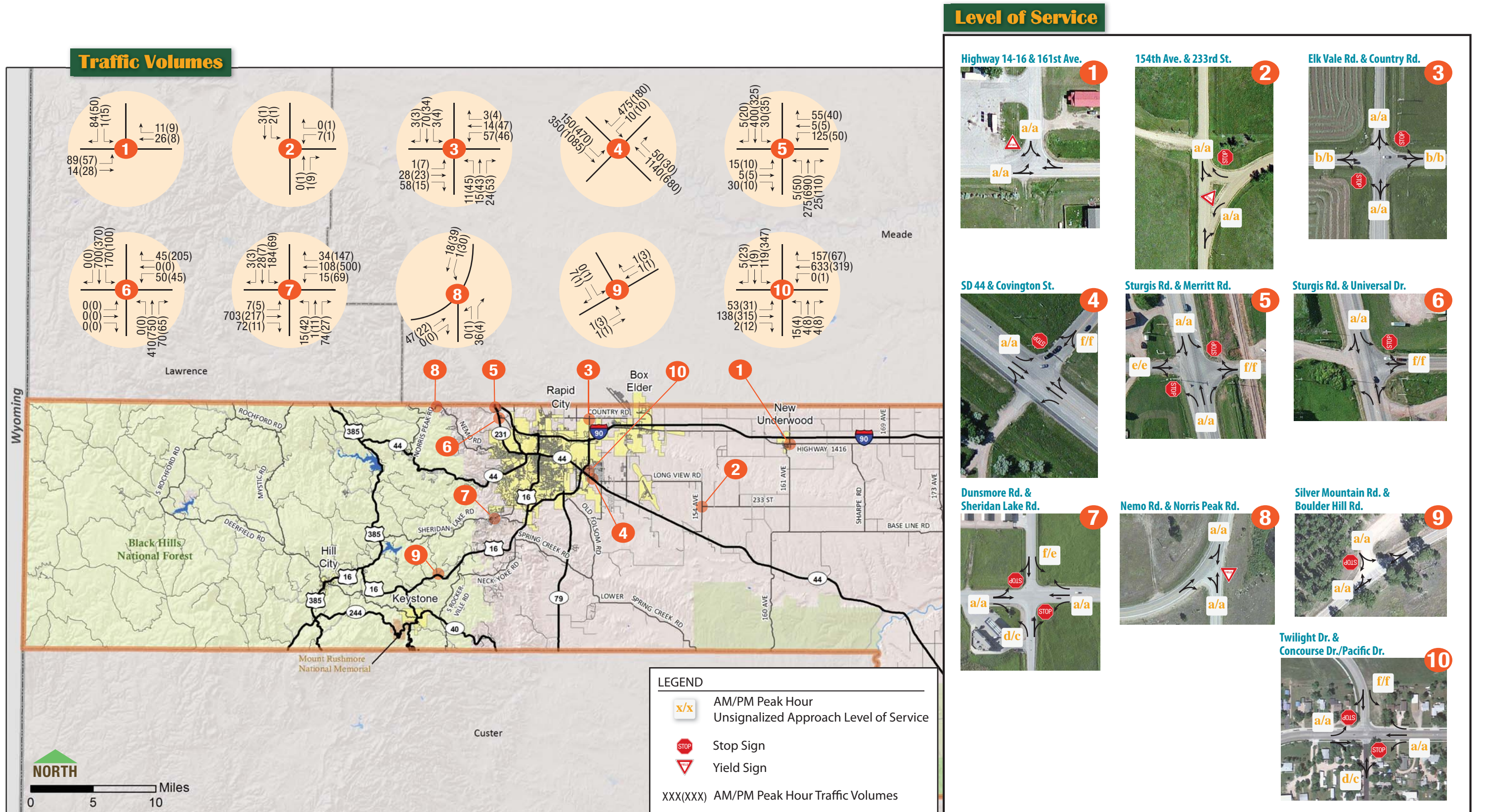
**Concourse Drive / Twilight Drive** – The current substandard operations are anticipated to continue into the future, with LOS F conditions anticipated in the Year 2035. The primary reason for this condition is the high southbound left-turn traffic volume which currently exceeds 250 vehicles per hour (vph) during the PM peak hour and is forecasted to reach nearly 350 vph by the Year 2035. Preliminary analyses of signalization warrants indicate that the intersection may reach signalization warrants in the future.

**Table 5. Current and Year 2035 Intersection Operations**

Intersection	AM / PM Peak Hour Critical Movement Level of Service	
	Current	Year 2035
Highway 1416/161 <sup>st</sup> Avenue	a/a	a/a
154 <sup>th</sup> Avenue / 233 <sup>rd</sup> Street	a/a	a/a
Elk Vale Road / Country Road	b/b	b/b
SD 44 / Covington Street	e/c	f/f
Sturgis Road / Merritt Road	c/d	f/f
Sturgis Road / Universal Drive	b/c	f/f
Dunsmore Road / Sheridan Lake Road	f/c	f/e
Nemo Road / Norris Peak Road	a/a	a/a
Silver Mountain Road / Boulder Hill Road	a/a	a/a
Concourse Drive / Twilight Drive	e/f	f/f



Figure 14 | Year 2035 Intersection Traffic Forecasts and Levels of Service





## IV. LONG RANGE TRANSPORTATION PLAN

### A. Roadway and Intersection Improvements

Recommendations for improvements to the Pennington County transportation system have been consolidated into a complete project listing. The goal for this listing was to compile improvements discussed during the public input process, projects identified through traffic forecasting, intersection analysis, and other studies completed by the Consultant Team, projects previously included in the Pennington County Transportation Improvement Plan and South Dakota Department of Transportation Statewide Transportation Improvement Program, and projects identified by the Study Advisory Team and County Staff.

In order to develop a project listing which provides the entire study area with the best future operations, while accounting for funding limitations, comments received during the public input process have been reviewed to determine what remedies would provide the greatest benefit. Typically, the projects included in the listing were identified by several members of the community and all projects were vetted by the Consultant Team and Study Advisory Team to ensure the recommendations are consistent with the goal for this Master Transportation Plan.

A map of project locations is shown on **Figure 15**. The complete project listing has been provided as **Table 6**.

The project improvement plan figure includes all projects described within the project listing. The different project types have been separated in the listing into two categories: Road Facilities, Intersections, and Bicycle Pedestrian Facilities.

#### Project Prioritization

The following sections discuss the roadway and intersections projects identified in the project listing. Each category has been separated due to the use of different funding mechanisms and budgets for the project classification. By identifying the public projects, even greater attention was given to these projects with the goal of creating a prioritized funding list for each category.

Short term projects are those anticipated to be funded and built within the next four years (2012-2015). Projects which have been included in this category are the most vital to the immediate workings of the transportation system. Mid-term projects are those anticipated to be funded and built not immediately but within the next fifteen years (2015-2025). Long term projects are those anticipated to be funded and built in the long term (beyond 2025).

#### Project Cost

In addition to providing the project type, a project cost has been developed for each of the projects in the complete listing. Projects previously identified by the Pennington County Transportation Improvement Plan and South Dakota Department of Transportation Statewide Transportation Improvement Program have been included listing the costs developed for those planning processes. For roadway segments new to the project listing, the cost has been based on the construction of the appropriate rural arterial or rural collector sections as defined on the Roadway Classification map. In addition, all of the intersection projects have had costs prepared based on the needed improvements, which includes potential signalization, tree

removal, intersection realignment, and intersection reconstruction to increase sight distance. These cost opinions include only items which are considered construction-related and are based on 2011 unit costs. No right of way costs have been included since these can be highly variable, depending on the current use and zoning of the adjacent property. Upon completing Year 2011 cost estimates, the values were adjusted to a Year-of-Expenditure (YOE) based on anticipated future increases in construction cost. An annual increase of 2 percent was selected, as this rate was utilized in the most recent *RapidTRIP 2035 – The Long Range Transportation Plan for the Rapid City Area* (September 2010). Base years of 2012 (Short Term), 2015 (Mid-Term) and 2025 (Long Term) were selected to develop YOE costs.

Cost analysis worksheets have been prepared for the basic roadway classifications as part of this project and are included in **Appendix E**.

### Project Descriptions

#### Roadway Facilities

Fifteen Roadway Facilities projects have been identified during the CHAPS process. Of those projects, nine have previously been identified by Pennington County staff and included in the Pennington County Transportation Improvement Plan and one project has previously been identified by the South Dakota Department of Transportation Statewide Transportation Improvement Program. These ten projects have been provided in the listing with cost information and timing provided by the referenced planning documents.

Five Roadway Facilities projects have been added to the project listing based on analysis completed for this study. Below is a description of each project along with a discussion of the project details including anticipated benefits.

**Sage Creek Road between 237<sup>th</sup> St and SD 44** – This paving project represents a sensitive roadway corridor on the western edge of Badlands National Park. The roadway enters the Park for a portion of the proposed project requiring close coordination between Pennington County and National Parks Service staff during this project planning, design, and construction. This roadway moves through known sensitive paleo-archaeological areas within the Park that will require a full NEPA process during planning of the project, this cost along with allowances for water runoff treatment have been incorporated into the overall cost projection. This project was included in the project listing based on future traffic forecasts exceeding an average of 250 vehicles per day.

**Reno Gulch Road between Reno Gulch Park and US 385** – This paving project provides local access to residences along the roadway corridor. This project was included in the project listing based on public input and discussion with County staff.

**Long View Road between Rapid City Regional Airport and 154<sup>th</sup> Ave** – This paving project provides continuity for the transportation system with Long View Road west of the airport to 154<sup>th</sup> Avenue. This project was included in the project listing based on existing and future traffic forecasts exceeding an average of 250 vehicles per day.

**154<sup>th</sup> Avenue between Long View Road and SD 44** – This paving project provides continuity for the transportation system with Long View Road and SD 44. This project was included in the project listing based on future traffic forecasts exceeding an average of 250 vehicles per day.



**Deadwood Avenue between Calamity Road and Meade County Line** – This roadway would be reconstructed to improve the pavement condition and provide the standard Pennington County Rural Arterial section.

### Intersections

Thirteen Intersection projects have been identified through analysis of intersection design, safety and operational conditions. The projects range in scope to include potential signalization, tree removal, intersection realignment, and intersection reconstruction to increase sight distance. Below is a description of each project along with its assigned priority and the rationale for prioritization.

#### Traffic Signalization Projects

To address traffic and safety concerns, it is recommended that a traffic signal be installed at the following intersections when signal warrants other than the peak hour warrant (#3) are met. Consistent with guidance in the MUTCD, 4-hour and/or 8-hour traffic counts should exceed warrant criteria for signalization to be justified. In addition, the MUTCD states that meeting of a single warrant does not necessarily justify signalization:

- **Dunsmore Road / Sheridan Lake Road** - Signalization of the Dunsmore Road / Sheridan Lake Road intersection is assigned a priority of Mid-Term to provide additional years of growth to confirm that 4-hour and 8-hour traffic counts exceed warrant criteria.
- **SD 44 / Covington Street** – Signalization of the SD 44 / Covington Street intersection is assigned a priority of Mid-Term to provide additional years of growth to confirm that 4-hour and 8-hour traffic counts exceed warrant criteria.
- **Sturgis Road (SD 231) / Universal Drive** – Signalization of the Sturgis Road / Universal Drive Intersection is assigned a priority of Long Term, as only Year 2035 traffic levels are shown to meet the peak hour signal warrant.
- **Sturgis Road (SD 231) / Merritt Road** – This project is assigned a priority of Mid Term due to crash history, future traffic volume forecasts relative to signal warrants, and proximity of the railroad track east of the intersection.

#### Intersection Safety Improvement Projects

**Boulder Hill Road / Silver Mountain Road** – It is recommended that the rise located in the northeast corner of the intersection be eliminated as a sight distance obstruction by constructing a retaining wall. This project is assigned a priority of Mid-term because Boulder Hill Road and Silver Mountain Road are lower volume, local County roadway connections.

**South Rockerville Road / Neck Yoke Road** – It is recommended that the Neck Yoke Road approach to the intersection be adjusted to provide tighter turning radii at the northeast and southeast corners of the intersection. The project is assigned a priority of Short Term because it is the intersection of two arterial roadways.

**154<sup>th</sup> Avenue / 233<sup>rd</sup> Street** – It is recommended that the intersection be reconstructed to provide a single 4-leg intersection instead of the current four separate intersections. The project is assigned a priority of Short Term because it is the intersection of two arterial roadways.

**Nemo Road / Norris Peak Road** – It is recommended that pavement be removed along the east edge of the intersection to clarify that Norris Peak Road ends at Nemo Road. This project is assigned a Short Term priority because it is the intersection of two arterials.

**Silver Mountain Road / US 16** – It is recommended that the Silver Mountain approach to US 16 be realigned to create a 90-degree angle approach and line up with the median opening. This project is assigned a priority of Mid-Term because Silver Mountain Road is a lower-volume, local County roadway connection.

**US 385 / Silver City Road** – It is recommended that trees be removed for a length of approximately 650 feet along the west edge of US 385 to enhance sight distance. This project is assigned a priority of Mid-term because Silver City Road is a local County roadway.

**Deerfield Road / Mystic Road** – It is recommended that the intersection be converted into a Tee intersection with eastbound Deerfield Road coming to a 90-degree angle with Mystic Road and being controlled with a stop sign. This project is assigned a Short Term priority because it is the intersection of two arterial roadways.

**SD 40 / Rockerville Road** – It is recommended that the existing driveway to Rockerville Road located very close to the intersection with SD 40 be realigned to provide additional distance from the intersection of SD 40 with Rockerville Road. This project is assigned a Short Term priority because it is the intersection of two arterials.

**Concourse Drive / Twilight Drive** – It is recommended that signs be provided along the southbound Concourse Drive and eastbound Twilight Drive approaches to the intersection warning drivers of the upcoming intersection. Both of these approaches include sharp horizontal curves. This project is assigned a Short Term priority because it is a high traffic location.

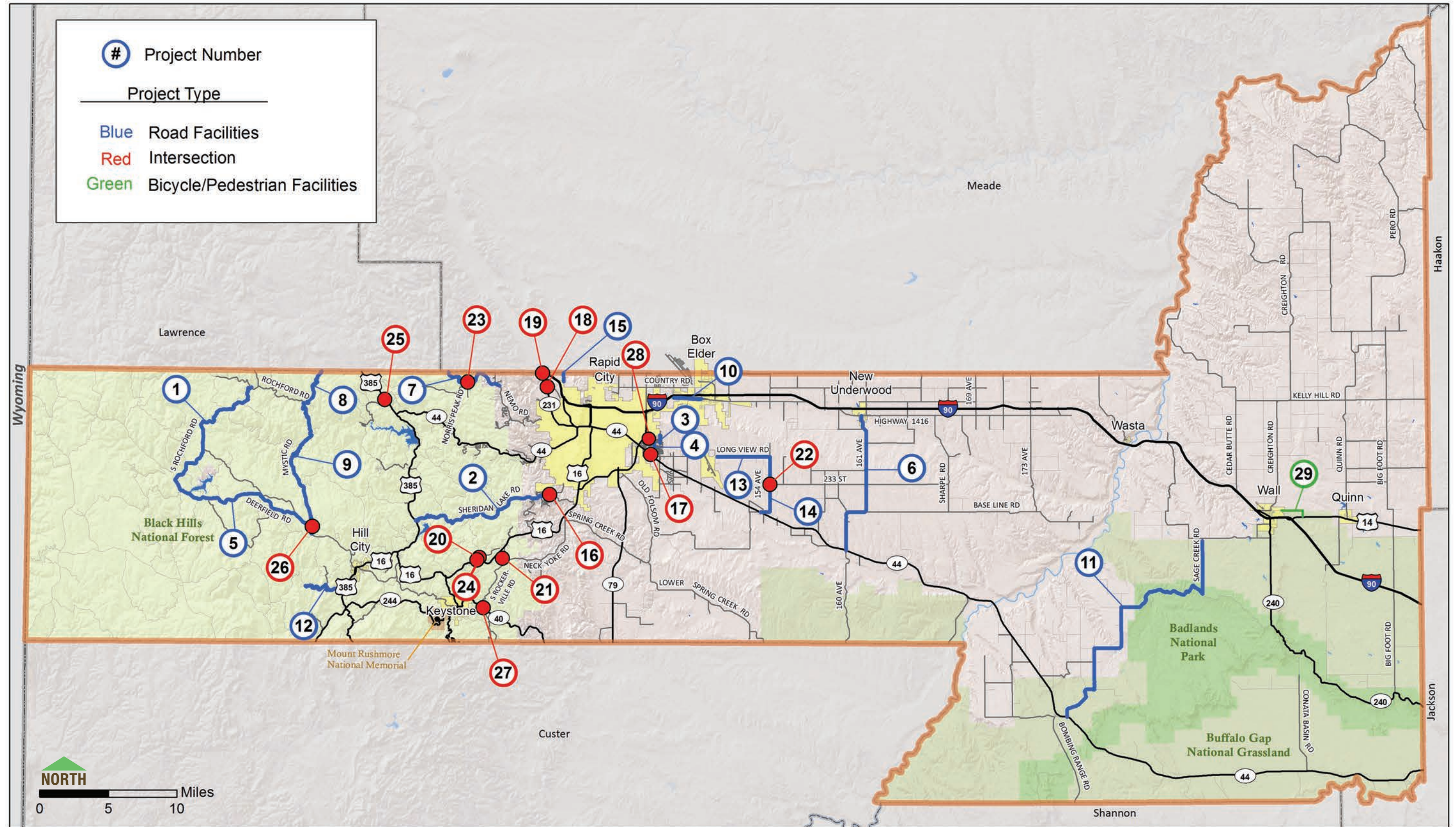
Of note, the intersection of Concourse Drive with Twilight Drive is currently the primary access from Elk Vale Road to Rapid Valley. Completion of the Homestead Avenue extension north of Rapid Valley would help bring some relief to this intersection by providing a second direct access to Rapid Valley from Elk Vale Road.

The estimated concept-level construction costs of the intersection improvements are shown in **Table 5**. The total cost of all intersection projects is approximately \$2.3 Million. **Appendix E** provides cost estimate worksheets and conceptualized sketches of the improvements for each intersection safety improvement. All costs provided in **Table 5** represent costs adjusted to “Year of Expenditure” dollars using the same 2 percent annual inflation rate. The costs in present day dollars can be found in **Appendix E**.





Figure 15 | Project Summary Map





**Table 6. Prioritized Project Listing**

Project Number	Project Location	Project Description	Cost (in Year of Expenditure)	Time Horizon
<b>Road Facilities</b>				
1	S. Rochford Rd between Rochford Rd and Deerfield Rd	Pave roadway <sup>1</sup> (2015)	\$10,200,000	Short Term
2	Sheridan Lake Rd between Alberta Dr and Victoria Lake Rd	Reconstruct roadway <sup>1</sup> (2014)	\$8,000,000	Short Term
3	Reservoir Rd between Twilight Dr and Meadow Ridge Dr	Reconstruct roadway <sup>1</sup> (2013)	\$1,950,000	Short Term
4	Plateau Ln between Twilight Dr and Williams St	Reconstruct roadway <sup>1</sup> (2013)	\$1,950,000	Short Term
5	Deerfield Rd (1.5 mile NE of Deerfield to FR 304)	Resurface roadway <sup>1</sup> (2014)	\$2,300,000	Short Term
6	From 228th St at New Underwood, south 7 miles on 161 Ave, west 1.5 miles and south 2.5 miles on Base Line Road to SD 44	Resurface roadway <sup>1</sup> (2017)	\$1,867,750	Mid-Term
7	Nemo Rd from the North County Line E/SE for 6.1 mile (to between Palmer Rd and Schmitz Trail)	Resurface roadway <sup>1</sup> (2019)	\$1,035,750	Mid-Term
8	Rochford Rd from Rochford east to the Lawrence County Line	Pave roadway <sup>2</sup>	\$6,403,700	Mid-Term
9	Mystic Rd from Rochford Rd south to Tigerville Junction	Pave roadway <sup>2</sup>	\$11,372,050	Mid-Term
10	County Road 1416 between Westgate Rd and Ellsworth Rd	Reconstruct roadway <sup>3</sup> (2016)	\$3,572,050	Mid-Term
11	Sage Creek Rd between 237th St and SD 44	Pave roadway	\$49,275,950	Long Term
12	Reno Gulch Rd between Reno Gulch Park and US 385	Pave roadway	\$7,654,300	Long Term
13	Long View Rd between Rapid City Regional Airport and 154th Ave	Pave roadway	\$9,599,250	Long Term
14	154th Ave between Long View Rd and SD 44	Pave roadway	\$10,759,050	Long Term
15	Deadwood Ave between Calamity Rd and Meade County Line	Reconstruct Roadway	\$1,182,050	Mid-Term
<b>Intersections</b>				
16	Dunsmore Road / Sheridan Lake Road	Signalize Intersection	\$243,550	Mid-Term
17	SD 44 / Covington Street	Signalize Intersection	\$243,550	Mid-Term
18	Sturgis Road (SD 231) / Universal Drive	Signalize Intersection	\$296,900	Long Term
19	Sturgis Road (SD 231) / Merritt Road	Signalize Intersection	\$737,500	Short Term
20	Boulder Hill Road / Silver Mountain Road	Remove trees at intersection causing poor sight distance	\$184,050	Mid-Term
21	South Rockerville Road / Neck Yoke Road	Remove trees at intersection causing poor sight distance	\$36,750	Short Term
22	154th Avenue / 233rd Street	Realign approaches to create single 90-degree intersection	\$278,500	Short Term
23	Nemo Road / Norris Peak Road	Realign approaches to soften turn angles	\$25,500	Short Term
24	Silver Mountain Road / Highway 16	Realign Silver Mountain Road approach to reduce skew	\$29,250	Mid-Term
25	US 385 / Silver City Road	Reconstruct intersection to improve sight distance looking south	\$102,850	Mid-Term
26	Deerfield Road / Mystic Road	Reduce curvature along Mystic Road approach	\$14,300	Short Term
27	SD 40 / Rockerville Road	Remove trees causing poor sight distance, realign skewed driveway	\$55,100	Short Term
28	Concourse Drive / Twilight Drive	Add intersection warning signs along curved approaches	\$9,200	Short Term
<b>Bicycle/Pedestrian Facilities</b>				
29	Wall trail extension	Extend Wall Loop Trail east to provide US 14 connection	\$434,100	Mid-Term

<sup>1</sup> Project included in March 6, 2012 Pennington County Transportation Improvement Plan, <sup>2</sup> Project included in March 16, 2010 Pennington County Transportation Improvement Plan, <sup>3</sup> Project included in current South Dakota Department of Transportation Statewide Transportation Improvement Program



## B. Transit Plan

As documented in Section II.C., a number of issues and needs related to transit in Pennington County were raised in conversations with transit providers and users. Pennington County is currently not involved in providing transit services to its residents, nor do any County funds go toward providing a local match for Federal transit funding.

It is recommended that Pennington County allocate \$3,000 annually to transit in the County. The funds should initially be provided to River Cities Transit (RCT), to help increase RCT's Federal matching grant amount. River Cities Transit is currently providing services and additional funding will help continue to serve the demand for transit in Eastern Pennington County and provide necessary services, particularly for the transit-dependent population in Pennington County.

## C. Pedestrian & Bicycle Master Plan

The Pedestrian and Bicycle Master Plan for CHAPS, shown on **Figure 16**, outlines a number of efforts recommended for the County to enhance the transportation network to serve multimodal travel and recreational needs. Recommended Bicycle and Pedestrian improvements are identified as follows:

### Shoulder Projects

As previously discussed, AASHTO recommends a 4-foot minimum shoulder width to accommodate bicycle travel. It is recommended that 4-foot minimum shoulders be provided along strategic County highways, with the ultimate goal of providing a continuous network of bicycle-friendly roadway facilities. Shoulder widening projects would not be implemented as standalone efforts. Rather, these projects would be built when the roadway itself is being reconstructed or resurfaced. It is recommended that 4-foot minimum shoulders be provided along the following roadways:

- South Rochford Road between Rochford Road and Deerfield Road
- Nemo Road between Wide View Drive and the Pennington/Meade County line
- Norris Peak Road between Nemo Road and SD 44
- Country Road between Haines Avenue and West Gate Road
- Radar Hill Road between SD 44 and Highway 1416
- Old Folsom Road between SD 79 and Lower Spring Creek Road
- Spring Creek Road between Neck Yoke Road and Old Folsom Road
- Lower Spring Creek Road between Old Folsom Road and end of paved surface
- Neck Yoke Road between US 16 and Rockerville Road
- Rockerville Road between US 16 and SD 40
- 161<sup>st</sup> Avenue between SD 44 and Highway 1416
- Sage Creek Road between SD 240 and SD 44
- Old Hill City Road between Hill City and Keystone
- SD 40 between Rockerville Road and US 16A

### Paths

A number of side and shared-use path projects have also been identified through the CHAPS process. These include:

- A side path along the future Cheyenne Boulevard extension, to be completed by the City of Box Elder
- A potential rails-to-trails conversion that would roughly parallel SD 44, connecting Rapid City with the southeast corner of Pennington County and beyond, to be done by others
- A potential trail connection between the Mickelson Trail and Town of Keystone, to be done by others
- An off-road path connecting the existing City of Wall loop trail east to US 14 to help facilitate bicycle travel between the City of Wall and Town of Quinn. It is recommended that Pennington County participate in funding for this project.

### Rapid City Projects

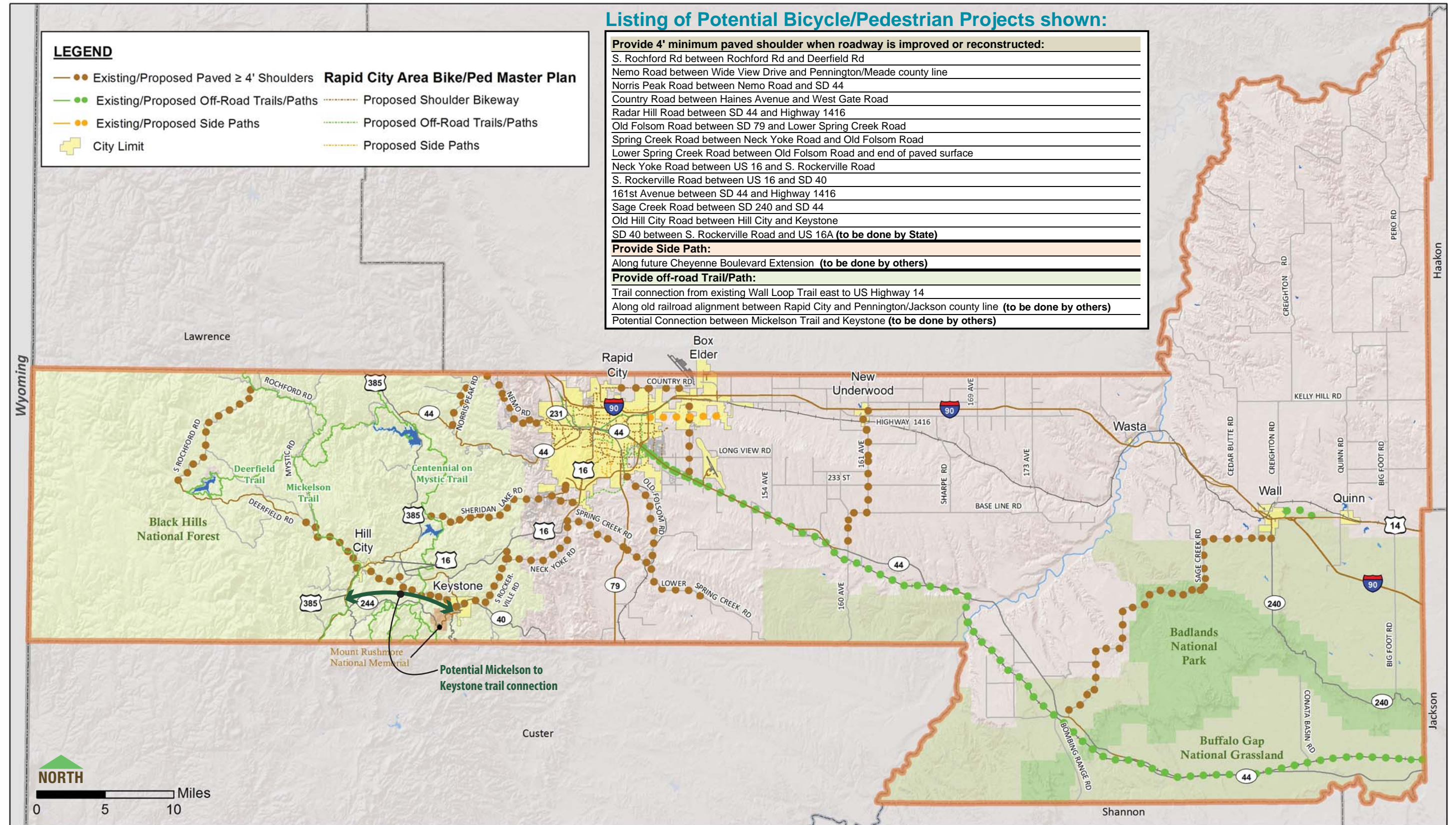
As discussed in the Inventory of Existing conditions, the recently completed *Rapid City Area Bicycle and Pedestrian Master Plan* included a number of proposed bicycle and pedestrian facilities extending into portions of Pennington County surrounding the City, including:

- Shared lane for bicycles, Moon Meadows Drive between US 16 and Sheridan Lake Road
- Shared-use path along southeast side of Rapid City, between Old Folsom Road and US 16
- Shoulder bikeway, Sheridan Lake Road between Rapid City limits and Moon Meadows Drive
- Shoulder bikeway, Country Road between 143<sup>rd</sup> Avenue and Rapid City limits
- Shared-use path along south side of I-90 extending east from Elk Vale Road
- Shared lane for bicycles, DeGeest Drive/Covington Street between SD 44 and Rapid City limits
- Shared lane for bicycles, Reservoir Road/Longview Drive between SD 44 and Twilight Drive
- Shared-use path along south side of SD 44 extending southeast from Rapid City. Rails-to-trails conversion

It is recommended that Pennington County provide support for efforts to implement these projects.



Figure 16 | Pedestrian and Bicycle Master Plan





## D. Budget Considerations

### Project Cost Summary

It is recommended that Pennington County begin to plan and budget for completion of the six roadway improvements and seven intersection improvements identified for the Short Term. The total estimated construction cost of the Short Term projects is \$25.6 Million. The Mid-Term projects total \$26.7 Million and Long Term projects reach a total estimated construction cost of \$77.6 Million. It is recommended that Pennington County Staff initiate planning now for these projects, to refine the estimated costs and complete preliminary studies to set the stage for implementation.

A total of approximately \$129.8 Million in transportation improvement projects is identified in CHAPS, approximately \$27.3 Million of which is comprised of projects already identified in the County’s current Transportation Improvement Plan (TIP).

### Funding

In the TIP, Pennington County has identified a capital program of \$27.1 Million to be spent on road projects (not including bridge projects) over the 6 years between 2013 and 2019, which averages to approximately \$4.5 Million per year. Funding for this capital program comes from a blend of County and Federal monies. Though subject to change, the TIP currently indicates that \$14.4 Million of the total would come from Federal funding sources, including the following specific sources:

- Surface Transportation Program (STP) Funds (\$6.79 Million)
- Federal Priority Funds (\$7.65 Million)

Of note, the Federal Priority funds consist of earmark money devoted exclusively to the South Rochford Road reconstruction project.

The remaining \$12.7 Million is shown in the TIP to come from County monies, including the following specific sources:

- Road Reserves (\$3.9 Million)
- Road and Bridge Reserves (\$7.9 Million)
- Road and Bridge Funds (\$920,000)

Looking beyond the projects already budgeted for in the County TIP, constructing the projects identified in CHAPS would require \$102.7 Million between 2012 and 2035, a capital program averaging approximately \$4.5 Million annually. A number of sources may be tapped to provide this funding. **Table 7** summarizes available sources and amounts.

**Table 7. Funding Sources and Amounts – CHAPS Projects**

Funding Source	Proposed Amount
Surface Transportation Program (STP)	\$550,000 <sup>1</sup>
County Funds	\$1.59 Million <sup>2</sup>
Other sources	\$2.36 Million <sup>3</sup>
<b>Total</b>	<b>\$4.5 Million</b>

<sup>1</sup> Typical STP annual amount based on information provided by Pennington County Highway Staff  
<sup>2</sup> Amount budgeted per year in current County TIP, assumed to continue at same level into the future  
<sup>3</sup> Estimated amount of Federal Grant and other sources needed to reach annual \$4.5 Million goal

As shown, Pennington County would need to increase funding from its internal budget or identify approximately \$2.36 Million in funding from other sources to help fund the CHAPS projects. There are a number of potential external funding sources that may be explored by Pennington County, including:

- **Federal Grant Programs** – There are a number of Federal discretionary grant programs that could be pursued by Pennington County, including potential funding for projects within Public Lands, National Scenic Byway projects, TIGER grants, and grant programs related to non-motorized transportation. These programs are intermittently changed or removed, so regular monitoring is necessary to track opportunities. Particular projects recommended in CHAPS may be well suited to receiving Federal grant monies, including the Sage Creek Road paving project along the edge of the Badlands National Park.
- **Special Districts** – Special highway districts may be formed to help fund projects
- **State Legislative Initiatives** – The South Dakota State Legislature has proposed highway funding measures in the past, and Pennington County can work with state legislative representatives to continue and build upon those efforts.

## E. Livability in CHAPS

The Federal Highway Administration (FHWA) has initiated the Livability Initiative, which emphasizes the importance of transportation facilities to broader opportunities, such as access to good jobs, affordable housing, quality schools, and safe roads and streets. Principles of livability are prominent throughout the CHAPS effort, highlighted as follows:

- The project recommendations include a series of safety enhancements to intersections in Pennington County totaling nearly \$800,000. Implementation of these projects will enhance livability by reducing the potential for crashes.
- Ease and safety of non-motorized transportation is a significant contributor to livability. Consistent with this influence, CHAPS recommends that rural, paved arterial roadways be constructed with a 4-foot minimum shoulder. In addition, the bicycle/pedestrian plan element highlights roadways that should be constructed with 4-foot minimum shoulders to improve safety for non-motorized and motorized travel modes and expand the network of bicycle-friendly County highways.
- Transit agencies provide invaluable services in Pennington County, particularly contributing to livability for transit-dependent residents. In light of this, CHAPS recommends that the County make an annual contribution to transit services.



## V. STANDARDS

### A. Road Classification

A key component to the Pennington County Master Transportation Plan as it relates to the road network is the development of the Roadway Classification map. The Roadway Classification map provides a framework for how the road network should be constructed in order to provide access throughout the County. The plan labels the classification of all roadways so that as future reconstruction and paving projects occur, these roadways can be constructed to meet County standards.

The Roadway Classification map is a high-level planning document which details the eventual roadway classification of all County highways. That is not to say that all of these roadways are currently constructed in alignment with these standards, but over the next 20-50 years as these roadways are reconstructed effort should be taken to be consistent with this document. As the county grows, it is recommended that the road classification map be revised. Future roadway alignments should be identified in advance of development so that property developers know to preserve right-of-way along key routes.

The Roadway Classification map is provided as **Figure 17**. This plan distinguishes the roadways as Interstate, US/State highways, Arterials, Minor Arterials, Collectors and Local roadways. This classification plan is based on the road classification provided in the 2005 Pennington County *Comprehensive Plan*.

A roadway network is comprised of a hierarchy of roads whose classification is defined by their usage. In general, roads serve two functions: they provide mobility between destination and access to property adjacent to the roadway. Roadway classification is determined by the relative degree to which a road serves mobility versus access functions, as well as characteristics such as continuity, trip lengths served, travel speeds, and traffic volumes. Following are descriptions of different roadway types in the Master Transportation Plan study area, building upon language included in the *Comprehensive Plan*.

#### State Highways

Within the study area, significant connectivity is provided by roadways that are maintained by the state government. Several of these roadways serve significant traffic volumes by connecting major destinations within the County; select state highways are described below:

- **Interstate 90 (I-90)** is rural Pennington County's only Freeway, defined by high speeds and access provided by widely spaced, grade-separated interchanges. I-90 passes through the study area as part of the east-west interstate route connecting across South Dakota and the northern United States.
- **Interstate 190 (I-190)** is an urban freeway connecting downtown Rapid City with I-90 to the north.
- **U. S. Highway 16 (US 16)** is one of the County's key state highways, and the highway provides connection between Rapid City and Mount Rushmore National Memorial.
- **U.S. Highway 385 (US 385)** is one of the County's state highways, and the highway provides a north-south connection through the Black Hills National Forest connecting Lawrence and Custer Counties.
- **U.S. Highway 14 (US 14)** is a connection between Wall and Quinn and east to Jackson County.

- **State Highway 44 (SD 44)** is one of the County's state highways providing access west of Rapid City between US 385 and Rapid City, and access east of Rapid City connecting travelers to Badlands National Park and further east to Jackson County.
- **State Highway 240 (SD 240)** is located in the eastern most section of the County providing access to and through a portion of Badlands National Park.
- **State Highway 79 (SD 79)** is one of the County's state highways providing access south of Rapid City connecting travelers to Hermosa in Custer County. SD 79 is also part of the designated Congressional High Priority Corridor entitled the "Heartland Expressway."
- **State Highway 40 (SD 40)** SD 40 provides a connection between Keystone and Hermosa and east to Shannon County and the Pine Ridge Indian Reservation.
- **State Highway 244 (SD 244)** is located in the southern section of the County and provides a connection between US 385 and Keystone past Mount Rushmore.
- **State Highway 231 (SD 231)** is located in the Rapid City / Summerset Area and runs parallel to I-90. It is called Sturgis Road for much of its length.

#### Arterials

Arterial roadways carry longer-distance trips for regional, inter-community and major commuting purposes. Arterials have a limited number of at-grade intersections and only provide direct property access when lower classification road access does not exist. Arterials can carry significant traffic volumes at higher speeds for longer distances and are seldom spaced at closer than one-mile intervals. Arterial roads in the more developed areas in and around Pennington County are likely to be constructed as urban arterials. Urban arterials have or are planned to have curbs, gutters, and sidewalks on each side. Arterial roads in less developed parts of the study area are typically constructed as rural arterials, which possess shoulders on the edges rather than urban curb, gutter and sidewalk treatments. For this study, the distinction between urban and rural Arterial has not been definitively drawn due to the uncertainty of ultimate development patterns within currently rural portions of the study area.

#### Minor Arterials

Minor Arterials are similar to Arterials, but tend to serve shorter trip lengths and/or carry fewer vehicles. Access may be limited in some areas.

#### Collectors

Collector roadways are Pennington County maintained roads that serve a combination of mobility and access functions. They typically distribute traffic between Arterials and Local roads. Collectors provide for moderate trip lengths and travel speeds. Access is provided via moderately spaced at-grade signalized and stop controlled intersections.

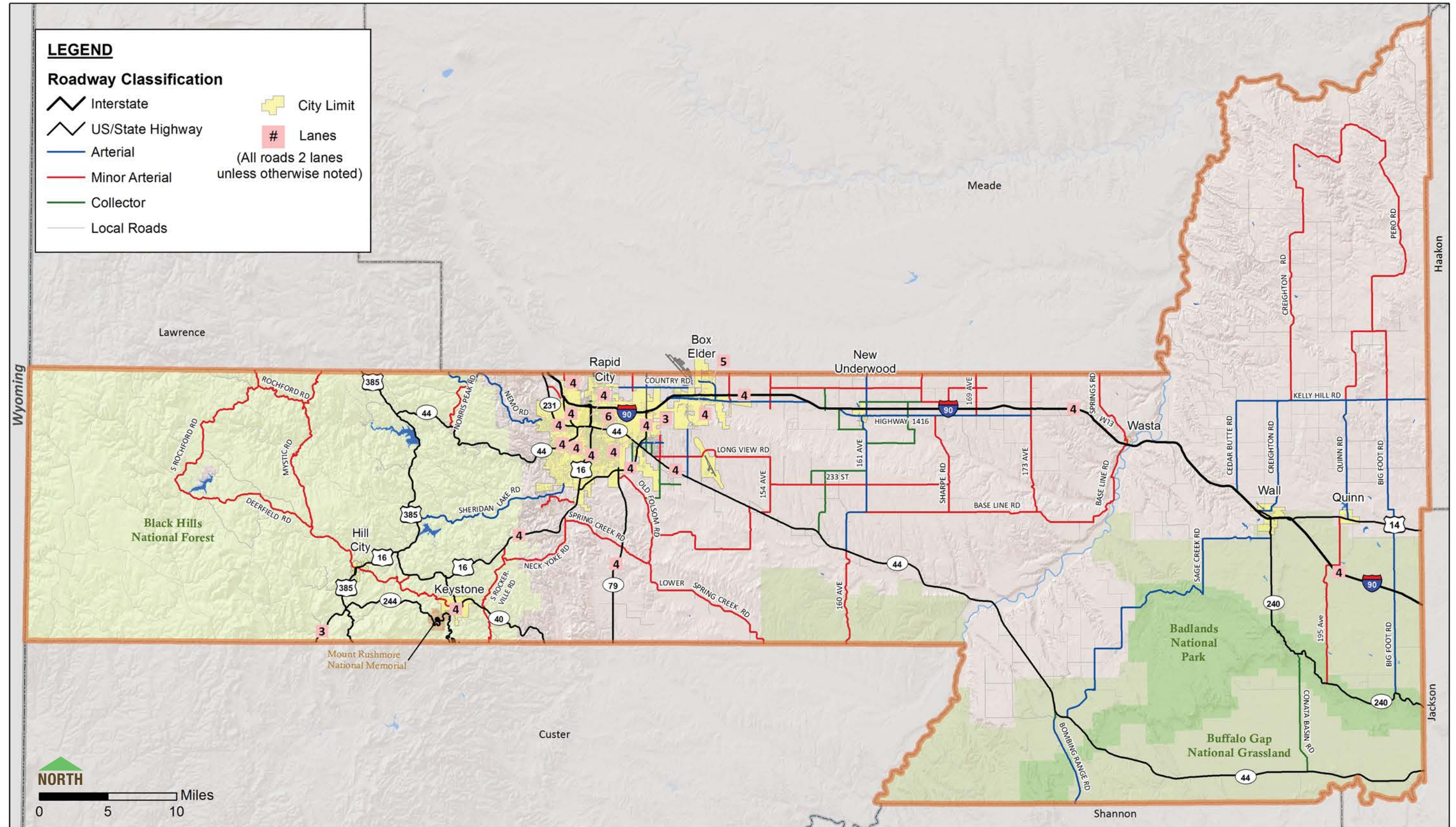
#### Locals

The primary function of local roads is to provide access to adjacent land uses. Local roads generally are internal to or serve an access function for a single neighborhood or development. Local roads are limited in length and continuity, and traffic using them should have a close-by origin or destination.

For reference purposes, the Rapid City Major Street Plan and Road Classification document is provided in **Appendix F**.



Figure 17 | Roadway Classification





## B. Proposed Roadway Cross Sections

Figures 18 and 19, respectively, depict typical cross-sections for Arterial and Collector roadways. These cross-sections would be used as a template for future roadway construction and improvements to existing roadways. For both Arterials and Collectors there are different cross-sections shown for roads in urban and rural areas. Urban cross-sections, for both Arterial and Collectors, include curbs, gutters and sidewalks adjacent to the travel lanes, while rural cross-sections have paved shoulders but no curb, gutter or sidewalk. Cross sections are also provided for rural unpaved (gravel) arterial and collector roadways. These are typical cross-sections; however, particular road segment cross-sections may vary depending on specific intersection improvements, topographical and environmental features, or roadside constraints.

The Roadway Classification Plan does not identify which facilities are ‘Urban’ or ‘Rural.’ This is done to provide the County with flexibility to implement either section where judged appropriate. Generally, urban sections should be sought within urban areas, though constraints may prevent construction of curb & gutter and associated drainage infrastructure.

The roadway cross sections shown reflect a ‘Complete Street’ philosophy of designing roads and streets to accommodate all roadway users. Providing detached walks and bicycle accommodations are two distinctive aspects of the Complete Street approach, which is intended to help build a road network that is safer, more livable, and welcoming to everyone ([www.completestreets.org](http://www.completestreets.org)). While Pennington County has not officially adopted a Complete Streets policy, the typical sections included in CHAPS are crafted to accommodate all users.

## C. Assessment of Development Traffic Impacts

New development in the study area generates vehicle-trips and associated new demands on the roadway system. The impacts of different developments vary from a small number of trips for a single new home to a large number of trips for a major residential subdivision or commercial development. Many municipalities require applicants for major developments to submit a traffic impact study, estimating the number of trips expected to be generated, the expected distribution of those trips onto the surrounding road network, and identifying major road improvements needed to accommodate the traffic.

Jurisdictions typically establish a threshold for the size of development that would trigger the requirement to do a traffic impact study (TIS). The traffic volume thresholds shown in Table 8 are recommended in consideration of the need for a traffic impact study:

**Table 8. Traffic Impact Study Requirements**

Daily Traffic Volume Generated by Proposed Development (Vehicle-trips per day) <sup>1</sup>	Study Requirements
1,000 or more	Traffic Impact Study Required
0-1,000	Traffic Impact Study may be required at the discretion of Pennington County

<sup>1</sup> Daily Traffic Volume generated by development may be calculated based on proposed land uses using Trip Generation, Eighth Edition (Institute of Transportation Engineers, 2008). Using these rates, 1,000 vehicles per day corresponds to approximately 23,000 Square Feet of Shopping Center Retail or 105 single-fam. det. homes

## D. Access Management Guidelines

Pennington County Highway Staff has indicated that the current Access Management process and standards are adequate for the County’s purposes in reviewing and allowing particular accesses to County highways. Currently, parties interested in acquiring access to a County highway must make application through an approach permitting process application. County Staff consider these applications on a case-by-case basis and accept or reject each application based on standards specified in County Ordinance 14. The current Pennington County approach permit application is included in Appendix G.

As traffic on County highways grows, it is recommended that the County develop guidelines for access to roadways of each classification. These guidelines should provide information about appropriate spacing between accesses, limitation of movements, and when auxiliary turn lanes should be considered at accesses or intersections.

## E. Roadway Surface Standards

As documented in County Ordinance 14, Pennington County currently seeks to pave roadways that exceed 250 vehicles per day in traffic volume. Paving needs have been evaluated in CHAPS on this basis.

## F. Special Events

Pennington County is home to numerous scheduled special events that can place a unique demand on the County’s highway network. The County Highway Department allows events to occupy highway right-of-way upon completion of an application process. Each application is evaluated individually by County Staff. No modifications to the current process are recommended.

## G. Guardrail

The Pennington County Highway Department current maintains a listing of various sites along County Highways which could be considered for installation of guardrail. It is recommended that County Staff continue to maintain this listing.

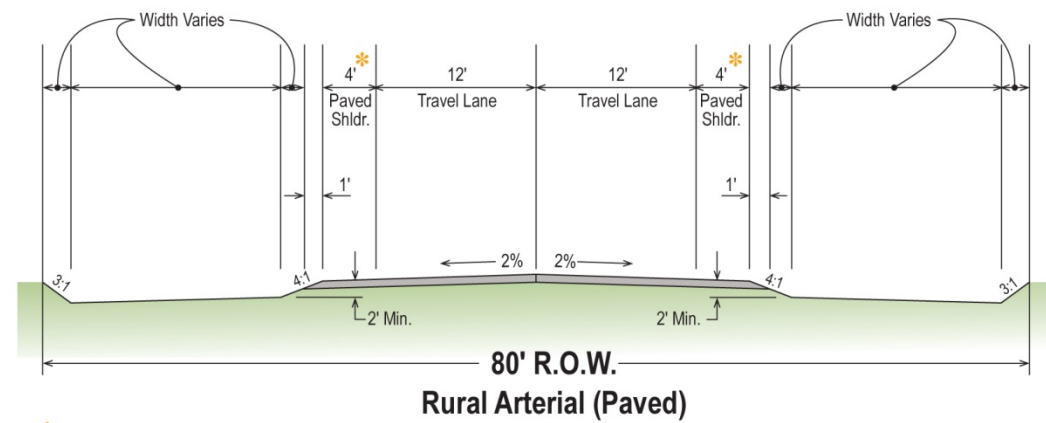
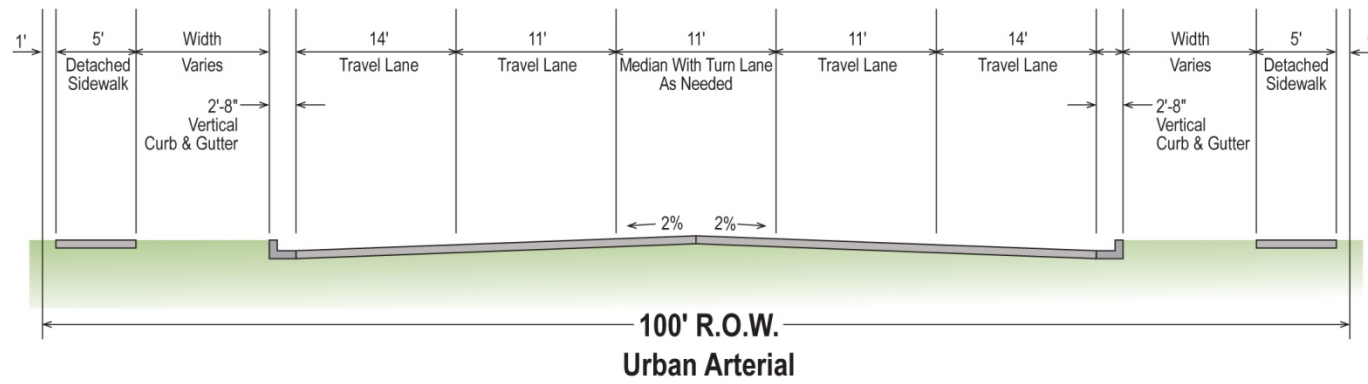
## H. Roadway Management System

As a part of the CHAPS project, the consultant team has furnished Pennington County with a Roadway Management System (RMS). The system consists of a comprehensive, customized software tool that tracks roadway surfacing and maintenance needs and identifies upcoming projects needed to keep County Roadways in acceptable condition. The RMS system will be documented independently.

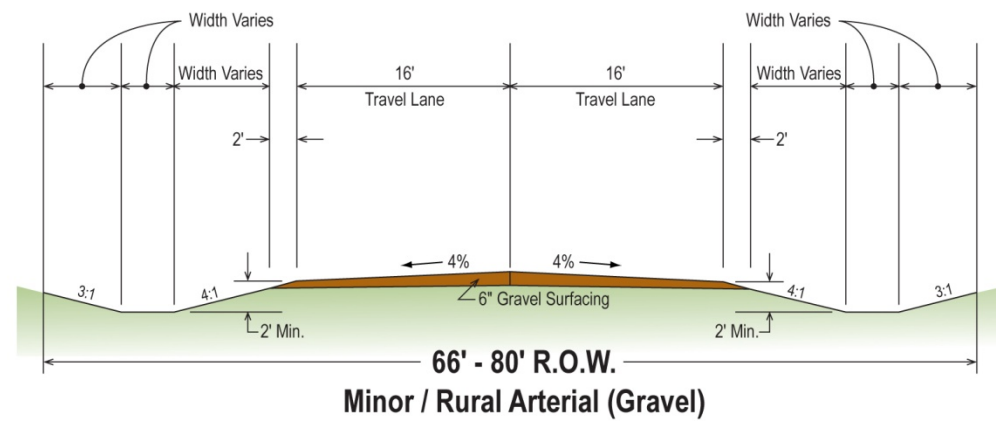




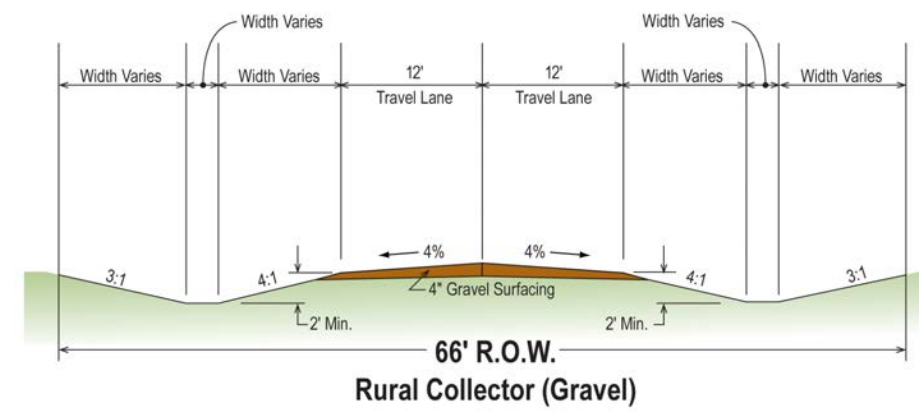
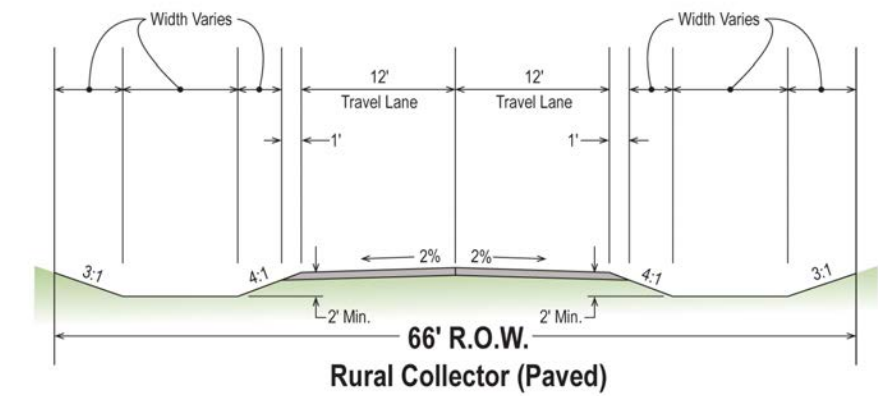
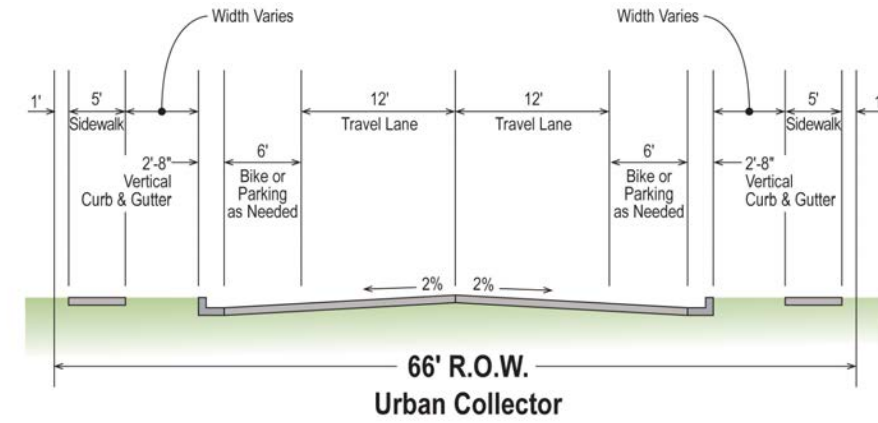
**Figure 18. Typical Roadway Sections - Arterials**



\* 6' shoulder to be considered along bicycle routes



**Figure 19. Typical Roadway Sections - Collectors**





## VI. SUMMARY OF RECOMMENDATIONS

The intent of this Master Transportation Plan, *CHAPS*, is to ensure that Pennington County has a plan in place to effectively upgrade the transportation system and a list of standards by which to make decisions as future development occurs. The prioritized project summary listing includes roadway and intersection improvements that are designed to be implemented over the next 25 years. The Transit Plan and Pedestrian & Bicycle Mater Plan include guidance for future improvements to the multi-modal transportation system over the same timeline. The projects discussed in detail in Section IV focus on a variety of multi-modal projects, which will be the responsibility of public agencies and will require coordination between Pennington County, local cities, and SDDOT.

The following list provides a summary of actions Pennington County should consider taking to ensure that the needed transportation improvements are funded:

### A. *Transportation Improvement Projects*

- It is recommended that Pennington County begin to plan and budget for completion of the five roadway improvements (all identified in the County's current Transportation Improvement Plan) and 7 intersection improvements identified for the Short Term. The total estimated construction cost of the Short Term projects is \$27.3 Million.
- The Mid-Term projects total \$26.7 Million and Long Term projects reach a total estimated construction cost of \$77.6 Million. It is recommended that Pennington County Staff initiate planning now for these projects, to refine the estimated costs and complete preliminary studies to set the stage for implementation.
- A total of approximately \$129.8 Million in transportation improvement projects is identified in *CHAPS*, approximately \$27.1 Million of which is comprised of projects already identified in the County's current Transportation Improvement Plan.

### B. *Bicycle and Pedestrian*

*CHAPS* includes a number of recommendations for bicycle and pedestrian improvements. A total of 14 roadway segments were identified for 4-foot minimum shoulders. Shoulder widening projects would not be implemented as standalone efforts. Rather, these projects would be built when the roadway itself is being reconstructed or resurfaced. A new shared-use path is recommended to be constructed extending the Wall Loop trail farther east to connect to US Highway 14 and facilitate additional bicycle connectivity between the City of Wall and Town of Quinn.

In addition to the County improvements, it is recommended that Pennington County provide support for implementing bicycle and pedestrian improvements identified in the *Rapid City Bicycle and Pedestrian Plan*.

### C. *Transit*

It is recommended that Pennington County allocate \$3,000 annually to transit in the County. The funds should initially be provided to River Cities Transit (RCT), to help increase RCT's Federal matching grant amount. River Cities Transit is currently providing services and additional funding will help continue to serve the demand for transit in Eastern Pennington County and provide necessary services, particularly for the transit-dependent population in Pennington County.

### D. *Implementation of Standards*

Pennington County currently possesses transportation standards related to access management, road classification and typical roadway sections. The *CHAPS* process has documented these standards and provided additional information and support where needed. The following recommendations relate to implementation of transportation standards:

- **Access Management** – The County has indicated that the current approach permitting process will remain sufficient for current needs. However, as population and commerce continue to grow in Pennington County, access requests will increase and county standards should be expanded to include recommended spacing of accesses along roadways of various classifications.
- **Classification** – The road classification system provided in *CHAPS* should be used by the County to maintain an organized hierarchy of highways and ensure that roads of each classification are built to appropriate standards. As the county grows, it is recommended that the road classification map be revised. Future roadway alignments should be identified in advance of development so that property developers know to preserve Right-of-way along key routes.
- **Traffic Impact Studies** – A standard for Traffic Impact Studies is provided in *CHAPS*. It is recommended that the county use this guidance to assess the traffic impacts of individual development proposals and reach agreement on appropriate cost sharing for infrastructure improvements.
- **Typical Sections** – Typical sections are provided in *CHAPS* for arterial and collector roadways. It is recommended that all new construction and roadway reconstruction projects on County highways utilized these sections as an initial standard.



## APPENDIX A PUBLIC OPEN HOUSES AND STAKEHOLDER MEETINGS – OCTOBER 2011



**Public Open Houses – Overview**

Dates and Location: October 18, 2011, 5:30 p.m. – 7:00 p.m.  
Wall Community Center  
501 Main Street, Wall

October 19, 2011, 5:30 p.m. – 7:00 p.m.  
Pennington County Courthouse  
315 Saint Joseph Street, Rapid City

October 20, 2011, 5:30 p.m. – 7:00 p.m.  
Hill City City Hall  
243 Deerfield Road, Hill City

Attendance: 2 people in Wall, 6 people in Rapid City, and 7 people in Hill City, plus consultants, Project Advisory Group members, and County representatives

Purpose: Provide overview of project and gather public input on critical issues and alternatives

Meeting Graphics: Thirteen display boards and a PowerPoint presentation

Feedback: Conversations with attendees, comment sheets (4), personal letters and e-mails (1), sketches and notes on display boards

**Comment Summary**

**Comment Sheet Questions:**

*What concerns do you have regarding the current Pennington County transportation system (highways, trails, airports, transit)?*

- Walking and bicycle trail demands as more tourists visit each year
- Keeping roads from deteriorating and the diversion of funds to recreation trails
- They are safe and effective

*Please rate the following transportation project types based on how important each is to you:*

*The transportation project types were ranked by all respondents and the following summary provides an approximation of the average value. Specific values for individual respondents can be found on the attached comment sheets.*

Bicycle (trails, bike lanes) - Important  
 Pedestrian (walks, crossings) – Very Important  
 Bus/Transit – Neutral  
 Existing Road Improvements - Important



New Road Construction - Important  
 Intersection Improvements - Important  
 Airport Improvements – Not Important

*What specific future projects are needed to improve the Pennington County Transportation Network?*

- More connecting roads for shorter access
- Walkways and bike paths along county roads
- Continued expansion of paved roads in rural communities to improve school routes, especially in Eastern Pennington where kids travel long distances

*General Comments from Comment Sheets:*

- More communication between all agencies
- The County does a great job on their system
- Need a more user friendly transportation system
- Long overdue to have this in place to benefit the county government and the public that uses the Transportation Network

**Conversational Comments:**

During the Community Open House, residents had an opportunity to talk with SDDOT, Pennington County, and the consultants to discuss recommendations and concerns about the transportation network. The following issues were raised during these discussions.

- Reno Gulch Road should be considered for improvements
- Add a wide shoulder on Sheridan Lake Road during the upcoming reconstruction project
- Consider/Include a potential rails-to-trails conversion for existing railroad right of way which connects Rapid City with Badlands National Park
- Widen the shoulder or provide a trail along Old Hill City Road for bicycle and pedestrian traffic
- Evaluate potential access issues along the west side of State Highway 16A – Old Hill City Road

**Post Meeting Correspondence:**

In addition to comment sheets and conversational comments received at the meeting, one e-mail correspondence has been received from T.J. and Anne French. This letter discussed the need for specific transportation improvements in the northwest portion of Pennington County, particularly for two travel corridors.

1. Rochford Road (Highways 231 and 312) – Connecting Rochford, SD with US 385
2. Mystic Road (Highway 231) – Connecting Mystic, SD with Rochford Road to the north and Deerfield Road to the south

Specific improvements for each corridor include hard surfacing the roadways and widening curves and providing guard rail where appropriate. The complete correspondence can be found attached.



**Stakeholder Meetings – Overview**

Dates and Location: October 19, 2011, 7:15 a.m. – 3:00 p.m.  
Wall Community Center  
501 Main Street, Wall

October 20, 2011, 8:00 a.m. – 3:00 p.m.  
Pennington County Courthouse  
315 Saint Joseph Street, Rapid City

October 21, 2011, 8:00 a.m. – 3:00 p.m.  
Pennington County Courthouse  
315 Saint Joseph Street, Rapid City

Attendance: A diverse group of key stakeholders in Pennington County was provided an opportunity to meet with Project Advisory Group members and the consultant team – 16 stakeholders accepted the invitation

Purpose: Participate in a project goals discussion designed to solicit feedback about the current Pennington County transportation system and needed improvements

Meeting Graphics: Thirteen display boards and a PowerPoint presentation

Feedback: Conversations with key stakeholders

**Comment Summary**

Comments from each of the participating stakeholders have been summarized in the following table:

Stakeholder	Comments
Eric Brunnemann US National Park Service - Badlands	<ul style="list-style-type: none"> <li>• Peak season is Memorial Day to Labor Day</li> <li>• Believes SD44 is growing in use as access to Badlands</li> <li>• More development likely along Sage Creek Rd due to recent land swap</li> <li>• Would like to see bike lane along SH 240, but is difficult to widen historic roads</li> <li>• Park shuttle being considered for future</li> <li>• Bureau of Indian Affairs currently evaluating paving a new regional loop south of the Badlands</li> </ul>



Kim Earney US Forest Service - National Grasslands	<ul style="list-style-type: none"> <li>• Coordination among all agencies is a chief concern, consider an annual meeting for agency discussion and to maintain the “road agreement” between the National Forest and Pennington County</li> <li>• Currently there is some pressure for more bike routes and trails south of Wall</li> <li>• Travel Management Analysis done for Grasslands, identified the need to define roadways and reduce off-road travel</li> <li>• National Forest can help with funding for roadway maintenance</li> <li>• Maintenance of the current roadway system is anticipated at this time</li> <li>• Rails-to-Trails would require a NEPA process in Grasslands</li> <li>• Grasslands is currently expanding a camping area – needs to coordinate with County, anticipating growth along 160<sup>th</sup> south of SD 44</li> </ul>
Dennis Rieckman & Dan Hauk Wall School District	<ul style="list-style-type: none"> <li>• District does not run daily school buses, does provide some activity busing</li> <li>• A bike path is needed near Kelly addition – between the two wall exists</li> <li>• Big Foot Rd degrades in condition during the winter</li> <li>• Interested in working on a Safe Routes to School Grant</li> <li>• Stadium facility may need a new access</li> </ul>
Dave Hahn Mayor of Wall	<ul style="list-style-type: none"> <li>• Concerned about the loss of the public transit system which is currently operated by River Cities Transit due to long term funding uncertainty</li> <li>• Railroad crossings can be a problem when trains sit on the track blocking crossings</li> <li>• Drunk driving an issue</li> <li>• Enforcement of stop signs is poor</li> <li>• Likes Pennington County road conditions</li> <li>• Wall is maintaining its population</li> <li>• Wall airport plans to extend the airport runway to 4100 feet in 2015</li> </ul>
Jack Trullinger Mayor of New Underwood	<ul style="list-style-type: none"> <li>• County Road 1416 has some sight distance issues</li> <li>• Bicycling along CR 1416 has increased and would benefit from additional shoulder</li> <li>• 161<sup>st</sup> north from New Underwood serves as an important arterial connection</li> <li>• Pennington County doing a very good job with maintenance</li> <li>• New residential development anticipated north of CR 1416 / south of I-90 / west of 161<sup>st</sup> (270 acres)</li> <li>• Public transit is unavailable and would not be profitable, does not feel service is needed for seniors currently</li> </ul>



<p><b>Patrick Broudos Neiman Timber Company</b></p>	<ul style="list-style-type: none"> <li>• Big issue is lack of information about upcoming construction projects – influences routing decisions for logging projects</li> <li>• Load limits on roads after paving cause routing issues which do not exist when roads are gravel; would like to see paved roads built to higher standards so that logging trucks can use facilities</li> <li>• New bridge needed along South Rochford Road</li> <li>• Need to know who is responsible for snow removal (especially for roadways where maintenance ownership is unclear) to avoid penalties for removing snow from county roads</li> <li>• Deerfield Rd is narrow for logging trucks</li> <li>• Intersections entering Hill City from Deerfield Road are difficult</li> </ul>
<p><b>Pete Haugh Douglas School District</b></p>	<ul style="list-style-type: none"> <li>• Prairie View Estates access often floods</li> <li>• Looks forward to use of Radar Hill Road after reconstruction</li> <li>• Buses primarily use Longview Road and Reservoir Road</li> <li>• Country Road/Elk Vale Road problems with stop sign obedience</li> <li>• 225<sup>th</sup> St should receive school zone enforcement – school flashers would help school children walking and forced to cross at this location</li> <li>• School bus stops on CR 1416 would benefit from signage</li> <li>• Development anticipated near Liberty/CR 1416</li> <li>• Busing radius is 2.5 miles from school</li> </ul>
<p><b>Denny Gorton Pennington County Fire Administration</b></p>	<ul style="list-style-type: none"> <li>• Need better highway signage (street name signs) and a standardized home addressing system to help find locations in case of emergency</li> <li>• Multiple accesses into each subdivision a concern for emergency response</li> <li>• Problem intersections                         <ul style="list-style-type: none"> <li>○ US 385/SD 44</li> <li>○ US 385 northbound from Custer (US385/244/287)</li> </ul> </li> </ul>
<p><b>Patsy Horton &amp; Kip Harrington Rapid City MPO</b></p>	<ul style="list-style-type: none"> <li>• Development standards for county a key – especially on edge of 3-mile platting jurisdiction</li> <li>• MPO support Rails-to-Trails project</li> <li>• Anticipated development around Elk Vale Road/ Minnesota area</li> <li>• A current project is looking at a new interchange and airport connection from Box Elder</li> <li>• Interested in a transit connection between Mount Rushmore and Rapid City</li> <li>• Old Hill City Road would be a nice bicycle/pedestrian trail</li> </ul>



<p><b>Kenny Gardner Hill City School District</b></p>	<ul style="list-style-type: none"> <li>• Old Hill City Road is primary concern – especially sight distance along railroad crossings</li> <li>• Train runs from April to October</li> <li>• Would like to see all roads paved</li> <li>• Narrow roads can be difficult if logging trucks and buses must pass</li> </ul>
<p><b>Al Dial Mayor of Box Elder</b></p>	<ul style="list-style-type: none"> <li>• Need collaboration between all agencies</li> <li>• Configuration of 1416 into the future uncertain, looking to eliminate H's ("Super 3")</li> <li>• New connection from Liberty at 151<sup>st</sup> north is needed</li> <li>• Would like to see enhancement money go to trail system in populated areas</li> <li>• Safety concerns at 1416/North Ellsworth</li> <li>• Would like to see an interchange at Exit 69</li> <li>• Would like to see transit started</li> </ul>
<p><b>Cheryl Schreier US National Park Service – Mount Rushmore</b></p>	<ul style="list-style-type: none"> <li>• Would like to see a plan to identify preferred routes to National Park</li> <li>• Completed Feasibility Study to look at plan to connect Mickelson Trail to Mount Rushmore</li> <li>• Would like to see seasonal public transit between Mount Rushmore and Rapid City</li> <li>• NPS has a focus on healthy parks and healthy people – offers assistance through Rivers, Trails, and Conservation Assistance Program designed to facilitate projects including helping to define and organize stakeholders</li> <li>• Sees importance in connecting trails and sidewalks with the development standards</li> <li>• Currently working on a new back country trail within the Park</li> </ul>
<p><b>Reed Hansen Hills Materials</b></p>	<ul style="list-style-type: none"> <li>• Hidden Valley Rod / SH 231 is in need of resurfacing (poor pavement condition)</li> <li>• Norris Peak Road should be classified as a collector roadway</li> </ul>
<p><b>Alan Michalewicz Black Hills Electric Cooperative</b></p>	<ul style="list-style-type: none"> <li>• Sheridan Lake is a popular bicycle/pedestrian route</li> <li>• Has noticed an increase in traffic volume along US16 to US385 east of Hill City</li> <li>• Two lane state highways are congested</li> <li>• Wild animal accidents are a major problem</li> <li>• Neck Yoke/Spring Creek/US 16 has a lot of conflicts and tight spacing</li> <li>• Neck Yoke/South Rockerville intersection a concern</li> <li>• South Rochford paving will radically change motorcycle patterns</li> </ul>



<p><b>Mike Kenton</b> Rapid City School District</p>	<ul style="list-style-type: none"> <li>• No concerns about the county highway system</li> <li>• Nemo Road is curvy and can be difficult</li> <li>• Bus stops are often provided with a pullout – which is preferred</li> <li>• Does not see a need to pave any gravel roads</li> <li>• Subdivisions need to be held to same standards as county highways</li> <li>• Experienced one bus crash at Highway 16/Catron Blvd</li> <li>• Anticipates growth in southeast part of Rapid City</li> </ul>
<p><b>David Slepnikoff</b> Mystic Ranger District Black Hills National Forest</p>	<ul style="list-style-type: none"> <li>• Sheridan Lake Drive (Road No. 228) – Please consider adding a bike path from Rapid City to Highway 385 along the shoulder of this road</li> <li>• Silver City Road (Road No. 299) – Consider the need for ATV, UTV access from the private Whispering Pines Campground located along Highway 385 to Forest Service Trails located along the Silver City Road</li> <li>• Rochford Deerfield Road (Road No. 306) – Please consider future hard surfacing of this road from the current end of asphalt to the north of Deerfield Lake to the intersection with Forest Service Road (FSR) 417 that goes to the Custer Trail Campground and boat ramp located on the north shore of Deerfield Lake.</li> </ul>
<p><b>Mark Merchen</b> West River Electric/Ellsworth Steering Cmte.</p>	<ul style="list-style-type: none"> <li>• In 2005, Mr. Merchen chaired steering cmte. Charged with planning for future of area without Ellsworth Air Force Base (EAFB).</li> <li>• Committee developed a land use study to consider Air Installation Compatible Use Zone (AICUZ) compatibility of area around EAFB. Plan also addressed transportation needs, such as examining the use (or disuse) of Exit 67 as a commuter route to EAFB, traffic growth along 1416, and road alignments within Box Elder/Pennington County south of I-90. Plan identified safety concerns along 1416, and recommended that efforts be made to discourage use of 1416 as a commuter route.</li> <li>• Jurisdictions have collaborated in the past and these collaborative efforts need to continue to support implementation of the following priorities:             <ol style="list-style-type: none"> <li>1. Support for the Ellsworth Development Authority in efforts to develop an Industrial Park along North Ellsworth Road near the base entrance.</li> <li>2. Conversion of 1416 to a Super 3 lane road with traffic calming</li> <li>3. Reconstruction of Exit 63</li> <li>4. Connection of Cheyenne Blvd. around south end of Box Elder.</li> </ol> </li> <li>• All work done to date on 1416 conversion is conceptual in nature</li> </ul>







## APPENDIX B WEB BASED COMMUNITY SURVEY



**Online Public Survey – Summary**

Dates Available: October 11, 2011 – December 6, 2011

Advertisement: Flyers at public and stakeholder meetings:

1. Wall Community Center (10/18/2011)
2. Pennington County Courthouse (10/19/2011)
3. Hill City City Hall (10/20/2011)

Included in the monthly utilities bill from Black Hills Electric Co-op

Four weeks of notices in the following newspapers:

- Pennington County Courant
- Hill City Prevailier News
- Rapid City Journal

Purpose: Gather public feedback using an online survey

Feedback: Online survey responses (53)

**Survey Results Summary**

**Survey Questions:**

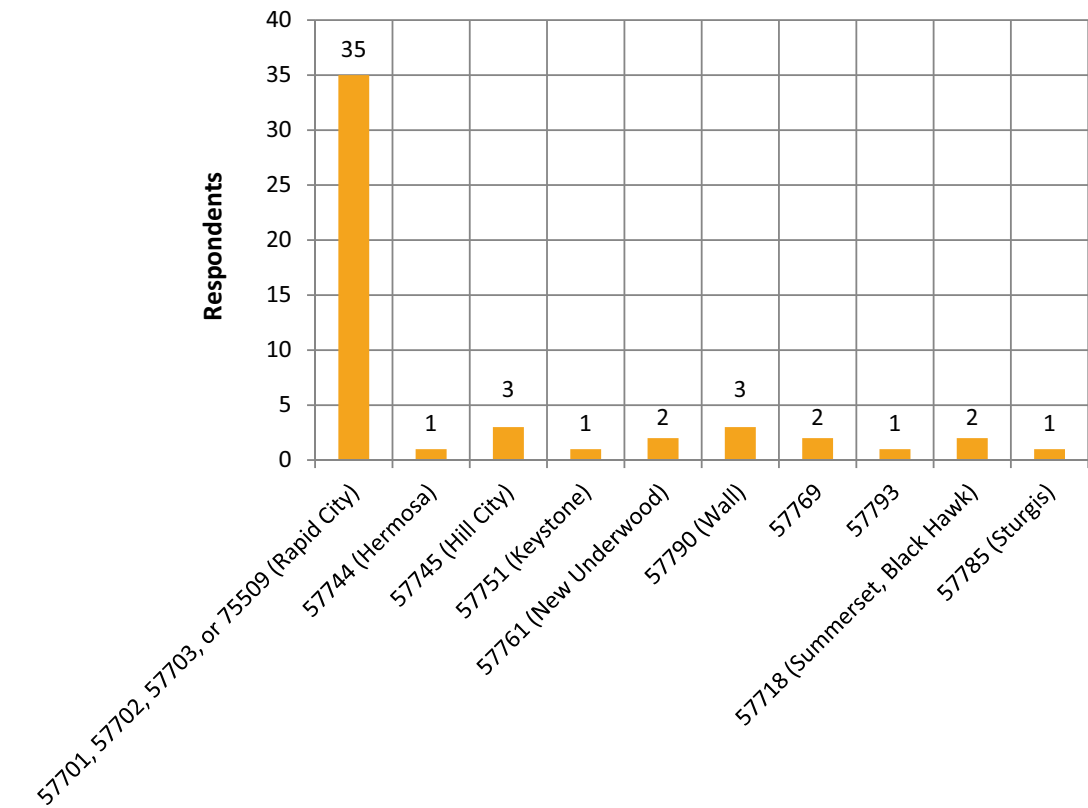
*How did you learn about this online survey?*

A majority of respondents heard about the survey through the newspaper (36%) and the project website (19%). Other sources (26%) not listed in the question include:

- Mailed postcard
- County/Municipal websites
- Word of mouth
- Facebook



*In what zip code do you live?*

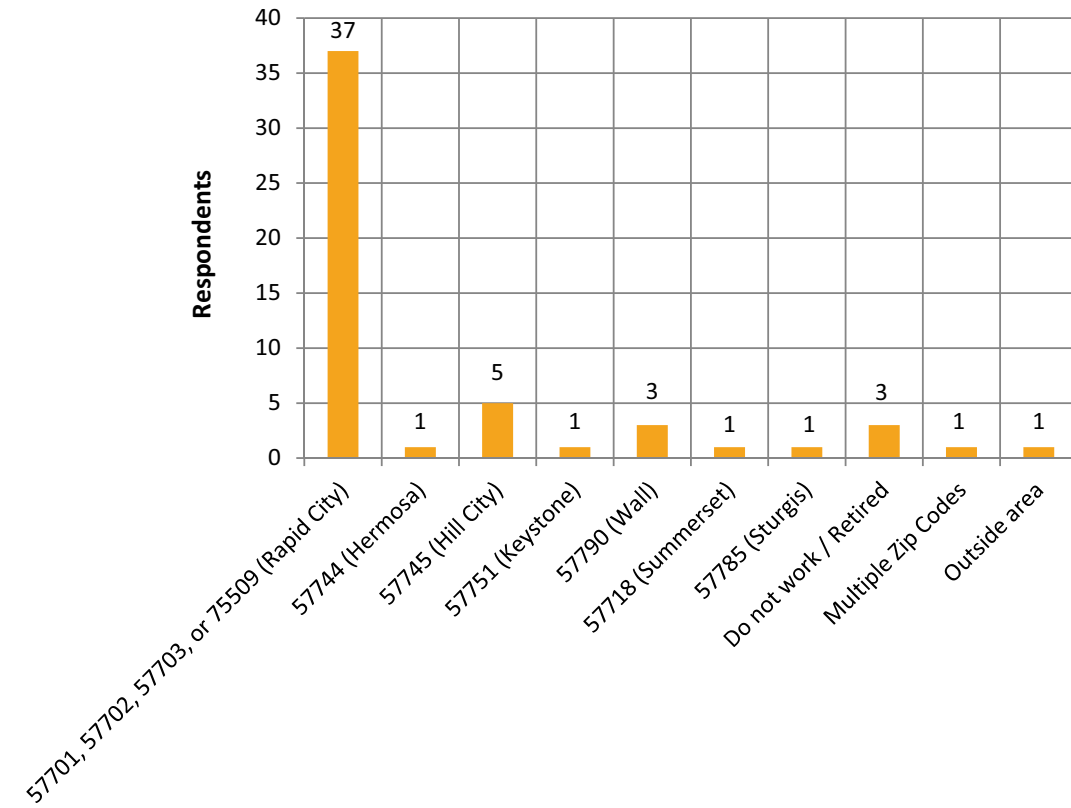


NOTE: The following ZIP codes registered no responses:

- 57719 (Box Elder)
- 57725 (Caputa)
- 57730 (Custer)
- 57767 (Owanka)
- 57775 (Quinn)
- 57780 (Scenic)
- 57791 (Wasta)



In what zip code do you work?



NOTE: The following ZIP codes registered no responses:

- 57719 (Box Elder)
- 57725 (Caputa)
- 57730 (Custer)
- 57761 (New Underwood)
- 57767 (Owanka)
- 57775 (Quinn)
- 57780 (Scenic)
- 57791 (Wasta)



What are your general feelings about the transportation system you use?

A vast majority of respondents (83%) stated they feel average to good about the transportation system they use, with most siding on good. Only two stated they feel poorly.

How would you rate traffic safety in Pennington County?

A vast majority of respondents (90%) rated the County's traffic safety as average to good, with a relatively even split between the two. Only one gave a rating of poor.

Are there any intersections in Pennington County outside of city limits that need additional stop sign control or traffic signals to enhance traffic safety? If so, please list:

Seven respondents provided information:

- Intersection of Dunsmore Rd and Sheridan Lake Rd. We need some type of traffic control from 7 & 8 AM Monday through Friday. We have been very lucky no one has been seriously injured or killed at the intersection.
- Stop with more stop signs and traffic lights. They impede traffic flow. Please make greater use of roundabouts. No crossing traffic in these.
- Neck Yoke Rd. and Highway 16
- Maybe not signs, but rebuilding to improve visibility.
- Covington and Hwy 44
- Cedar Butte Rd & Creighton Rd is very dangerous due to poor visibility.
- Stop sign at S. Rockerville Rd & Hwy 40, speed limit is 55 mph on Hwy 40 & a slight corner. When you pull out if someone is speeding it's a SERIOUS problem. And ALOT of people do speed once they hit that straight stretch.

Are there any intersections in Pennington County outside of city limits where you experience excessive delay in your travels? If so, please list:

Six respondents provided information, with Hwy 44 and Sheridan Lake Rd receiving multiple mentions:

- Hwy 44 stoplights
- By Reptile Gardens
- Sheridan Lake Rd to Corral Dr
- Highway 44 - summer time due to bicycles
- Sheridan Lake Rd entrance into Countryside South is dangerous
- Covington and Hwy 44



*Is additional speed enforcement needed on County roads? If so, which roads?*

Eleven respondents provided information, with Sheridan Lake Rd receiving multiple mentions:

- City is having more trouble than the County.
- Nemo Rd (2 responses)
- Hwy 16 coming into Hill City
- Sheridan Lake Rd - 2 through 6 miles out of town.
- The roads north of Rapid City seem to be a problem along with Neck Yoke Rd.
- All gravel roads
- Sheridan Lake Rd and South Canyon Rd
- Sheridan Lake Rd in the Countryside/Countryside S/Dunsmore Rd area—people just pull out in front of traffic on the road. I suppose as the area grows, a signal will eventually be necessary, but a real nuisance for those of us on the highway.
- Longview and Radar Hill Rd. Also, the bottom of the hill in for Radar Hill Rd between Cheyenne Crossing and the main road in Box Elder & Deadwood Ave.
- Sheridan Lake Road out of city limits.

*How would you rate travel by automobile in your area?*

A majority of respondents rated travel by automobile as good (60%), with 21% giving a rating of average and 13% a rating of excellent. Only three respondents provided a rating of poor.

*How would you rate the condition and maintenance of asphalt-surfaced roads in Pennington County?*

A vast majority of respondents rated conditions and maintenance as either average or good (88%), with a relatively even split between the two. Only one respondent provided a rating of poor.

*How would you rate the condition and maintenance of gravel-surfaced roads in Pennington County?*

A vast majority of respondents rated conditions and maintenance as either average or good (92%), with a relatively even split between the two. The remaining four respondents provided a rating of poor.

*How would you rate the winter-time maintenance and condition of Pennington County roads?*

A majority of respondents rated winter-time maintenance as either average or good (74%), with most siding with good. 16% provided a rating of excellent, while 10% responded with poor.

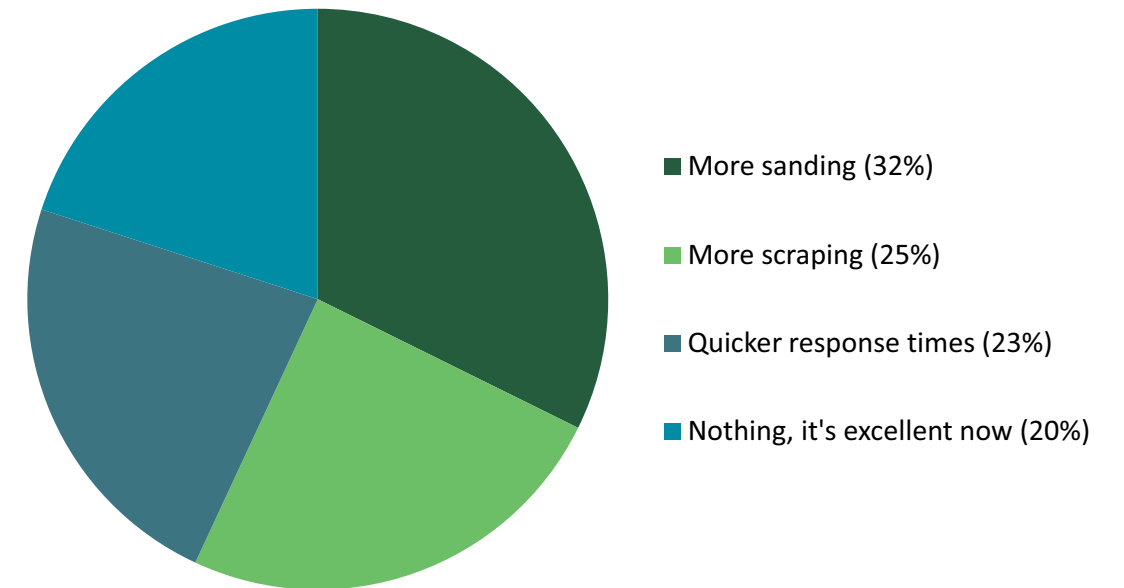


*Please rate the County's response time to snow storms.*

A majority of respondents rated snow storm response time as good (45%), while a nearly even split of respondents rated response time as average or excellent (24% and 22% respectively).

*What should be done to improve Winter road maintenance in Pennington County? Please check all that apply.*

Responses were rather evenly distributed between the four options provided:



*Please indicate whether you would consider the following situations to be examples of traffic congestion. Multiple answers are allowed.*

Most respondents found barely moving or stopped traffic to be an example of congestion (80%), while a majority also found 10 mph below the speed limit to also be an example (68%). Nearly a quarter of respondents interpreted 5 mph below the speed limit to be congestion as well.

*Overall, do you think the current level of traffic congestion in Pennington County is:*

A vast majority found congestion in the County to be a minor problem or no problem at all, with most stating it was a minor issue. Only three respondents stated it was a major problem.

*Do you have concerns about dust generated from gravel roads in Pennington County? If so, please list which roads.*

One respondent acknowledged that gravel roads are dusty, but wants more of them and less paved roads because gravel roads are cheaper. Six respondents expressed concerns, with five providing the following specifics:

- Sage Creek Rd
- Rolling Hills
- 231, 312, and 237
- The Burnt Fork Rd 3 miles West of Hill City off the Deerfield Rd. It needs to be paved up to end of private land. Forest Service is hauling timber out of there but don't help with dust control.
- Trask Rd and 222<sup>nd</sup> St

*How frequently should County gravel roads be bladed?*

A majority of respondents found the current schedule satisfactory (65%), while 35% wanted it done more often. No one suggested less often.

*Are there specific locations where you would like to see additional or improved roadway facilities in Pennington County?*

One respondent would like to see Sheridan Lake Rd past Countryside South to stay unimproved, while nine respondents provided locations where they'd like to see improvements:

- The gravel on Sage Creek Rd from the paved portion to the National Park is too soft to ride a bicycle.
- I would like to see the intersection of the Exit 78 ramp, eastbound, with the overpass (New Underwood Rd) over the interstate fixed. Turning left to go northbound is blind. I have almost been T-boned on numerous occasions.
- County Roads 231, 237, and 312
- Sheridan Lake Rd to intersection with 385. And Burnt Fork Road off Deerfield Rd.
- Plateau in Rapid Valley
- Cheney Rd and Wilsey Rd
- Bridge improvement where South Rochford Rd and Rochford Rd intersect.
- All the paved county roads really need to be wider with shoulders.
- The Gap by Bakken Park

*How would you rate travel by bicycle/walking in your area?*

A vast majority of respondents rated travel by bicycle/walking as poor or average (73%), with most providing a rating of poor (51%). Five respondents provided a rating of excellent.

*Are there specific locations where you would like to see additional or improved bicycle/pedestrian facilities in Pennington County? If so, please describe:*

Twenty-four respondents provided information, with Sheridan Lake Rd, Nemo Rd, and narrow roads in general receiving multiple mentions, as well as issues with bikes on roads without or minimal shoulders:

- South and West: Countryside and Moon Meadows areas
- The landfill road from Wall to Quinn. There is no alternative (efficient) route other than the interstate to connect these communities. Walking/bicycling is not an option. There are many families that live in Quinn.
- Along the Mickelson trail
- Road to the airport
- Add bike lanes, increase sidewalks where people already are walking on the grass (i.e. by Department of Labor).
- Along Hwy 44 east of Rapid City
- Hwy 44 West, bicycle traffic should be required to stay on shoulders. Their 15 mph on a 50 mph highway is an issue.
- Wider shoulders on Sheridan Lake Rd
- Upper Spring Creek Rd, Sheridan Lake Rd, and Lower Spring Creek Rd. County should assist with rails to trails connecting Rapid City to Wasta as a transportation alternative.
- All of Valley Dr
- Plateau in Rapid Valley
- Anywhere downtown, and throughout the city. Not a recreational path, usable for destination travel.
- Narrow shoulder on Nemo Road
- Deadwood Ave and connect with the bike path. All routes to Rapid Valley.
- Valley into Rapid City to better use of bike to work travel.
- Along Sheridan Lake Rd, South Canyon Rd, and Nemo Rd
- Sheridan Lake Rd from Countryside into town
- Vehicle traffic & bicycles just don't mix on the narrow roads without shoulders in the Black Hills. I consider riding a bicycle on any road in that area suicidal.
- Hwy 40 from Playhouse Rd into Keystone
- Underneath the interstate overpass in Wall from the Kelly addition to the main part of town.
- Deadwood Ave has no sidewalks.
- Nemo Rd a few miles out. No/minimal shoulder.
- Out by Western Dakota Tech and Menards. A side walk would be nice so they don't ride their bikes on the street.
- Not allowed on roads without a shoulder

*How would you rate travel by transit in your area?*

Many respondents rated travel by transit as poor (45%) or good (32%). Only two respondents found travel by transit to be excellent.



Are there specific areas where you would like to see additional or improved transit facilities in Pennington County? If so, please describe:

One respondent stated none is needed, while another stated it's hard to do in a rural area. Three other respondents provided information as to how to improve transit in the County:

- A good bus system would be a plus for city and surrounding areas to get to town. The train idea connecting the airport with the hills would be a great addition to the area for locals and would be a great draw for tourists.
- Extend to cover more areas, keep up with the development and expansion of city
- Hill City and Rapid City

For what types of trips do you use alternative modes of transportation (bicycle, pedestrian, or transit)? (Select all that apply):

A vast majority stated they use alternative modes for recreation (82%), while just over half use it for social purposes (55%). Almost a quarter of respondents use it for work, while shopping and medical received three votes each. Five respondents provided additional comments to the question:

- Distance is too great and no other alternative exists.
- Might ride to work if better bike routes were available.
- Shoulders or roads wide enough to permit golf carts is important to me.
- Training for competitive cycling.
- Not safe to bicycle from Valley to Rapid City

Please rate the following transportation project types based on how important each is to you.

Responses were fairly close between projects for the level of importance:

	Not Important	Neutral	Somewhat Important	Very Important
Bicycle	16%	20%	29%	35%
Pedestrian	8%	16%	39%	37%
Bus/Transit	24%	42%	22%	12%
Existing Road Improvements	2%	24%	36%	38%
New Road Construction	16%	34%	30%	20%
Intersection Improvements	4%	26%	41%	29%





## APPENDIX C PUBLIC OPEN HOUSES AND STAKEHOLDER MEETINGS – APRIL 2012



**Public Open Houses – Overview**

Dates and Location: April 16, 2012, 5:30 p.m. – 7:00 p.m.  
 Wall Community Center  
 501 Main Street, Wall

April 17, 2012, 5:30 p.m. – 7:00 p.m.  
 Hill City City Hall  
 243 Deerfield Road, Hill City

April 18, 2012, 5:30 p.m. – 7:00 p.m.  
 Pennington County Courthouse  
 315 Saint Joseph Street, Rapid City

Attendance: 0 people in Wall, 2 people in Hill City, and 6 people in Rapid City, plus consultants, Project Advisory Group members, and County representatives

Purpose: Review the development of the transportation plan and solicit reaction from the public about the proposed findings.

Meeting Graphics: Thirteen display boards and a PowerPoint presentation

Feedback: Conversations with attendees, comment sheets (1), and notes on display boards. These public open houses were conducted to record issues, comments, and concerns from the public regarding the Pennington County Master Transportation Plan project. Input received does not establish project direction or decisions.

**Comment Summary**

**Comment Sheet Questions:**

*Roadway, Intersection, and Bicycle & Pedestrian Projects: Do you agree with the list of projects shown?*

- Yes

*Roadway, Intersection, and Bicycle & Pedestrian Projects: What projects have we missed?*

- No response

*Roadway, Intersection, and Bicycle & Pedestrian Projects: Would any of the proposed projects negatively affect the community? How?*

- No response



*Project Priorities: Of the identified projects, what project(s) are most important to you in each category?*

*Roadway Facilities?*

- No response

*Intersections?*

- No response

*Bicycle/Pedestrian Facilities?*

- Would like to see bicycle and pedestrian facility along Old Hill City Rd 1 mile west out of Keystone

*General Comments:*

- No response

**Conversational Comments:**

During the Community Open House, residents had an opportunity to talk with SDDOT, Pennington County, and the consultants to discuss recommendations and concerns about the transportation network. The following issues were raised during these discussions.

- The alignment at the intersection of Mystic Rd and Deerfield Rd causes confusion about which movement has the right of way.
- There is a potential connection of Moon Meadows to Sheridan Lake Rd in the future.
- Twilight Drive will extend to Radar Hill Rd in the long term future.
- 225<sup>th</sup> Street should be shown as a County Road on all maps.
- SDDOT is allowing too much access onto Catron Blvd and Elk Vale Rd.
- Bicycles should be banned on Spring Creek Rd.
- County standards should include no rumble strips to allow for use by bicyclists on shoulders.
- There is a 1 ¼ mile section of gravel roadway on Old S Folsom Rd, edits should be made on figures and this project should be included in the project listing.
- Conata Basin Rd should be included in the project listing to be paved.
- “Share the Road” signs should be posted on all county roads.

**Post Meeting Correspondence:**

Two separate sets of comments were received following the public meetings from Ellen Conroy and Ann Van Loan, the details of these discussions are provided below.





The consultant Project Manager received a telephone call from Ellen Conroy, a member of the public, on Friday, May 4, 2012. Mrs. Conroy expressed the following comments regarding the CHAPS project:

- Mrs. Conroy was not aware of the public meetings until they had already occurred
- The rails-to-trails project is of interest to many of the Badlands visitors and could see use by many visitors
- Mrs. Conroy is opposed to the paving of South Rochford Road
- Improvements to Bureau of Indian Affairs (BIA) Road 2 in Shannon County are more important than improvements to Sage Creek Road with respect to tourism.

Ann Van Loan, Executive Director of Western Resources for dis-ABLED Independence (WRDI), provided the project team with notes from a meeting of the Black Hills Workshop, an advocacy group that provides services and supports to people with disabilities. The group discussed transportation issues in Pennington County with respect to the disabled on April 25, 2012. Notes from the meeting emphasize the need for supplemental public transportation services for people with disabilities, including the need for night/weekend hours and service to communities surrounding Rapid City. The meeting notes are included with the attached comment sheets.



**Stakeholder Meetings – Overview**

Dates and Location: April 17, 2012, 7:30 a.m. – 12:00 p.m.  
Wall Community Center  
501 Main Street, Wall

April 18, 2012, 7:15 a.m. – 12:00 p.m.  
SDDOT – Rapid City  
2300 Eglin Street, Rapid City

April 19, 7:15 a.m. – 2:00 p.m.  
SDDOT – Rapid City  
2300 Eglin Street, Rapid City

Attendance: A diverse group of key stakeholders in Pennington County was provided an opportunity to meet with Project Advisory Group members and the consultant team – 15 stakeholders accepted the invitation

Purpose: Participate in a review of the preliminary study findings and provide input about potential changes to the recommended plan

Meeting Graphics: Thirteen display boards and a PowerPoint presentation

Feedback: Conversations with key stakeholders. These stakeholder meetings were conducted to record issues, comments, and concerns from representatives of involved organizations regarding the Pennington County Master Transportation Plan project. Input received does not establish project direction or decisions.

**Comment Summary**

Comments from each of the participating stakeholders have been summarized in the following table:

Stakeholder	Comments
Alan Anderson Buffalo Gap National Grasslands	<ul style="list-style-type: none"> <li>• 195<sup>th</sup> Ave has a drainage problem</li> <li>• Huether Rd has a load restricted bridge</li> <li>• Paving of Sage Creek a good project</li> <li>• 16<sup>1st</sup> could be a good regional connector between Spring Creek Rd and Hermosa</li> </ul>
Jim Books South Dakota Bicycle Coalition	<ul style="list-style-type: none"> <li>• Wants to be involved in approval process going forward</li> <li>• Conata Basin Rd should be included in the project listing to be paved</li> <li>• “Share the Road” signs should be posted on all county roads</li> <li>• Recommends development of Bicycle/Pedestrian task force with the goal of implementing the “Share the Road”</li> </ul>



	<p>program</p> <ul style="list-style-type: none"> <li>• Advises using seamless gutters in construction of 4-lane urban arterial roadways</li> <li>• There is a 1 ¼ mile section of gravel roadway on Old S Folsom Rd, edits should be made on figures and this project should be included in the project listing</li> </ul>
Patrick Brondos Neiman Timber Company	<ul style="list-style-type: none"> <li>• Consider a seasonal traffic light at Deerfield Rd / US 16</li> <li>• Acknowledges need for shoulders on S Rochford Rd</li> <li>• Improve S Rochford Rd bridge just south of Rochford Rd which is currently load limited</li> <li>• Pave roads in hills to avoid load limits – but acknowledges this may not be fiscally feasible</li> </ul>
Eric Brunnemann & Wolf Schwarz US National Park Service - Badlands	<ul style="list-style-type: none"> <li>• Show roadway connections within Badlands so connectivity can be understood</li> <li>• Acknowledges the need for Sage Creek Rd paving but advises that a full NEPA process will be needed due paleo archaeological sensitivities in park and that drainage and engineering will be difficult for project</li> <li>• Advises about future development of South Unit of Badlands and the anticipated roadway demand connecting the two parks (such as BIA 2 Roadway)</li> <li>• Suggested focus on Bombing Range Rd and its potential traffic increases with development of South Unit of Badlands</li> <li>• Supports development of bicycle shoulders surrounding the park especially Bombing Range Rd and SH 240</li> <li>• Supports rails-to-trails project</li> <li>• Provided a CD copy to the consultant of the Final General Management Plan (GMP) and Environmental Impact Statement for Badlands National Park, South Unit</li> </ul>
Al Dial Mayor of Box Elder	<ul style="list-style-type: none"> <li>• Concerned about impacts on local roadways as a result of Super-3 project</li> <li>• Emphasizes importance of Exit 63 reconstruction and Cheyenne Blvd construction to make Super-3 work, needed before reconstruction of County Road 1416</li> <li>• Commercial truck traffic routing has been difficult due to truck load limits on CR 1416 during spring</li> <li>• Provided a map of the future local road network and the necessary improvements to get the Super-3 design to work with City of Box Elder plans</li> <li>• Exit 69 may be needed in future with changes to Transload facility</li> <li>• Sees benefit to a north side connection between New Underwood and Box Elder</li> <li>• Not supportive of rails-to-trails conversion between Rapid City and Kadoka</li> <li>• Cheyenne Blvd planned to be extended into Rapid City with bicycle facilities provided along roadway</li> <li>• DeGeest bike path extension makes sense</li> </ul>



	<ul style="list-style-type: none"> <li>• Warns that airport may not support paving of Longview Rd</li> </ul>
Kenny Gardner Hill City School District	<ul style="list-style-type: none"> <li>• The alignment at the intersection of Mystic Rd and Deerfield Rd causes confusion about which movement has the right of way</li> <li>• Logging trucks problematic in terms of travel speeds/safety</li> <li>• Deerfield Rd hill at US 16 is a problem during icy conditions</li> <li>• Deerfield Rd accesses by City Building have awkward sight distance due to road grade</li> </ul>
Dave Hahn Mayor of Wall	<ul style="list-style-type: none"> <li>• Transit service future funding a major concern</li> <li>• Potential bike connection between Wall and Quinn may be difficult due to alignment concerns, use of Old Highway an option but ownership of ROW unknown</li> <li>• Railroad noise and blocking of roadways through town a concern during tourist season</li> </ul>
Pete Haugh Douglas School District	<ul style="list-style-type: none"> <li>• Local traffic congestion around Vandenburg school is a problem during peak hours – area around Tower Dr, 225<sup>th</sup> St, and N Ellsworth</li> <li>• Liberty Blvd is a good alternate route during peak hours to avoid EAFB congestion</li> </ul>
Patsy Horton & Kip Harrington Rapid City MPO	<ul style="list-style-type: none"> <li>• Coordination between Rapid City and Box Elder is important</li> <li>• A new water line to the airport may facilitate growth in Rapid Valley</li> <li>• Local links could be identified as “developer driven” in the report</li> <li>• Feel that 12 foot lanes may be a bit narrow for rural collectors</li> <li>• If rumble strips are added, provide guidelines about how to build them</li> <li>• The County should participate in MPO-led discussion of bicycle/pedestrian facilities</li> </ul>
Dennis Rieckman & Dan Hauk Wall School District	<ul style="list-style-type: none"> <li>• There is a school on Big Foot Rd that will be well served by the planned arterials</li> <li>• The project to pave Sage Creek Rd is important as it has had students using it to commute in the past</li> <li>• Intersection safety projects are important</li> </ul>
Brent Kertzman Black Hills Mountain Bike Association (BH MBA)	<ul style="list-style-type: none"> <li>• Would like to see a separate non-motorized path from Rapid City to the Hills</li> <li>• BH MBA has been working with the forest service to get trails recognized in the system: Storm Mountain, Victoria Lake, Buzzard’s Roost, and Rim Trails</li> <li>• Multimodal shift requires a significant cultural shift among residents</li> <li>• Dedicated non-motorized trail facilities are the most important</li> <li>• Concourse/Twilight should be evaluated for a signal due to poor sight distance for stopped minor traffic</li> </ul>



<p>Brett McMacken City of Hill City</p>	<ul style="list-style-type: none"> <li>• Speeding on Sheridan Lake Rd an issue</li> <li>• Hears comments from the public that at Old Hill City Rd at Keystone it is difficult to make a left turn</li> <li>• Deerfield Rd / US 16 is difficult due to grade and curve</li> <li>• Reno Gulch Rd paving is a good project</li> </ul>
<p>Mark Merchen Ellsworth Authority</p>	<ul style="list-style-type: none"> <li>• Ellsworth Air Force Base is a major county destination</li> <li>• Recent transportation plan financed by federal and local should be referenced</li> <li>• Transload facility a safety issue that should be prioritized and studied</li> <li>• North Ellsworth and CR 1416 are county responsibility and county should be involved in local planning</li> <li>• Exit 63 should be studied as it relates to the reconstruction of CR 1416</li> <li>• Emphasize the importance of multi-agency collaboration</li> <li>• County should be more involved in the accesses to I-90</li> <li>• County should be aware that ROW changes can affect other agencies (e.g., electric companies)</li> </ul>
<p>Roy Roberts Rapid City Christian High School</p>	<ul style="list-style-type: none"> <li>• Arena Dr / Spring Creek Rd sees a large amount of bicycling activity</li> <li>• Spring Creek Rd experiences a lot of turning movements due to school, consider a left turn lane(s) at nearby intersection(s)</li> <li>• Recent improvements at Spring Creek Rd / Neck Yoke Rd have occurred</li> </ul>
<p>Jack Trullinger Mayor of New Underwood</p>	<ul style="list-style-type: none"> <li>• Growth anticipated north of I-90 along 226<sup>th</sup></li> <li>• Consider paving 160<sup>th</sup> south of SD 44 to the motorcycle track, would also help enhance emergency response</li> <li>• Consider widening the shoulder on CR 1416 for bicycles</li> <li>• County should be more selective when allowing access to highways</li> </ul>







## APPENDIX D INTERSECTION TECHNICAL MEMORANDUM



## Technical Memorandum No. 1 (Revised)

To: Lyle DeVries

From: Chad Petersen  
Mike Bittner

Date: 7/3/2012 (Revision Date)

Subject: Existing Capacity and Geometric Design Analysis

The contents of this technical memorandum include the results of an existing and forecasted conditions assessment completed on fifteen (15) study intersections in Pennington County South Dakota as part of the Pennington County Master Transportation Plan. As requested by FHU Engineering, the existing conditions assessment included capacity, operational, warrant and geometric design analysis. The results of this memorandum highlight the deficiencies identified as part of this assessment.

### SUMMARY OF KEY FINDINGS

1. Of the fifteen (15) intersections studied, the following locations meet warrants to install a traffic control signal:
  - a. Intersection of SD 44 with Covington Street is estimated to meet four-hour and eight-hour volume warrant standards if right-turns are not omitted from the analysis during existing and forecasted peak hour traffic conditions.
  - b. Intersection of Sturgis Road with Merritt Road meets the intersection near a grade crossing warrant standards under existing and forecasted peak hour traffic conditions. This intersection is also estimated to meet four-hour and eight-hour volume warrant standards during forecasted 2035 traffic conditions.
  - c. Intersection of Sturgis Road with Universal Drive is estimated to meet four-hour and eight-hour volume warrant standards if right-turns are not omitted from the analysis under forecasted 2035 traffic conditions.
  - d. Intersection of Dunsmore Road with Sheridan Lake Road is estimated to meet four-hour and eight-hour volume warrant standards under existing and forecasted traffic conditions.
2. Of the ten (10) intersections analyzed for capacity and operational deficiencies, the following deficiencies were identified during the existing AM or PM peak hour:
  - a. Southbound approach of Covington Street at the intersection of SD 44 operates at LOS "E" during the AM peak hour.
  - b. Westbound approach of Merritt Road at the intersection of Sturgis Road operates at a LOS "D" during the PM peak hour.
  - c. Southbound approach of Dunsmore Road at the intersection of Sheridan Lake Road operates at a LOS "F" during the AM peak hour.
  - d. Southbound Approach of Concourse Drive at the intersection of Twilight Drive operates at a LOS "E" and LOS "F" during the AM and PM peak hours respectively.



3. Of the ten (10) intersections analyzed for capacity and operational deficiencies, the following deficiencies were identified during the forecasted 2035 AM or PM peak hour:
  - a. Southbound approach of Covington Street at the intersection of SD 44 operates at LOS "F" during the forecasted 2035 AM and PM peak hour.
  - b. Westbound approach of Merritt Road at the intersection of Sturgis Road operates at a LOS "E" during the forecasted 2035 AM and PM peak hour.
  - c. Eastbound approach of Merritt Road at the intersection of Sturgis Road operates at a LOS "F" during the forecasted 2035 AM and PM peak hour.
  - d. Westbound approach of Universal Drive at the intersection of Sturgis Road operates at a LOS "F" during the forecasted 2035 AM and PM peak hour.
  - e. Northbound approach of Dunsmore Road at the intersection of Sheridan Lake Road operates at a LOS "D" during the forecasted 2035 AM peak hour.
  - f. Southbound approach of Dunsmore Road at the intersection of Sheridan Lake Road operates at a LOS "F" during the forecasted 2035 AM and PM peak hour.
  - g. Southbound Approach of Concourse Drive at the intersection of Twilight Drive operates at a LOS "F" during the 2035 AM and PM peak hours.
  - h. Northbound approach of Pacific Lane at the intersection of Twilight Drive operates at a LOS "D" during the 2035 AM peak hour.
4. The proximity of the railroad tracks across Merritt Road to the intersection of Sturgis Road and Merritt Road may warrant a traffic control signal based upon Warrant 9 (Intersection Near a Grade Crossing) standards.
5. Of the ten (10) intersections reviewed for geometric design deficiencies, the following approaches were identified as having sight distance constraints caused by the horizontal curvature of a particular roadway:
  - a. Southeastbound Boulder Creek Road at the intersection of Silver Mountain Road
  - b. Westbound Neck Yoke Road at the intersection of South Rockerville Road
  - c. Northwestbound Silver City Road at the intersection of US 385
  - d. Southbound Mystic Road at the intersection of Deerfield Road
  - e. Southbound Concourse Drive at the intersection of Twilight Drive
6. Of the ten (10) intersection reviewed for geometric design deficiencies, the following approaches were identified as having sight distance constraints caused by the vertical curvature of a particular roadway:
  - a. Eastbound Merritt Road at the intersection of Sturgis Road
  - b. Westbound Merritt Road at the intersection of Sturgis Road
  - c. Southeastbound Boulder Creek Road at the intersection of Silver Mountain Road
  - d. Westbound Neck Yoke Road at the intersection of South Rockerville Road
  - e. Southbound Mystic Road at the intersection of Deerfield Road
7. Of the ten (10) intersection reviewed for geometric design deficiencies, the following approaches were identified as having sight distance constraints caused by trees on a particular quadrant of the intersection:
  - a. Westbound Neck Yoke Road at the intersection of South Rockerville Road
  - b. Southeastbound Boulder Creek Road at the intersection of Silver Mountain Road





8. Of the ten (10) intersection reviewed for geometric design deficiencies, the following approaches were identified as having a skewed approach that resulted in sight distance constraints, sharp turning maneuvers or both:
- a. Westbound 233<sup>rd</sup> Street at the intersection of 154<sup>th</sup> Avenue
  - b. Northbound Norris Peak Road at the intersection of Nemo Road
  - c. Southwestbound Silver Mountain Road at the intersection of Highway 16

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## INTRODUCTION

As part of the Pennington County Master Transportation Plan, fifteen (15) intersections were studied to determine operational and/or geometric design deficiencies. Table 1 includes descriptions of the fifteen (15) intersections and a summary of analyses completed at each site. The type of analysis conducted at each intersection was selected by FHU based upon insight provided by Pennington County and SDDOT personnel.

TABLE 1 – STUDY SITES AND ANALYSIS SUMMARY

Location	Capacity Analysis	Geometric Design Analysis
Highway 14-16 & 161st Ave	X	
154th Ave & 233rd St	X	X
County Rd & Elk Vale Rd	X	
SD 44 & Covington St	X	
Sturgis Rd (SD 231) & Merritt Rd	X	X
Sturgis Rd (SD 231) & Universal Dr	X	
Dunsmore Rd & Sheridan Lake Rd	X	
Norris Peak Rd & Nemo Rd	X	X
Boulder Hill Rd & Silver Mountain Rd	X	X
S Rockerville Rd & Neck Yoke Rd		X
US 385 & Silver City Rd		X
Deerfield Rd & Mystic Rd		X
Highway 16 & Silver Mountain Rd		X
SD 40 & S Rockerville Rd		X
Twilight Dr & Concourse Dr/Pacific Ln	X	X

## STUDY METHODOLOGY

### Capacity Analysis

Capacity analysis was conducted at ten (10) study intersections to determine motorist delay and level of service (LOS). Delay and LOS was calculated using Synchro modeling software. Synchro is a macroscopic traffic software program based on the intersection capacity methodology found in the 2010 *Highway Capacity Manual* (HCM). The HCM utilizes deterministic equations to aggregate measures of effectiveness for each movement at an intersection. Based upon the modeled vehicle delay, a level of service value can be determined. Levels of service ranges from “A” representing free flow operations to LOS “F” representing oversaturated conditions with volumes typically exceeding capacity (refer to TABLE 1).



TABLE 2 – Level of Service (LOS) Criteria

Control Delay (sec)	LOS By Volume-to-Capacity Ratio	
	$v/c \leq 1$	$v/c > 1$
0-10	A	F
>10-15	B	F
>15-25	C	F
>25-35	D	F
>35-50	E	F
>50	F	F

HCM methodology does not measure aggregated intersection delay for a two-way stop controlled (TWSC) intersection. As a result, critical movements at each intersection were studied to identify any potential operational deficiencies. Critical movements at TWSC intersections include any minor controlled movement and the major street left-turn movements. It is important to note that yield control signs are installed at multiple study approaches. The HCM 2010 does not include methodology for calculating delay at yield controlled approaches. As a result, these approaches were conservatively classified as stop control when calculating motorist delay.

LOS values were calculated at each study intersection to provide insight into the intersection’s current operation and capacity. For new designs, the SDDOT requires that an intersection achieve a LOS “C” or better at all facilities other than interchange ramps. As a result, to identify approaches that should be studied further for capacity expansion or traffic control revision, the LOS “D” was utilized to highlight potential operational deficiency areas. It is important to note that it is not uncommon for stop controlled minor approached to experience LOS “D” or worse at the intersection of major uncontrolled roadways.

Peak hour turning movement counts were collected at each intersection studied for capacity and operations. Based upon insight provided by the SDDOT, the selected AM peak study period was 7:00 am to 9:00 am and the PM peak study period was 4:00 pm to 6:00 pm. The data was collected between February 15<sup>th</sup> 2012 and March 1<sup>st</sup> 2012. Collection was conducted on either Tuesday, Wednesday, or Thursday in order to capture normal travel behavior.

Future turning movement data was assimilated using established growth factors and existing peak hour traffic volumes and distributions for intersections where growth factors varied by approach. Where growth was homogenous throughout the intersection, factors were directly applied to the intersections. Growth factors were established by FHU.

**Geometric Design Analysis**

Geometric design analysis was studied to identify any geometric features that may lend themselves to increased crash potential. Geometric design analysis was conducted through a field review. Where applicable, existing conditions were compared with standards and guidelines from AASHTO’s 2010 *Policy on Geometric Design of Highways and Streets* (Green Book) and FHWA’s 2009 *Manual of Uniform Traffic Control Devices* (MUTCD). Actual field measurements were not taken as part of this



study. It may be appropriate to collect detailed geomtric survey data to verify these observations as planning evolves into project development.

**Warrant Analysis**

Warrant analyses were conducted to determine if traffic control signals were warranted to improve traffic operations. Analyses were completed at intersections where existing or forecasted delays correlated to LOS “D” or worse. Warrant analyses were based upon standards outlined in the 2009 Manual on Uniform Traffic Control Devices (MUTCD) published by the Federal Highway Administration. Each warrant requires a unique variety of data requirements including; traffic volumes, pedestrian volumes, crash data, and context specific studies in school zones and adjacent to railroad grade crossings.

Only applicable warrants were studied at each intersection. It is important to note that pedestrian activity was minimal throughout the study area. In fact, the highest existing pedestrian hour on any study approach was nearly 70 pedestrians short of meeting the minimum Warrant 4 (Pedestrian Volume) standard. As result, this warrant was not studied for future scenarios.

For the context of this study only Warrant 1 (Eight-Hour Vehicular Volume) and Warrant 2 (Four-Hour Vehicular Volume) were studied at intersections with delays correlating to LOS “D” or worse. These warrants include a variety of scenarios and corresponding standards to warrant a traffic control signal based upon intersecting traffic volumes.

These warrants require multiple hours of data. However, the scope of this study only included data collection during the AM and PM peak hours. Without 8 hours of turning movement data, average distributions were utilized to estimate whether this intersection meets Warrants 1 and 2 for 2035 traffic conditions. Average distribution data was not readily available for Rapid City, Pennington County or South Dakota. As a result, data provided in the 2011 Traffic Report produced by the North Dakota Department of Transportation was utilized. Distribution percentages utilized to estimate whether an intersection is expected to meet traffic signal control warrants can be reviewed on TABLE 2. It is important to note distribution data corresponding to a collect was used for roadways classified as local roads. Prior to traffic control signal installation, full-day traffic counts should be collected to validate any estimates.

TABLE 3 – Hourly Traffic Distributions

Roadway Classification	Percentage of Daily Traffic		
	Peak Hour	4th Highest Hour	8th Highest Hour
Rural Principal Arterial	7.6%	6.6%	6.1%
Rural Minor Arterial	7.9%	6.3%	5.7%
Rural Major Collector	7.6%	6.7%	5.7%
Urban Principal Arterial	8.1%	7.1%	6.2%
Urban Minor Arterial	8.2%	7.0%	5.8%
Urban Collector	9.5%	7.9%	6.5%

Source: North Dakota Department of Transportation





In addition to Warrants 1 and 2, Warrant 9 (Intersection Near a Grade Crossing) was applied at intersections within 140 feet of a railroad crossing where the approach traversing the crossing is either stop and or yield controlled. Analysis of this warrant includes studying the intersection's proximity to a railroad crossing, frequency of rail traffic and percentage of high-occupancy busses and tractor-trailer trucks on the minor approach that crosses the railroad track. These considerations are incorporated into volume adjustment factors and warrant curves which can be reviewed further in the MUTCD.

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## EXISTING CONDITIONS ASSESSMENT

### Highway 14-16 & 161st Avenue – Capacity Analysis Only



FIGURE 1 – Hwy 14-16 & 161<sup>st</sup> Avenue Intersection Configuration

TABLE 4 - Hwy 14-16 & 161<sup>st</sup> Avenue Capacity Analysis – 2012

Study Site	Approach	AM Peak - 2012						PM Peak - 2012					
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c				
				Left	Thru	Right			Left	Thru	Right		
Hwy 14 16 & 161st Ave	EB	6.2	A	0.05	-	-	4.7	A	0.04	-	-		
	WB	0	A	-	-	-	0	A	-	-	-		
	SB	9	A	0.12			8.8	A	0.06				

TABLE 5 – Hwy 14-16 & 161<sup>st</sup> Avenue Capacity Analysis – 2035

Study Site	Approach	AM Peak - 2035						PM Peak - 2035					
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c				
				Left	Thru	Right			Left	Thru	Right		
Hwy 14 16 & 161st Ave	EB	6.2	A	0.07	-	-	4.7	A	0.05	-	-		
	WB	0	A	-	-	-	0	A	-	-	-		
	SB	9.3	A	0.17			9.1	A	0.08				

#### Capacity Analysis

Minimal traffic volumes at this intersection result in LOS "A" for all approaches during existing 2012 and forecasted 2035 AM and PM peak periods. This indicates that the existing capacity and traffic operations at this intersection are adequate through the year 2035 based upon SDDOT standards.



Although geometric design was not requested at this intersection, access management strategies may be appropriate at the driveways adjacent to this intersection.

**154th Avenue & 233rd Street – Capacity and Geometric Design Analysis**



FIGURE 2 – 154<sup>th</sup> Avenue & 233<sup>rd</sup> Street Intersection Configuration

TABLE 6 - 154<sup>th</sup> Avenue & 233<sup>rd</sup> Street Capacity Analysis – 2012

Study Site	Approach	AM Peak - 2012						PM Peak - 2012					
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c				
				Left	Thru	Right			Left	Thru	Right		
154th Ave & 233rd St	WB	8.7	A	0.01			8.4	A	0				
	NB	0	A	-	-	-	0	A	-	-	-		
	SB	1.7	A	0.002	-	-	3.6	A	0	-	-		

TABLE 7 – 154<sup>th</sup> Avenue & 233<sup>rd</sup> Street Capacity Analysis – 2035

Study Site	Approach	AM Peak - 2035						PM Peak - 2035					
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c				
				Left	Thru	Right			Left	Thru	Right		
154th Ave & 233rd St	WB	8.7	A	0.02			8.5	A	0.002				
	NB	0	A	-	-	-	0	A	-	-	-		
	SB	1.7	A	0.002	-	-	3.6	A	0.001	-	-		



Capacity Analysis

Minimal traffic volumes at this intersection result in LOS “A” for all approaches during existing 2012 and forecasted 2035 AM and PM peak periods. This indicates that the existing capacity and traffic operations at this intersection are adequate through the year 2035 based upon SDDOT standards.

Geometric Design Analysis

The westbound approach of 233<sup>rd</sup> Street merges with 154<sup>th</sup> Avenue at an acute angle. This angle requires drivers performing a westbound to southbound left-turn movement to look over their shoulder to check for oncoming traffic. This is a particular concern when multiple vehicles are making this movement in succession. For example, if the first vehicle stops, the following vehicles may not be looking in the correct direction to notice the stopped vehicle ahead of them. This intersection may benefit from realignment of the westbound approach of 233<sup>rd</sup> Street South to meet at 90° with 154<sup>th</sup> Avenue. If this improvement is implemented, it may be appropriate to align the driveway on the west approach to line up with 233<sup>rd</sup> Street to avoid a negatively offset intersection.

**Elk Vale Road & Country Road – Capacity Analysis Only**

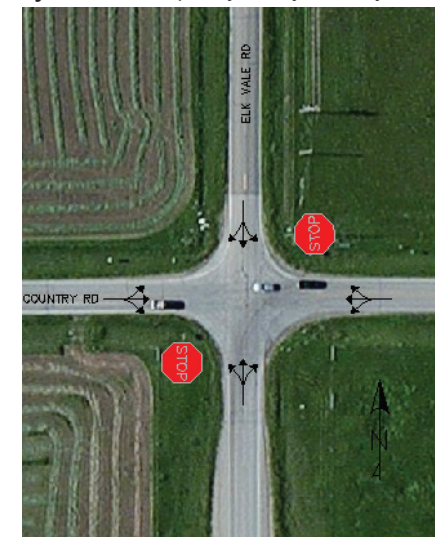


FIGURE 3 – Elk Vale Road & Country Road Intersection Configuration

TABLE 8 - Elk Vale Road & Country Road Capacity Analysis – 2012

Study Site	Approach	AM Peak - 2012						PM Peak - 2012					
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c				
				Left	Thru	Right			Left	Thru	Right		
Elk Vale Rd and Country Rd	EB	9.7	A	0.11			10.2	B	0.08				
	WB	10.7	B	0.11			11.3	B	0.14				
	NB	2	A	0.01	-	-	2.6	A	0.03	-	-		
	SB	0.3	A	0.003	-	-	1.2	A	0.005	-	-		



TABLE 9 – Elk Vale Road & Country Road Capacity Analysis – 2035

Study Site	Approach	AM Peak - 2035					PM Peak - 2035				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
Elk Vale Rd and Country Rd	EB	10.3	B	0.08			11.1	B	0.12		
	WB	11.9	B	0.01			13	B	0.21		
	NB	2	A	0.02	-	-	2.6	A	0.05	-	-
	SB	0.4	A	0.004	-	-	1.2	A	0.007	-	-

Capacity Analysis

Minimal traffic volumes at this intersection result in LOS “A” of “B” for all approaches during the existing 2012 and forecasted 2035 AM and PM peak periods. This indicates that the existing capacity and traffic operations at this intersection are adequate through the year 2035 based upon SDDOT standards.

**SD 44 & Covington Street- Capacity Analysis Only**

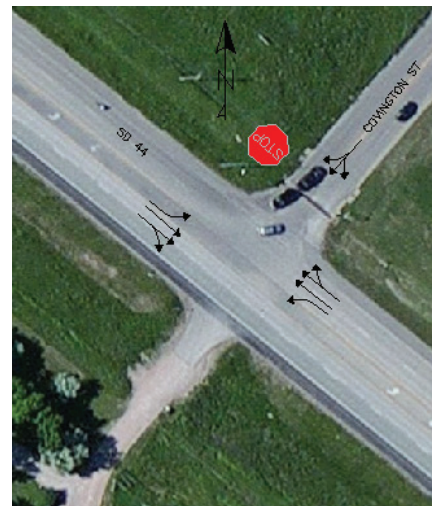


FIGURE 4 – SD 44 & Covington Street Intersection Configuration



TABLE 10 – SD 44 & Covington Street Capacity Analysis - 2012

Study Site	Approach	AM Peak - 2012					PM Peak - 2012				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
SD 44 & Covington St	EB	4.4	A	0.2	-	-	2.8	A	0.27	-	-
	WB	0	A	-	-	-	0	A	-	-	-
	SB	37	E	0.84			15.1	C	0.33		

TABLE 11 – SD 44 & Covington Street Capacity Analysis – 2035

Study Site	Approach	AM Peak - 2035					PM Peak - 2035				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
SD 44 & Covington St	EB	7.4	A	0.51	-	-	4.7	A	0.62	-	-
	WB	0	A	-	-	-	0	A	-	-	-
	SB	1160.1	F	3.5			856.4	F	2.7		

Capacity Analysis

The southbound stop-controlled approach on Covington Street experiences LOS “E” for the AM peak period and LOS “C” for the PM peak period. This is the result of higher traffic volumes on the Covington Street approach during the AM peak period compared to the PM peak period. Covington Street primarily provides access to residential neighborhoods. As a result, it is not abnormal for the AM peak to experience higher traffic volumes as motorists utilize this intersection to commute from their homes to work and return onto Covington Street from SD 44 during the PM peak period.

As traffic volumes increase through the horizon year of 2035, the LOS on the southbound approach is anticipated to decrease to LOS “F” with the existing intersection configuration. The LOS “E” experienced during the existing AM peak hour and LOS “F” experienced during the forecasted peak AM and PM peak hour is below the SDDOT standard LOS threshold value. This indicates that traffic delay mitigation strategies including but not limited to intersection capacity expansion or traffic control revision may be appropriate at this intersection to reduce overall motorist delay and improve the traffic operations of the intersection. It is important to note that due to the high traffic volumes experienced on SD 44, installation of new turn lanes on Covington Street is not anticipated to reduce motorist delays enough to affect the LOS.

Warrant Analysis

The MUTCD stipulates that engineering judgment should be utilized to determine if right-turning traffic from the minor approach should be included or omitted from warrant analyses. During the existing peak hour (AM) a distribution of 99% right-turn vehicles is experienced. Similarly, during the forecasted 2035 peak hour (AM) experiences a 98% right-turn distribution. Intuitively, removing the right-turning vehicles from the traffic stream would not meet traffic signal warrants.

During the 2035 peak hour, the westbound SD 44 approach experiences 1140 vehicles. A uniform distribution of these vehicles would yield major stream headways of approximately 3 seconds for the



westbound traffic. This is less than half the critical gap time for right turns from stop controlled approaches. Although a uniform headway distribution would not be observed in the field, this exercise illustrates how omitting all right-turning vehicles may not be appropriate at this location.

If right-turn lanes are included in the analysis, this intersection warrants a traffic control single based upon Warrant 1 (Eight-Hour Vehicular Volume) and Warrant 2 (Four-Hour Vehicular Volume) standards for existing and forecasted traffic conditions. Furthermore, if only the conflicting westbound SD 44 through-moving and southbound Covington Street right-turning movements are analyzed, these volumes warrant a traffic control signal for forecasted traffic volumes.

**Sturgis Road & Merritt Road- Capacity and Geometric Design Analysis**

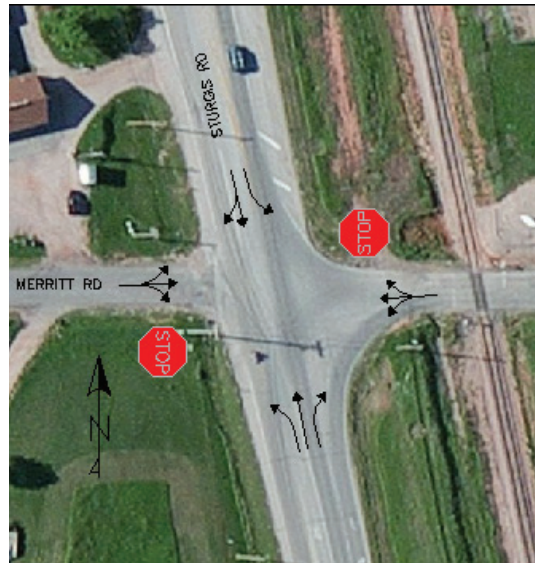


FIGURE 5 – Sturgis Road & Merritt Road Intersection Configuration

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TABLE 12 – Sturgis Road & Merritt Road Capacity Analysis – 2012

Study Site	Approach	AM Peak - 2012					PM Peak - 2012				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
Sturgis Rd & Merritt Rd	EB	15.2	C	0.12			14.6	B	0.06		
	WB	21.9	C	0.43			24.8	D	0.37		
	NB	0.2	A	0.004	-	-	0.5	A	0.04	-	-
	SB	0.4	A	0.02	-	-	1	A	0.03	-	-

TABLE 13 – Sturgis Road & Merritt Road Capacity Analysis – 2035

Study Site	Approach	AM Peak - 2035					PM Peak - 2035				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
Sturgis Rd & Merritt Rd	EB	39	E	0.42			38.1	E	0.28		
	WB	350.8	F	1.6			220.9	F	1.2		
	NB	0.3	A	0.01	-	-	0.5	A	0.06	-	-
	SB	0.3	A	0.03	-	-	1.1	A	0.07	-	-

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**Capacity Analysis**

The westbound stop controlled approach of Merritt Road experiences delays that are unacceptable according to SDDOT standards during the existing PM peak hour. Furthermore, vehicle queues spillback across the adjacent railroad tracks during AM and PM peak hours. As traffic volumes increase through the study horizon of 2035, motorist delay on the eastbound and westbound approaches increase. This results in LOS values below LOS “C” on both approaches during the forecasted AM and PM peak hour. The LOS “E” and “F” experienced on these approaches indicates that traffic delay mitigation strategies including but not limited to intersection capacity expansion or traffic control revision may be appropriate at this intersection to reduce overall motorist delay and improve the traffic operations of the intersection. It is important to note that due to the existing and forecasted traffic volumes on Sturgis Road, installation of an additional turn lane does not improve traffic operations enough to improve the LOS on westbound approach of Merritt Road.

**Warrant Analysis**

As noted in the capacity analysis, westbound Universal Drive vehicles queues spillback across the adjacent railroad tracks. Although studying crash data was beyond the scope of this study, queuing across railroad crossings has obvious crash implications. One potential remedy is the installation of a traffic control signal with railroad preemption and vehicle detection to dissipate queues prior to train crossings. To determine if this intersection warrants a signal, Warrant 1 (Eight-Hour Vehicular Volume), Warrant 2 (Four-Hour Vehicular Volume) and Warrant 9 (Intersection Near a Grade Crossing) were studied.

Warrant 9 is applied during the highest traffic volume hour during which rail traffic uses the crossing. Collecting train frequency data was beyond the scope of this study. As a result, the peak hour of traffic was conservatively utilized. Utilizing the existing lane configuration and applying the appropriate adjustment factors for percentage of high-occupancy buses and tractor-trailer trucks to the existing PM peak hour, this intersection meets Warrant 9 standards for 1 train during the peak hour.

It is important to note that another alternative would be installing an additional turn lane. Installing turn lane(s) on the westbound approach has the potential to improve the queuing capacity between the intersection and the railroad tracks. As noted in the capacity analysis section, the addition of the turn-lane is not anticipated to improve the LOS at this approach. Warrant 9 is still met with 2 approach lanes during the existing PM peak hour. In addition to meeting Warrant 9, this intersection is estimated to meet Warrant 1 (Eight-Hour Vehicular Volume) and Warrant 2 (Four-Hour Vehicular Volume) for forecasted 2035 traffic volumes.



**Geometric Design Analysis**

The only geometric design concern noted at this intersection is the intersection’s proximity to the railroad tracks to the east as noted in the capacity analysis section.

**Sturgis Road & Universal Drive- Capacity Analysis Only**

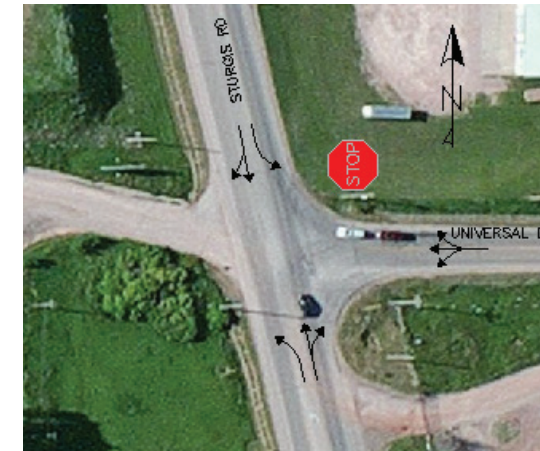


FIGURE 6 – Sturgis Road & Universal Drive Intersection Configuration

TABLE 14 – Sturgis Road & Universal Drive Capacity Analysis - 2012

Study Site	Approach	AM Peak - 2012					PM Peak - 2012				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
Sturgis Rd & Universal Dr	WB	14.8	B	0.12			18.1	C	0.44		
	NB	0	A	-	-	-	0	A	-	-	-
	SB	2.2	A	0.16	-	-	2.5	A	0.09	-	-

TABLE 15 – Sturgis Road & Universal Drive Capacity Analysis – 2035

Study Site	Approach	AM Peak - 2035					PM Peak - 2035				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
Sturgis Rd & Universal Dr	WB	431	F	1.7			305	F	1.5		
	NB	0	A	-	-	-	0	A	-	-	-
	SB	2.2	A	0.25	-	-	5.1	A	0.22	-	-

**Capacity Analysis**

All approaches at the intersection of Sturgis Road and Universal Drive currently operate at LOS “C” or better during AM and PM peak periods. This indicates that the existing capacity and traffic operations at this intersection are adequate at this time based upon SDDOT standards. It is important to note that the



westbound PM peak hour motorist delay on Universal Drive is only 1 second away from experiencing LOS “D” operations.

As traffic growth is experienced at this intersection, the LOS “D” threshold is surpassed on the westbound approach of Universal Drive during both the AM and PM peak 2035 period. This approach experiences LOS “F” during these periods. This indicates that traffic delay mitigation strategies including but not limited to intersection capacity expansion or traffic control revision may be appropriate at this intersection to reduce overall motorist delay and improve the traffic operations of the intersection.

Although geometric design was not requested at this intersection, access management strategies may be appropriate at the driveways adjacent to this intersection.

**Warrant Analysis**

As previously noted, the MUTCD relies on engineering judgment to determine the applicable percentage of right-turns to subtract from warrant analysis. During the existing PM peak hour, the period experiencing the highest levels of delay, a distribution of 92% right-turn vehicles is experienced. Similarly during the forecasted 2035 peak hour an 82% right-turn distribution is experienced. Intuitively, removing the right-turning vehicles from the traffic stream would not meet traffic signal warrants.

Under 2035 traffic conditions 750 through movements are forecasted northbound on Sturgis Road. If a uniform distribution is assumed, the northbound headway available for right turns from Universal Drive would be 5 seconds. This value is less than the critical gap for right-turning vehicles under stop control. As such, additional field observation may be warranted to determine the proportion of right turns which should be omitted from the warrant analysis. If right-turning movements are not removed from the warrant analysis, this intersection meets Warrant 1 (Eight-Hour Vehicular Volume) and Warrant 2 (Four-Hour Vehicular Volume) standards for traffic control signal installation for existing and forecasted traffic volume scenarios. Furthermore, if only the conflicting northbound Sturgis Road through movements and westbound Universal Drive right-turning movements are analyzed, these volumes warrant a traffic control signal for forecasted 2035 traffic volumes.

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**Dunsmore Road & Sheridan Lake Road- Capacity Analysis Only**

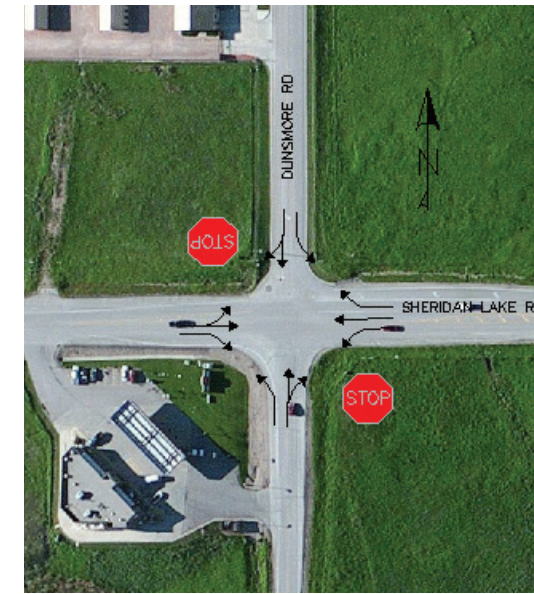


FIGURE 7 – Dunsmore Road & Sheridan Lake Road Intersection Configuration

TABLE 16 –Dunsmore Road & Sheridan Lake Road Capacity Analysis - 2012

Study Site	Approach	AM Peak - 2012					PM Peak - 2012				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
Dunsmore Rd & Sheridan Lake Rd	EB	0.1	A	0.006	-	-	0.5	A	0.01	-	-
	WB	0.9	A	0.02	-	-	0.9	A	0.05	-	-
	NB	16.2	C	0.08	0.22		14.7	B	0.11	0.08	
	SB	90.1	F	0.96	0.11		21.5	C	0.26	0.04	

TABLE 17 – Dunsmore Road & Sheridan Lake Road Capacity Analysis – 2035

Study Site	Approach	AM Peak - 2035					PM Peak - 2035				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
Dunsmore Rd & Sheridan Lake Rd	EB	0.1	A	0.009	-	-	0.5	A	0.02	-	-
	WB	1.1	A	0.04	-	-	0.9	A	0.08	-	-
	NB	25.4	D	0.2	0.4		21.6	C	0.25	0.14	
	SB	766	F	2.8	0.23		48	E	0.58	0.08	



**Capacity Analysis**

The southbound controlled approach on Dunsmore Road experiences LOS “F” for the AM peak period and LOS “C” for the PM peak period. This is the result of higher traffic volumes during the AM peak period on this approach of Dunsmore Road, particularly the southbound left-turn movement. Dunsmore Road primarily provides access to residential neighborhoods. As a result, it is normal for the AM peak to experience higher traffic volumes as motorists utilize the southbound approach to access Sheridan Lake Road to commute from their homes to work and return home via Dunsmore Road from Sheridan Lake Road.

As traffic volumes increase through the study horizon of 2035, motorist delay on the northbound and southbound approaches increase. This results in LOS values below the “C” threshold on the northbound approach during the AM 2035 peak hour and on the southbound approach during both the AM and PM 2035 peak hours. This indicates that traffic delay mitigation strategies including but not limited to intersection capacity expansion or traffic control revision may be appropriate at this intersection to reduce overall motorist delay and improve the traffic operations of the intersection.

It is important to note that the eastbound approach of Sheridan Lake Road is configured with a right-turn lane and a combination left-through lane. The opposing approach has dedicated turn lanes for each movement (left, through and right). To align this roadway without an offset, the eastbound area opposing the westbound left-turn lane is marked with double yellow stripes to restrict vehicle from utilizing this area for left-turns. However, judging by the degree of pavement marking fading relative to surrounding markings it may be assumed that it is not uncommon for this area to be utilized as a left-turn lane.

**Warrant Analysis**

Based upon existing and forecasted traffic volumes, this intersection meets Warrant 1 (Eight-Hour Vehicular Volume) to install a traffic control signal. It is important to note that this intersection would not meet warrants if the speed on Sheridan Lake road is reduced to 40 miles per hour (mph) or less. Currently, the speed limit is 45 mph to the west and 50 mph to the east.

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**Nemo Road & Norris Peak Road – Capacity and Geometric Design Analysis**



FIGURE 8 – Nemo Road & Norris Peak Road Intersection Configuration

TABLE 18 – Nemo Road and Norris Peak Road Capacity Analysis - 2012

Study Site	Approach	AM Peak - 2012						PM Peak - 2012					
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c				
				Left	Thru	Right			Left	Thru	Right		
Nemo Rd & Norris Peak Rd	EB	0	A	-	-	-	0	A	-	-	-		
	NB	8.5	A	0.03			8.6	A	0.004				
	SB	0.5	A	0.001	-	-	3.1	A	0.01	-	-		

TABLE 19 – Nemo Road and Norris Peak Road Capacity Analysis – 2035

Study Site	Approach	AM Peak - 2035						PM Peak - 2035					
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c				
				Left	Thru	Right			Left	Thru	Right		
Nemo Rd & Norris Peak Rd	EB	0	A	-	-	-	0	A	-	-	-		
	NB	8.6	A	0.04			8.6	A	0.005				
	SB	0.4	A	0.001	-	-	3.2	A	0.02	-	-		

**Capacity Analysis**

Minimal traffic volumes at this intersection result in LOS “A” for all approaches during existing 2012 and forecasted 2035 AM and PM peak periods. This indicates that the existing capacity and traffic operations at this intersection are adequate through the year 2035 based upon SDDOT standards.

**Geometric Design Analysis**

The westbound approach of Norris Peak Road merges with Nemo Road at an acute angle. This angle requires drivers performing a northbound to northeastbound right-turn movement to look over their shoulder to check for oncoming traffic. This scenario requires motorists to look in a direction opposite to the direction of their vehicle to identify the presence of oncoming vehicles. This is a particular concern when multiple vehicles are making this movement in succession. For example, if the first vehicle stops,



the following vehicles may not be looking in the correct direction to notice the stopped vehicle ahead of them.

The approach angle of Norris Peak Road at the intersection of Nemo Road and the radius of the curve on the southeast quadrant of the intersection results in sharp left and right turning maneuvers between the roadways (refer to FIGURE 9). The sharp right-turn maneuver from Nemo Road onto Norris Peak Road requires an abnormally slow turning speed that may potentially interfere with driver expectance. Similarly, the sharp left-turn maneuver may result in significant speed differentials between motorists on Nemo Road and motorists turning onto Nemo Road. Turn lanes have the potential to separate turning traffic from through traffic and alleviate concern regarding speed differentials.



FIGURE 9 – Roadway Curvature on Nemo Road with Norris Peak Road in the Background (Camera Facing South)

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**Silver Mountain Road & Boulder Hill Road – Capacity and Geometric Design Analysis**



FIGURE 10 – Silver Mountain Road & Boulder Hill Road Intersection Configuration

TABLE 20 – Silver Mountain Road & Boulder Hill Road Capacity Analysis - 2012

Study Site	Approach	AM Peak - 2012						PM Peak - 2012					
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c				
				Left	Thru	Right			Left	Thru	Right		
Silver Mountain Rd & Boulder Hill Rd	EB	3.4	A	0.001	-	-	4.9	A	0.001	-	-		
	WB	0	A	-	-	-	0	A	-	-	-		
	SB	8.6	A	0.005			8.6	A	0.002				

TABLE 21 – Silver Mountain Road & Boulder Hill Road Capacity Analysis – 2035

Study Site	Approach	AM Peak - 2035						PM Peak - 2035					
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c				
				Left	Thru	Right			Left	Thru	Right		
Silver Mountain Rd & Boulder Hill Rd	EB	3.4	A	0.001	-	-	5.1	A	0.002	-	-		
	WB	0	A	-	-	-	0	A	-	-	-		
	SB	8.6	A	0.008			8.6	A	0.002				

Capacity Analysis

Minimal traffic volumes at this intersection result in LOS “A” for all approaches during existing 2012 and forecasted 2035 AM and PM peak periods. This indicates that the existing capacity and traffic operations at this intersection are adequate through the year 2035 based upon SDDOT standards.

Geometric Design Analysis

The horizontal curvature and presence of existing trees on Boulder Hill Road as the roadway intersects with Silver Mountain Road limits sight distance. Additionally, field observation also indicated that vertical sight distance constraints exist between southbound motorists on Boulder Hill Road and westbound motorists on Silver Mountain Road (refer to FIGURE 11).





FIGURE 11 – Vertical Curvature on Silver Mountain Road with Boulder Hill Road in the Background (Camera Facing Northeast)



FIGURE 13 – Vertical Curvature on S Rockerville Rd (Camera Facing South)

**South Rockerville Road & Neck Yoke Road – Geometric Design Analysis Only**

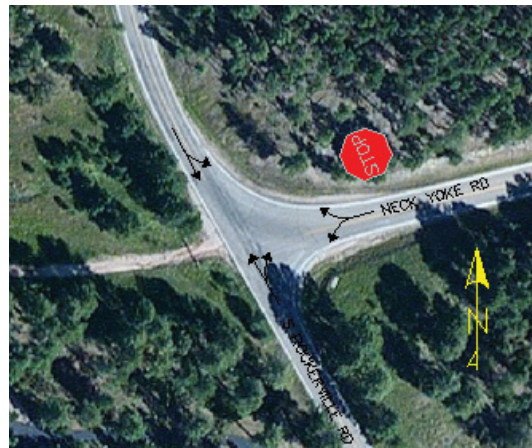


FIGURE 12 – S Rockerville Road & Neck Yoke Rd Intersection Configuration



FIGURE 14 – Limited Sight Distance From Neck Yoke Road Approach (Camera Facing North Approach of S Rockerville Road)

Geometric Design Analysis

The horizontal curvature of South Rockerville Road and the presence of trees on the northeast and southeast quadrants of the intersection create sight distance limitations for motorists on Neck Yoke Road. Additionally, field observation indicated that higher elevation of the northbound approach of South Rockerville Road may present sight distance issues for turning vehicles from Neck Yoke Road. FIGURES 15-16 illustrate sight distance constraints.



**US 385 & Silver City Road – Geometric Design Analysis Only**



FIGURE 15 – US 385 & Silver City Road Intersection Configuration

Geometric Design Analysis

The rolling landscape and horizontal curvature present at this intersection create vertical sight distance constraints particularly between motorists on Silver City Road and northwestbound motorists on U.S. 385.

**Deerfield Road & Mystic Road – Geometric Design Analysis Only**



**FIGURE 16 – Deerfield Road & Mystic Road Intersection Configuration**

Geometric Design Analysis

The horizontal and vertical curvature leading up to the intersection create sight distance constraints for motorists on Mystic Road. Furthermore, the sharp curvature of Deerfield Road may become difficult to navigate during times of inclement weather.

**Highway 16 & Silver Mountain Road – Geometric Design Analysis Only**

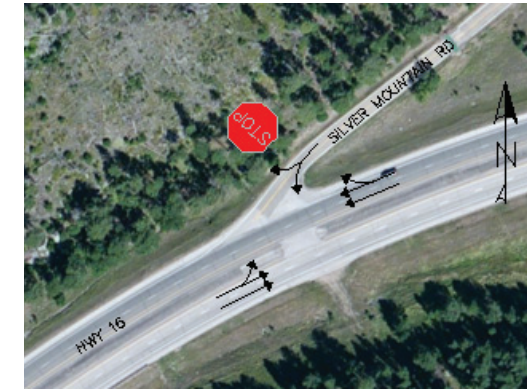


FIGURE 17 – Highway 16 & Silver Mountain Road Intersection Configuration

Geometric Design Analysis

The southwestbound approach of Silver Mountain Road merges with Highway 16 at an acute angle. This angle requires drivers performing a Southwestbound to westbound right-turn movement to look over their shoulder to check for oncoming traffic. This scenario requires motorists to look in a direction opposite to the direction of their vehicle to identify the presence of oncoming vehicles. This is a particular concern when multiple vehicles are making this movement in succession. For example, if the first vehicle stops, the following vehicles may not be looking in the correct direction to notice the stopped vehicle ahead of them.

The approach angle of Silver Mountain Road at the intersection of Highway 16 and the radius of the curve on the southeast quadrant of the intersection results in sharp left and right turning maneuvers between the roadways. The sharp right-turn maneuver from Silver Mountain Road onto Highway 16 requires an abnormally slow turning speed that may potentially interfere with driver expectance. Similarly, the sharp left-turn maneuver may result in significant speed differentials between motorists on Highway 16 and motorists turning onto Highway 16. Additionally, the approach angle of Silver Mountain Road may cause visibility difficulties for motorists on this roadway looking westbound. Turn lanes have the potential to separate turning traffic from through traffic and alleviate concern regarding speed differentials.



**SD 40 & S Rockerville Road - Geometric Design Analysis Only**

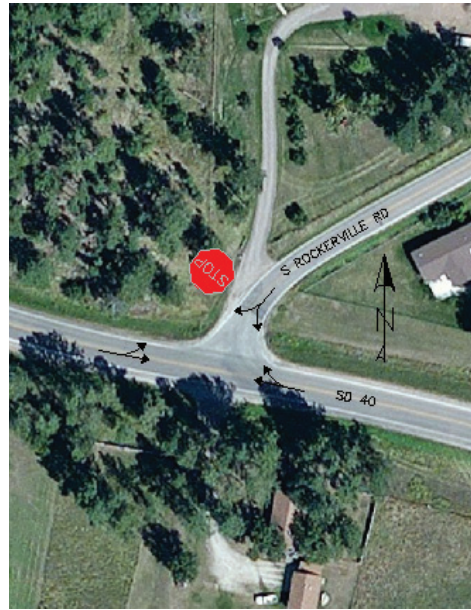


FIGURE 18 – SD 40 & S Rockerville Rd Intersection Configuration

Geometric Design Analysis

The horizontal curvature of SD 40 and the presence of trees on the northwest quadrant of the intersection create sight distance limitations for motorists on South Rockerville Road (refer to FIGURE 21). Additionally, a private driveway merges with South Rockerville Road at a skewed angle which may cause driver expectancy concerns as motorists navigate the winding South Rockerville Road headed southbound.

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FIGURE 19 – Limited Sight Distance Facing West Along SD 40 from S Rockerville Rd

**Twilight Drive & Concourse Drive/Pacific Drive – Capacity and Geometric Design Analysis**

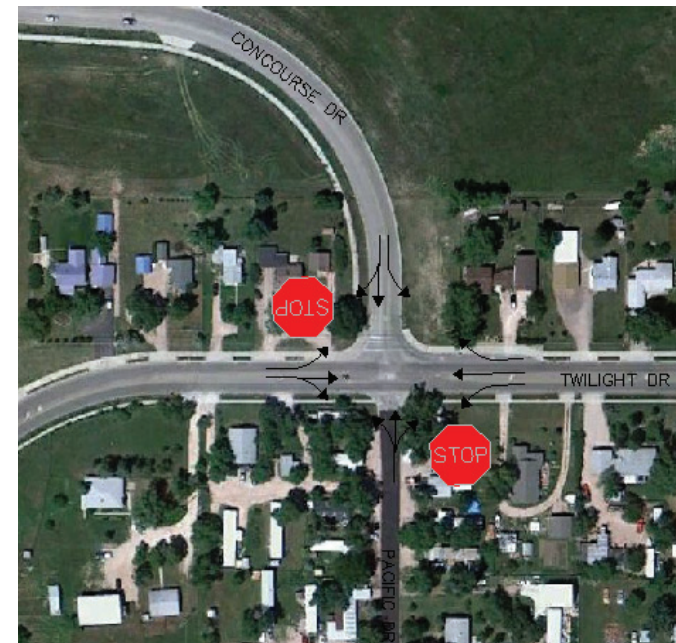


FIGURE 20 – Twilight Drive & Concourse Drive/Pacific Drive Intersection Configuration



TABLE 22 – Twilight Drive & Concourse Drive/Pacific Drive Capacity Analysis - 2012

Study Site	Approach	AM Peak - 2012					PM Peak - 2012				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
Twilight Dr & Concourse Dr/Pacific Dr	EB	2.3	A	0.069	-	-	0.7	A	0.026	-	-
	WB	0	A	0	-	-	0.1	A	0.003	-	-
	NB	19	C	0.067			15.1	C	0.091		
	SB	48.9	E	0.71	0.023		240.5	F	1.5	0.1	

TABLE 23 – Twilight Drive & Concourse Drive/Pacific Drive Capacity Analysis - 2035

Study Site	Approach	AM Peak - 2035					PM Peak - 2035				
		Delay (sec)	LOS	v/c			Delay (sec)	LOS	v/c		
				Left	Thru	Right			Left	Thru	Right
Twilight Dr & Concourse Dr/Pacific Dr	EB	2.6	A	0.12	-	-	0.8	A	0.04	-	-
	WB	0	A	0	-	-	0.1	A	0.004	-	-
	NB	31.6	D	0.16			20.8	C	0.17		
	SB	400.8	F	1.7	0.039		931.2	F	3.1	0.18	



FIGURE 21 - Limited Sight Distance Facing North Along Concourse Drive

Capacity Analysis

The southbound stop controlled approach of Concourse Drive fails to meet the SDDOT LOS threshold value of “C” for any of the four study periods. In fact, this approach experienced a LOS “F” for all study periods other than the 2012 AM peak hour where a LOS “E” was achieved. The primary reason for these deficient LOS values is the combination of high volumes of left-turning traffic on this approach versus the high conflicting volumes on Twilight Drive. Left-turn traffic accounts for 95% and 91% of the AM and PM peak hour traffic on the Concourse Drive approach. It is important to note that a left-turn lane currently exists for this movement. Although the traffic volumes on the northbound approach of Pacific Drive are minimal (peak of 24 vehicles for 2012 conditions), the high volumes of cross traffic create delays on this approach that correspond with a LOS “D” during the 2035 AM peak hour.

Warrant Analysis

This intersection is not estimated to meet any traffic control signal warrants for either existing or forecasted 2035 traffic conditions.

Geometric Design Analysis

The horizontal curvature and presence of existing trees on Concourse Drive as the roadway approaches Twilight Drive limits sight distance. The limited sight distance may result in abrupt stops as motorists round the corner of Concourse Drive and encounter the stop sign at this intersection. Additionally, during the field review it was noted that a school bus stopped in the eastbound Twilight Drive through lane just east of the Pacific Lane/Concourse Drive intersection after turning off of Concourse Drive. To complete the sharp turning movement necessary to stop at this location the bus occupied both approach lanes on Concourse Drive at this intersection.



## APPENDIX E COST ANALYSIS WORKSHEETS

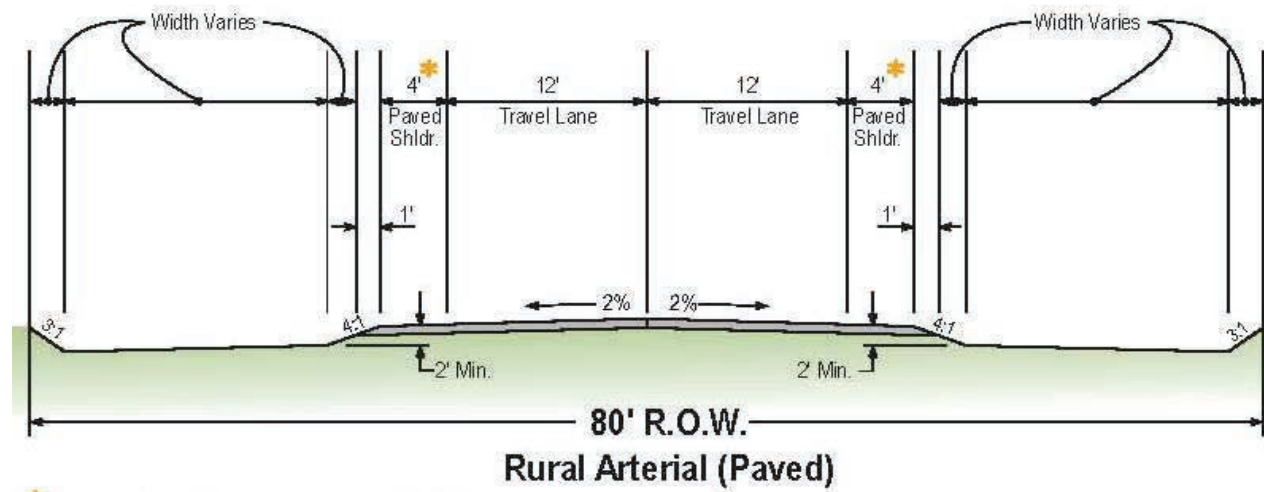
**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**Sage Creek Road (237th Street to SD 44)**



Date Prepared: June 25, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS \$750,000	1	\$750,000	
2 Unclassified Excavation (CIP)	CY \$10	638,538	\$6,385,378	3.17' cut to recondition soil & apply 6" ABC & HBP
3 Bridge Structure	SF \$120	5,400	\$648,000	East of Sage Creek Campground
4 HBP (Grading S) (100) (PG 76-28)	Ton \$63	190,690	\$12,013,470	Assum 8" (4' Shoulders)
5 Aggregate Base Course (Class 6)	CY \$26	72,230	\$1,877,980	Assum 6"
6 Embankment Material (Special) (R-50)	CY \$12	144,460	\$1,733,520	Assum 1'
7 Traffic Signals	Each \$250,000	0	\$0	
			\$23,408,348	

	% Range	% Used	Cost
Project Construction Bid Items	Project Dependent	N / A	\$23,408,348 (A)
Contingencies	(15 - 30%) of A	30.0%	\$7,022,504 (B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$1,521,543 (D)
Drainage / Irrigation	(4 - 10%) of (A+B)	6.0%	\$1,825,851 (E)
Signing and Striping	(1 - 5%) of (A+B)	3.0%	\$912,926 (F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	2.0%	\$608,617 (G)
Lighting	(1 - 5%) of (A+B)	1.0%	\$304,309 (H)
Landscaping	(1 - 5%) of (A+B)	1.0%	\$304,309 (I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$1,436,336 (J)
ROW	Lump Sum	N / A	\$0 (K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$37,345,000</b>



\* 6' shoulder to be considered along bicycle routes

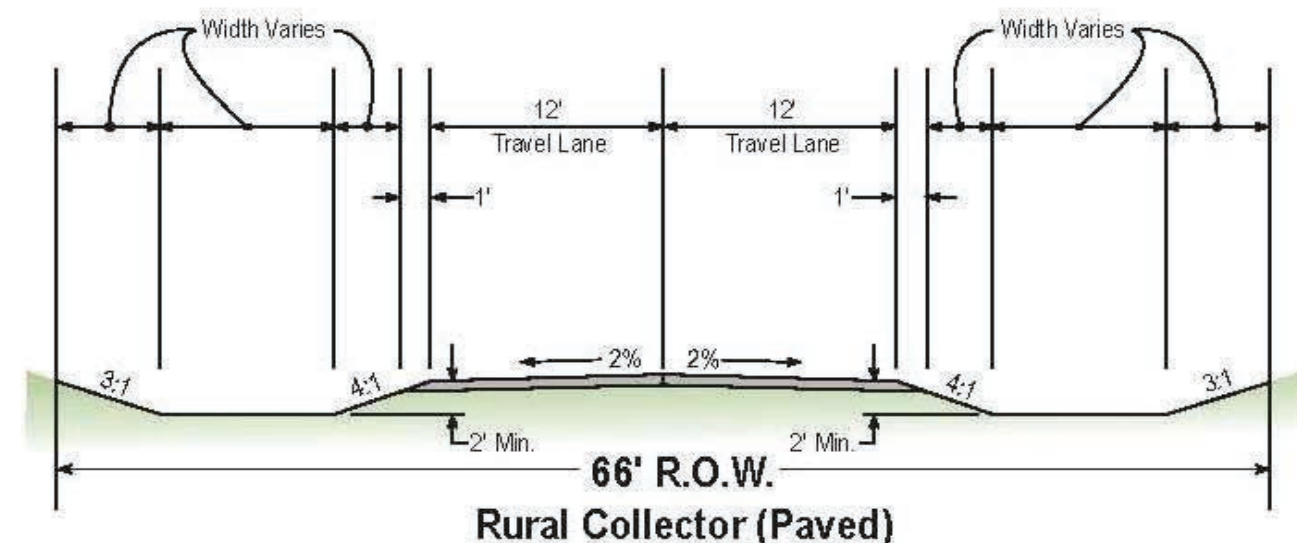
**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**Reno Gulch Road (Reno Gulch Park to US 385)**



Date Prepared: June 25, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS \$100,000	1	\$100,000	
2 Unclassified Excavation (CIP)	CY \$10	91,425	\$914,246	3' cut to recondition soil & apply 6" ABC & HBP
3 Bridge Structure	SF \$120	0	\$0	
4 Retaining Wall	SF \$90	10,000	\$900,000	approximate 2000 longitudinal feet @ 5' high
5 HBP (Grading S) (100) (PG 76-28)	Ton \$63	20,640	\$1,300,320	Assum 6"
6 Aggregate Base Course (Class 6)	CY \$26	10,430	\$271,180	Assum 6"
7 Embankment Material (Special) (R-50)	CY \$12	20,850	\$250,200	Assum 1'
8 Traffic Signals	Each \$250,000	0	\$0	
			\$3,635,946	

	% Range	% Used	Cost
Project Construction Bid Items	Project Dependent	N / A	\$3,635,946 (A)
Contingencies	(15 - 30%) of A	30.0%	\$1,090,784 (B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$236,337 (D)
Drainage / Irrigation	(4 - 10%) of (A+B)	4.0%	\$189,069 (E)
Signing and Striping	(1 - 5%) of (A+B)	3.0%	\$141,802 (F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	2.0%	\$94,535 (G)
Lighting	(1 - 5%) of (A+B)	3.0%	\$141,802 (H)
Landscaping	(1 - 5%) of (A+B)	1.0%	\$47,267 (I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$223,102 (J)
ROW	Lump Sum	N / A	\$0 (K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$5,801,000</b>



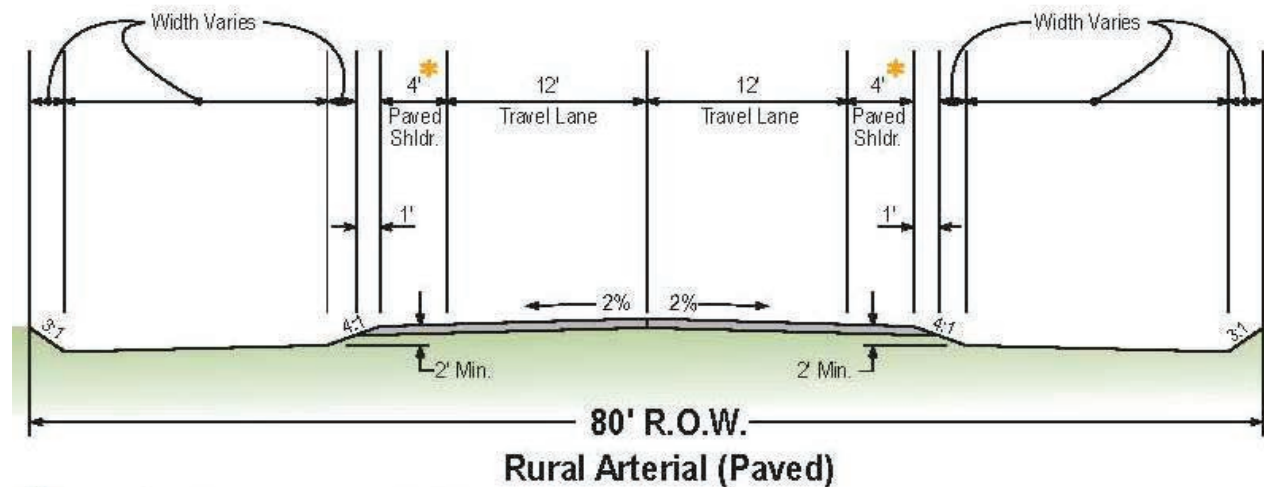
**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**Long View Road (Rapid City Airport to 154th Ave)**



Date Prepared: June 25, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS \$100,000	1	\$100,000	
2 Unclassified Excavation (CIP)	CY \$10	106,243	\$1,062,430	3.17' cut to recondition soil & apply 6" ABC & HBP
3 Bridge Structure	SF \$120	5,400	\$648,000	Just east of access to airport
4 HBP (Grading S) (100) (PG 76-28)	Ton \$63	31,730	\$1,998,990	Assum 8" (4' Shoulders)
5 Aggregate Base Course (Class 6)	CY \$26	12,020	\$312,520	Assum 6"
6 Embankment Material (Special) (R-50)	CY \$12	24,040	\$288,480	Assum 1'
7 Traffic Signals	Each \$250,000	0	\$0	
			\$4,410,420	

	% Range	% Used	Cost	
Project Construction Bid Items	Project Dependent	N / A	\$4,410,420	(A)
Contingencies	(15 - 30%) of A	30.0%	\$1,323,126	(B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$286,677	(D)
Drainage / Irrigation	(4 - 10%) of (A+B)	10.0%	\$573,355	(E)
Signing and Striping	(1 - 5%) of (A+B)	3.0%	\$172,006	(F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	2.0%	\$114,671	(G)
Lighting	(1 - 5%) of (A+B)	1.0%	\$57,335	(H)
Landscaping	(1 - 5%) of (A+B)	1.0%	\$57,335	(I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$279,797	(J)
ROW	Lump Sum	N / A	\$0	(K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$7,275,000</b>	



\* 6' shoulder to be considered along bicycle routes

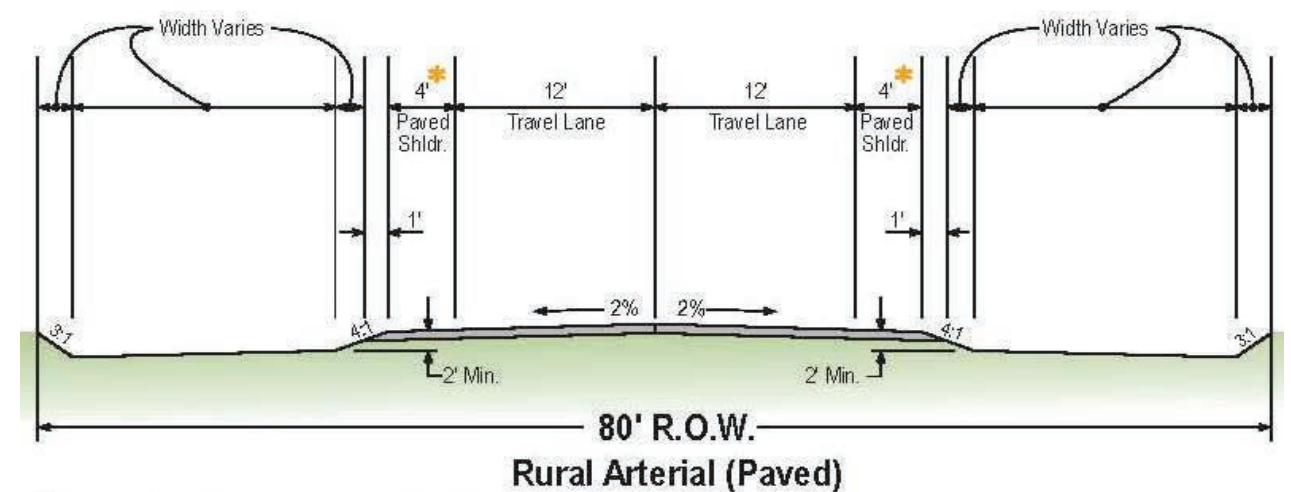
**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**154th Ave (Long View Rd to SD 44)**



Date Prepared: June 25, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS \$400,000	1	\$400,000	
2 Unclassified Excavation (CIP)	CY \$10	130,114	\$1,301,138	3.17' cut to recondition soil & apply 6" ABC & HBP
3 Removal of Asphalt Material	SY \$5	11,677	\$58,384	Dawkins Road
4 Bridge Structure	SF \$120	0	\$0	
5 HBP (Grading S) (100) (PG 76-28)	Ton \$63	38,860	\$2,448,180	Assum 8" (4' Shoulders)
6 Aggregate Base Course (Class 6)	CY \$26	14,720	\$382,720	Assum 6"
7 Embankment Material (Special) (R-50)	CY \$12	29,440	\$353,280	Assum 1'
8 Traffic Signals	Each \$250,000	0	\$0	
			\$4,943,702	

	% Range	% Used	Cost	
Project Construction Bid Items	Project Dependent	N / A	\$4,943,702	(A)
Contingencies	(15 - 30%) of A	30.0%	\$1,483,111	(B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$321,341	(D)
Drainage / Irrigation	(4 - 10%) of (A+B)	10.0%	\$642,681	(E)
Signing and Striping	(1 - 5%) of (A+B)	3.0%	\$192,804	(F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	2.0%	\$128,536	(G)
Lighting	(1 - 5%) of (A+B)	1.0%	\$64,268	(H)
Landscaping	(1 - 5%) of (A+B)	1.0%	\$64,268	(I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$313,628	(J)
ROW	Lump Sum	N / A	\$0	(K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$8,154,000</b>	



\* 6' shoulder to be considered along bicycle routes

**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**Deadwood Avenue**

**FELSBURG HOLT & ULLEVIG**  
*engineering paths to transportation solutions*

Date Prepared: **June 25, 2012**

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS	\$40,000	1	\$40,000
2 Unclassified Excavation (CIP)	CY	\$10	15,490	\$154,897
3 Removal of Asphalt Material	SY	\$5	8,542	\$42,709
4 Bridge Structure	SF	\$120	0	\$0
5 HBP (Grading S) (100) (PG 76-28)	Ton	\$63	4,630	\$291,690
6 Aggregate Base Course (Class 6)	CY	\$26	1,750	\$45,500
7 Embankment Material (Special) (R-50)	CY	\$12	3,500	\$42,000
8 Traffic Signals	Each	\$250,000	0	\$0

	% Range	% Used	Cost
Project Construction Bid Items	Project Dependent	N / A	\$616,796 (A)
Contingencies	(15 - 30%) of A	30.0%	\$185,039 (B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$40,092 (D)
Drainage / Irrigation	(4 - 10%) of (A+B)	10.0%	\$80,184 (E)
Signing and Striping	(1 - 5%) of (A+B)	3.0%	\$24,055 (F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	10.0%	\$80,184 (G)
Lighting	(1 - 5%) of (A+B)	2.0%	\$16,037 (H)
Landscaping	(1 - 5%) of (A+B)	1.0%	\$8,018 (I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$42,016 (J)
ROW	Lump Sum	N / A	\$0 (K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$1,092,000</b>

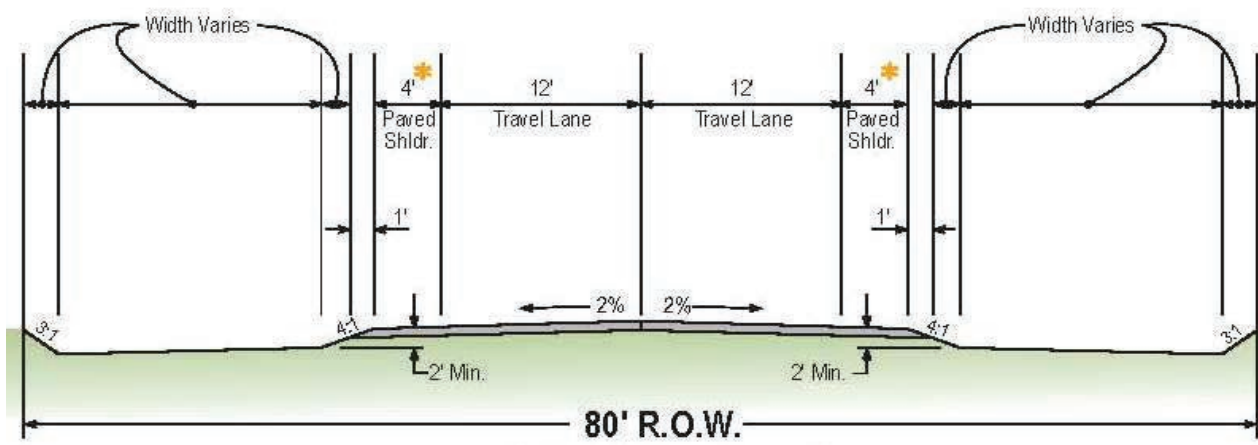
**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**TYPICAL PATH**

**FELSBURG HOLT & ULLEVIG**  
*engineering paths to transportation solutions*

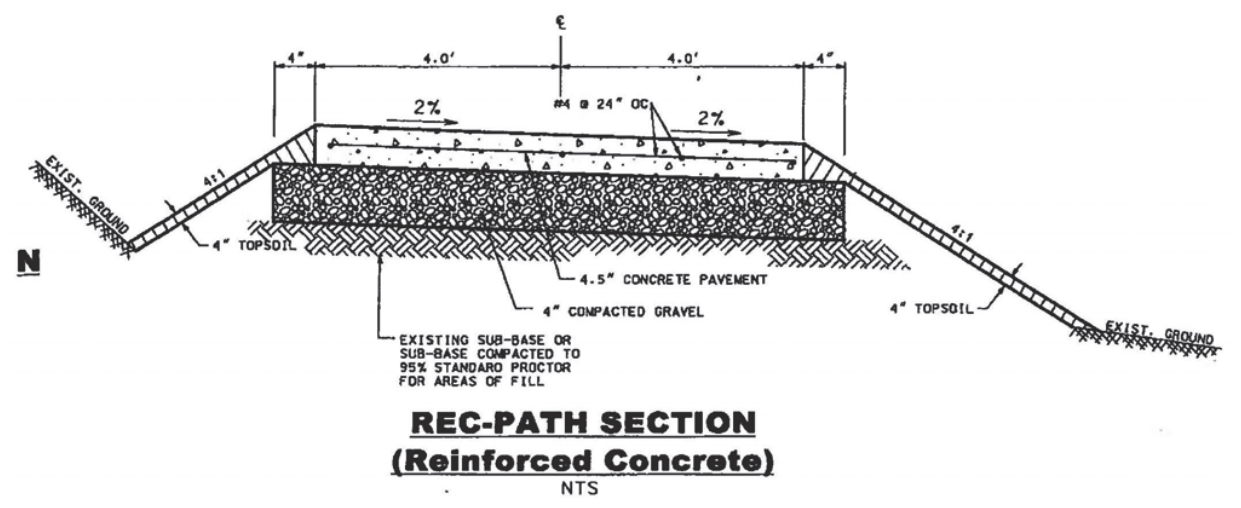
Date Prepared: **June 25, 2012**

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS	\$30,000	1	\$30,000
1 Unclassified Excavation (CIP)	CY	\$10	3,667	\$36,667
2 Aggregate Base Course (Class 6)	CY	\$26	782	\$20,338
3 Embankment Material (Special) (R-50)	CY	\$12	1,564	\$18,773
4 Concrete Sidewalk (4.5 Inch)	SY	\$35	4,693	\$164,267
			\$270,045	

	% Range	% Used	Cost
Project Construction Bid Items	Project Dependent	N / A	\$270,045 (A)
Contingencies	(15 - 30%) of A	20.0%	\$54,009 (B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$16,203 (D)
Drainage / Irrigation	(4 - 10%) of (A+B)	4.0%	\$12,962 (E)
Signing and Striping	(1 - 5%) of (A+B)	1.0%	\$3,241 (F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	0.0%	\$0 (G)
Lighting	(1 - 5%) of (A+B)	4.0%	\$12,962 (H)
Landscaping	(1 - 5%) of (A+B)	5.0%	\$16,203 (I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$15,425 (J)
ROW	Lump Sum	N / A	\$0 (K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$401,000</b>



\* 6' shoulder to be considered along bicycle routes



**REC-PATH SECTION**  
**(Reinforced Concrete)**  
 NTS



**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**154th Avenue / 233rd Street**



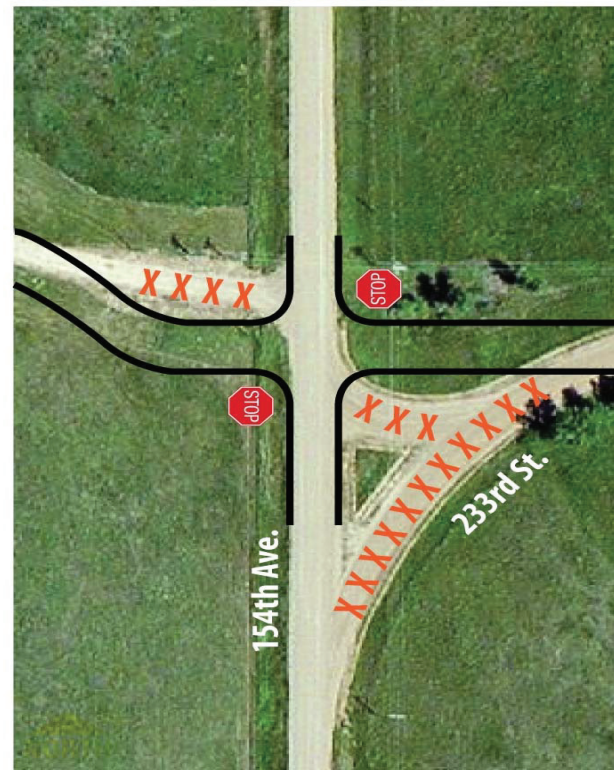
Date Prepared: June 27, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS	\$20,000	1	\$20,000
2 Unclassified Excavation (CIP)	CY	\$10	3,667	\$36,671
3 HBP (Grading S) (100) (PG 76-28)	Ton	\$63	1,100	\$69,300
4 Aggregate Base Course (Class 6)	CY	\$26	410	\$10,660
5 Embankment Material (Special) (R-50)	CY	\$12	830	\$9,960
				\$146,591

	% Range	% Used	Cost
Project Construction Bid Items	Project Dependent	N / A	\$146,591 (A)
Contingencies	(15 - 30%) of A	30.0%	\$43,977 (B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$9,528 (D)
Drainage / Irrigation	(4 - 10%) of (A+B)	6.0%	\$11,434 (E)
Signing and Striping	(1 - 5%) of (A+B)	3.0%	\$5,717 (F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	20.0%	\$38,114 (G)
Lighting	(1 - 5%) of (A+B)	0.0%	\$0 (H)
Landscaping	(1 - 5%) of (A+B)	5.0%	\$9,528 (I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$7,623 (J)
ROW	Lump Sum	N / A	\$0 (K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$273,000</b>

**154th Ave. & 233rd St.**



**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**Sturgis Road (SD 231) / Merritt Road**



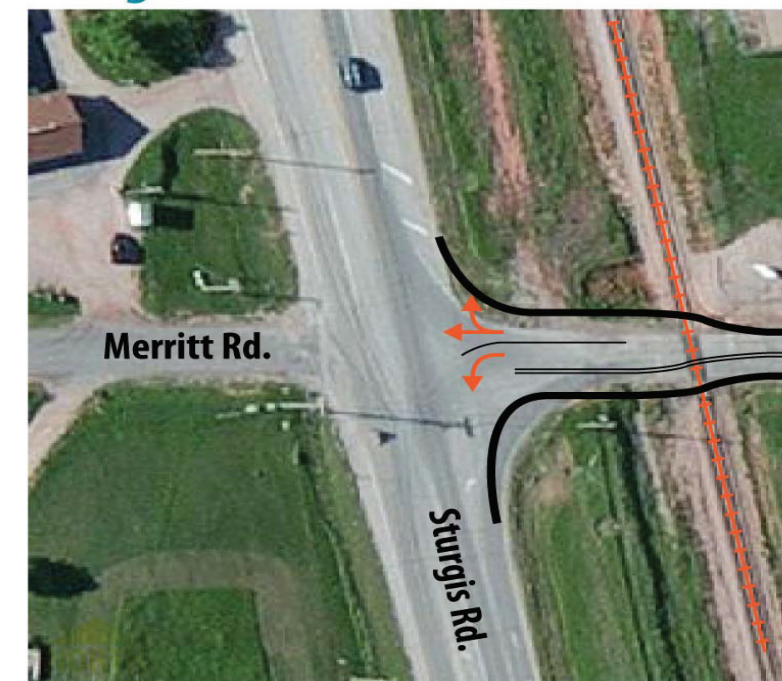
Date Prepared: June 27, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS	\$10,000	1	\$10,000
2 Unclassified Excavation (CIP)	CY	\$10	860	\$8,601
3 Removal of Asphalt Material	SY	\$5	1,333	\$6,667
4 Rail Road Crossing Material/Equipment	LS	\$100,000	1	\$100,000
6 HBP (Grading S) (100) (PG 76-28)	Ton	\$63	230	\$14,490
6 Aggregate Base Course (Class 6)	CY	\$26	90	\$2,340
7 Embankment Material (Special) (R-50)	CY	\$12	180	\$2,160
8 Traffic Signals	Each	\$250,000	1	\$250,000
				\$394,258

	% Range	% Used	Cost
Project Construction Bid Items	Project Dependent	N / A	\$394,258 (A)
Contingencies	(15 - 30%) of A	30.0%	\$118,277 (B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$25,627 (D)
Drainage / Irrigation	(4 - 10%) of (A+B)	6.0%	\$30,752 (E)
Signing and Striping	(1 - 5%) of (A+B)	3.0%	\$15,376 (F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	15.0%	\$76,880 (G)
Lighting	(1 - 5%) of (A+B)	3.0%	\$15,376 (H)
Landscaping	(1 - 5%) of (A+B)	5.0%	\$25,627 (I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$20,501 (J)
ROW	Lump Sum	N / A	\$0 (K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$723,000</b>

**Sturgis Rd. & Merritt Rd.**



**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**Nemo Road / Norris Peak Road**

**FELSBURG HOLT & ULLEVIG**  
 engineering paths to transportation solutions

Date Prepared: June 27, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS \$4,000	1	\$4,000	
2 Removal of Asphalt Material	SY \$5	2,000	\$10,000	
			\$14,000	

	% Range	% Used	Cost	
Project Construction Bid Items	Project Dependent	N / A	\$14,000	(A)
Contingencies	(15 - 30%) of A	30.0%	\$4,200	(B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$910	(D)
Drainage / Irrigation	(4 - 10%) of (A+B)	6.0%	\$1,092	(E)
Signaling and Striping	(1 - 5%) of (A+B)	10.0%	\$1,820	(F)
Construction Signaling & Traffic Control	(5 - 30%) of (A+B)	10.0%	\$1,820	(G)
Lighting	(1 - 5%) of (A+B)	0.0%	\$0	(H)
Landscaping	(1 - 5%) of (A+B)	5.0%	\$910	(I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$728	(J)
ROW	Lump Sum	N / A	\$0	(K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$25,000</b>	

**Nemo Rd. & Norris Peak Rd.**



**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**Boulder Hill Road / Silver Mountain Road**

**FELSBURG HOLT & ULLEVIG**  
 engineering paths to transportation solutions

Date Prepared: June 27, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS \$10,000	1	\$10,000	To eliminate knob at infield of intersection
2 Unclassified Excavation (CIP)	CY \$10	2,000	\$20,000	
3 Retaining Wall	SF \$90	750	\$67,500	
4 Removal of Tree	Each \$500	3	\$1,500	
			\$99,000	

	% Range	% Used	Cost	
Project Construction Bid Items	Project Dependent	N / A	\$99,000	(A)
Contingencies	(15 - 30%) of A	30.0%	\$29,700	(B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$6,435	(D)
Drainage / Irrigation	(4 - 10%) of (A+B)	10.0%	\$12,870	(E)
Signaling and Striping	(1 - 5%) of (A+B)	3.0%	\$3,861	(F)
Construction Signaling & Traffic Control	(5 - 30%) of (A+B)	5.0%	\$6,435	(G)
Lighting	(1 - 5%) of (A+B)	0.0%	\$0	(H)
Landscaping	(1 - 5%) of (A+B)	5.0%	\$6,435	(I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$5,148	(J)
ROW	Lump Sum	N / A	\$0	(K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$170,000</b>	

**Silver Mountain Rd. & Boulder Hill Rd.**



**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**Silver Mountain Road / Highway 16**



Date Prepared: June 27, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS \$5,000	1	\$5,000	
2 Removal of Asphalt Material	SY \$5	2,000	\$10,000	
			\$15,000	

	% Range	% Used	Cost	
Project Construction Bid Items	Project Dependent	N / A	\$15,000	(A)
Contingencies	(15 - 30%) of A	30.0%	\$4,500	(B)
Utilities	(5 - 20%) of (A+B)	2.0%	\$390	(D)
Drainage / Irrigation	(4 - 10%) of (A+B)	6.0%	\$1,170	(E)
Signing and Striping	(1 - 5%) of (A+B)	10.0%	\$1,950	(F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	10.0%	\$1,950	(G)
Lighting	(1 - 5%) of (A+B)	0.0%	\$0	(H)
Landscaping	(1 - 5%) of (A+B)	5.0%	\$975	(I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$780	(J)
ROW		N / A	\$0	(K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$27,000</b>	

**Silver Mountain Rd. & Highway 16**



**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**South Rockerville Road / Neck Yoke Road**

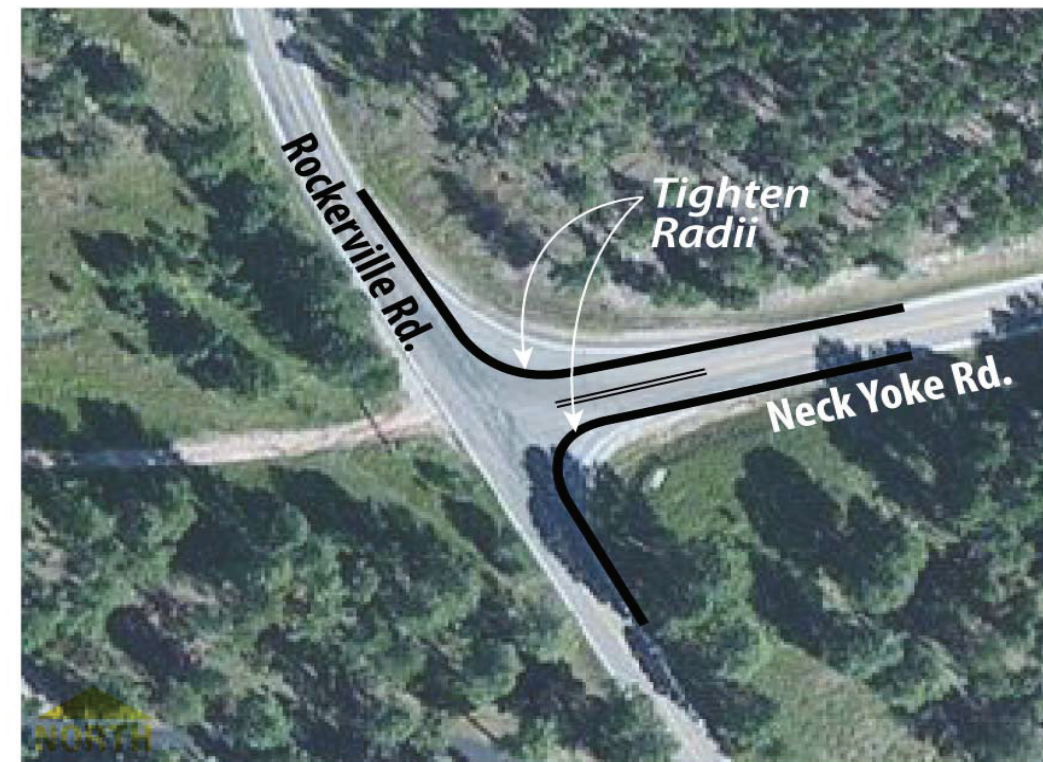


Date Prepared: June 27, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS \$10,000	1	\$10,000	
2 Removal of Asphalt Material	SY \$5	2,000	\$10,000	
			\$20,000	

	% Range	% Used	Cost	
Project Construction Bid Items	Project Dependent	N / A	\$20,000	(A)
Contingencies	(15 - 30%) of A	30.0%	\$6,000	(B)
Utilities	(5 - 20%) of (A+B)	2.0%	\$520	(D)
Drainage / Irrigation	(4 - 10%) of (A+B)	6.0%	\$1,560	(E)
Signing and Striping	(1 - 5%) of (A+B)	10.0%	\$2,600	(F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	10.0%	\$2,600	(G)
Lighting	(1 - 5%) of (A+B)	0.0%	\$0	(H)
Landscaping	(1 - 5%) of (A+B)	5.0%	\$1,300	(I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$1,040	(J)
ROW		N / A	\$0	(K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$36,000</b>	

**Rockerville Rd. & Neck Yoke Rd.**



<b>PENNINGTON COUNTY MASTER TRANSPORTATION PLAN</b> <b>ESTIMATE OF PROBABLE CONSTRUCTION COST</b> <b>US 385 / Silver City Road</b>	 <b>FELSBURG HOLT &amp; ULLEVIG</b> <i>engineering paths to transportation solutions</i>
Date Prepared: <b>June 27, 2012</b>	

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS	1	\$60,000	
			\$60,000	

	% Range	% Used	Cost	
Project Construction Bid Items	Project Dependent	N / A	\$60,000	(A)
Contingencies	(15 - 30%) of A	30.0%	\$18,000	(B)
Utilities	(5 - 20%) of (A+B)	0.0%	\$0	(D)
Drainage / Irrigation	(4 - 10%) of (A+B)	6.0%	\$4,680	(E)
Signing and Striping	(1 - 5%) of (A+B)	2.0%	\$1,560	(F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	5.0%	\$3,900	(G)
Lighting	(1 - 5%) of (A+B)	0.0%	\$0	(H)
Landscaping	(1 - 5%) of (A+B)	5.0%	\$3,900	(I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$3,120	(J)
ROW	Lump Sum	N / A	\$0	(K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$95,000</b>	

<b>PENNINGTON COUNTY MASTER TRANSPORTATION PLAN</b> <b>ESTIMATE OF PROBABLE CONSTRUCTION COST</b> <b>Deerfield Road / Mystic Road</b>	 <b>FELSBURG HOLT &amp; ULLEVIG</b> <i>engineering paths to transportation solutions</i>
Date Prepared: <b>June 27, 2012</b>	

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Signing and Striping	LS	1	\$8,000	
			\$8,000	

	% Range	% Used	Cost	
Project Construction Bid Items	Project Dependent	N / A	\$8,000	(A)
Contingencies	(15 - 30%) of A	30.0%	\$2,400	(B)
Utilities	(5 - 20%) of (A+B)	0.0%	\$0	(D)
Drainage / Irrigation	(4 - 10%) of (A+B)	6.0%	\$624	(E)
Signing and Striping	(1 - 5%) of (A+B)	0.0%	\$0	(F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	20.0%	\$2,080	(G)
Lighting	(1 - 5%) of (A+B)	0.0%	\$0	(H)
Landscaping	(1 - 5%) of (A+B)	5.0%	\$520	(I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$416	(J)
ROW	Lump Sum	N / A	\$0	(K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$14,000</b>	

## US 385 & Silver City Rd.



## Deerfield Rd. & Mystic Rd.



**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**SD 40 / Rockerville Road**



Date Prepared: June 27, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Clearing and Grubbing	LS \$6,000	1	\$6,000	
2 Unclassified Excavation (CIP)	CY \$10	2,000	\$20,000	
3 HBP (Grading S) (100) (PG 76-28)	Ton \$63	110	\$6,930	
			\$0	
			\$32,930	

	% Range	% Used	Cost	
Project Construction Bid Items	Project Dependent	N / A	\$32,930	(A)
Contingencies	(15 - 30%) of A	30.0%	\$9,879	(B)
Utilities	(5 - 20%) of (A+B)	5.0%	\$2,140	(D)
Drainage / Irrigation	(4 - 10%) of (A+B)	10.0%	\$4,281	(E)
Signing and Striping	(1 - 5%) of (A+B)	1.0%	\$428	(F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	2.0%	\$856	(G)
Lighting	(1 - 5%) of (A+B)	0.0%	\$0	(H)
Landscaping	(1 - 5%) of (A+B)	5.0%	\$2,140	(I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$1,712	(J)
ROW	Lump Sum	N / A	\$0	(K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$54,000</b>	

**SD 40 & Rockerville Rd.**



**PENNINGTON COUNTY MASTER TRANSPORTATION PLAN**  
**ESTIMATE OF PROBABLE CONSTRUCTION COST**  
**Concourse Drive / Twilight Drive**

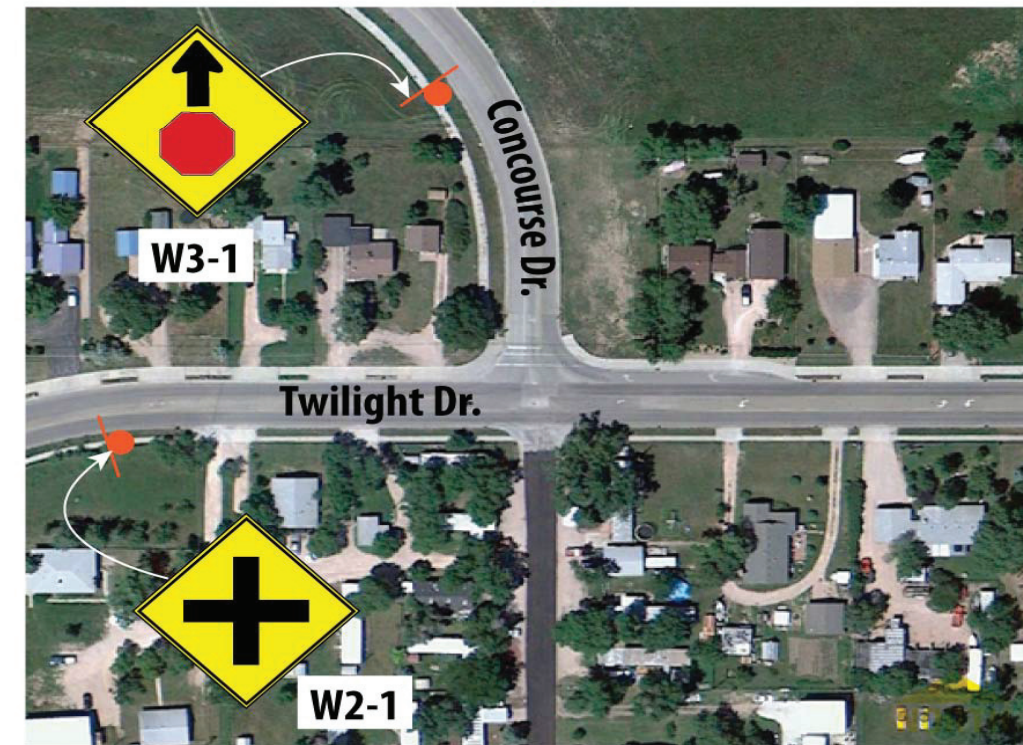


Date Prepared: June 27, 2012

Item	Unit Cost	Quantity	Extended Cost	Shaded Fields are for INPUT
1 Flashing Beacon (Solar Powered)	EA \$4,000	2	\$8,000	Stop Sign and Intersection Sign Ahead
			\$8,000	

	% Range	% Used	Cost	
Project Construction Bid Items	Project Dependent	N / A	\$8,000	(A)
Contingencies	(15 - 30%) of A	10.0%	\$800	(B)
Utilities	(5 - 20%) of (A+B)	0.0%	\$0	(D)
Drainage / Irrigation	(4 - 10%) of (A+B)	0.0%	\$0	(E)
Signing and Striping	(1 - 5%) of (A+B)	0.0%	\$0	(F)
Construction Signing & Traffic Control	(5 - 30%) of (A+B)	0.0%	\$0	(G)
Lighting	(1 - 5%) of (A+B)	0.0%	\$0	(H)
Landscaping	(1 - 5%) of (A+B)	0.0%	\$0	(I)
Mobilization	(4 - 7%) of (A+B+C+D+E+F+G+H+I)	4.0%	\$352	(J)
ROW	Lump Sum	N / A	\$0	(K)
<b>Total of Construction Bid Items</b>	<b>(A+B+C+D+E+F+G+H+I+J+K)</b>		<b>\$9,000</b>	

**Concourse Dr. & Twilight Dr.**







## APPENDIX F CITY OF RAPID CITY MAJOR STREET PLAN AND ROAD CLASSIFICATION

# Major Street Plan City Of Rapid City

I do hereby certify that this Major Street Plan was adopted by the Rapid City Council on December 1, 2008. I further certify that original minutes of the Rapid City Council meeting on December 1, 2008 are on file in the Finance Office.

Dated this 1st day of December, 2008.

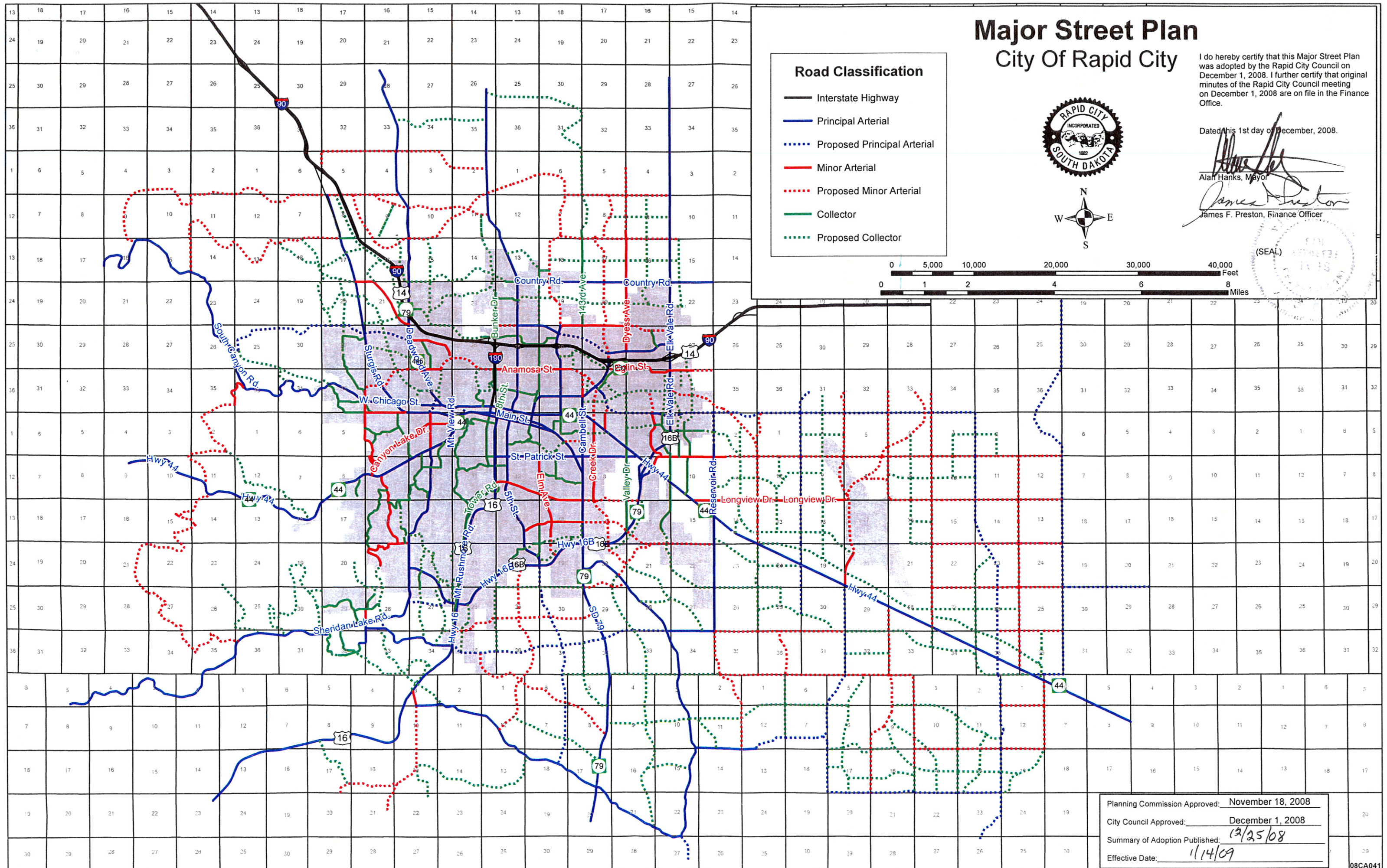
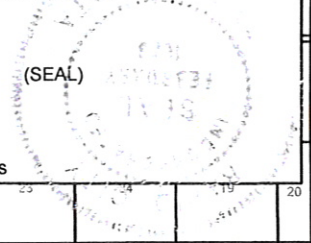
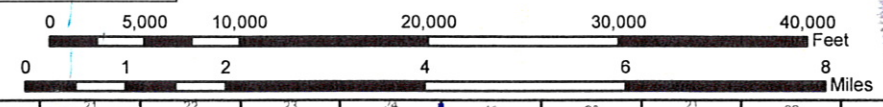
*Alan Hanks*  
Alan Hanks, Mayor

*James F. Preston*  
James F. Preston, Finance Officer



### Road Classification

- Interstate Highway
- Principal Arterial
- - - Proposed Principal Arterial
- Minor Arterial
- - - Proposed Minor Arterial
- Collector
- - - Proposed Collector



Planning Commission Approved: November 18, 2008

City Council Approved: December 1, 2008

Summary of Adoption Published: 12/25/08

Effective Date: 1/14/09





## APPENDIX G PENNINGTON COUNTY APPROACH PERMIT APPLICATION

**PENNINGTON COUNTY HIGHWAY DEPARTMENT  
APPROACH PERMIT  
APPLICATION FOR ROAD APPROACH PERMIT**

Print Form

On this date  the Applicant hereby applies to Pennington County for permission to construct an approach to the  side of  located approximately . The approach will serve a  and will be constructed between  and .

(north, south, etc.) (road name)  
(describe location)  
(residence, business, etc.) (beginning date) (completion date)

Applicant shall construct the approach and install all required culverts according to County standards and specifications (standards and specifications are shown on back side of this form and Ordinance 14) and is responsible for all cost of construction and maintenance. If any deficiencies are noted during final inspection Owner will be responsible to correct deficiencies within 30 days of notification.

Please attach a drawing or sketch showing the proposed location of the approach and set stakes in the ground to enable the Pennington County Highway Department to locate the proposed, centerline of the approach.

Culverts shall be sized to assure proper drainage. The minimum size of culvert will be eighteen inches (18") in diameter, fifteen inches (15") may be allowed under certain conditions. The minimum length of culvert shall be thirty-two feet (32').

Only one (1) approach per residence will be allowed. Approaches to General Commercial, Highway Service, General or Limited Agriculture Districts, large tracts or parcels of land will be per South Dakota Codified Law (SDCL) 31-24-3 through 31-24-7.

Name:  Address:   
Phone #:  Signed: \_\_\_\_\_  
Property Owner/Representative

**(Applicant shall notify the Pennington County Highway Department (394-2166) upon completion of the approach for final inspection.)**

**TO BE COMPLETED BY PENNINGTON COUNTY HIGHWAY DEPARTMENT**

Permit #: \_\_\_\_\_  
MO/DY/YR

PRELIMINARY INSPECTION: Date: \_\_\_\_\_ By: \_\_\_\_\_

Culvert Diameter \_\_\_\_\_ Culvert Length \_\_\_\_\_

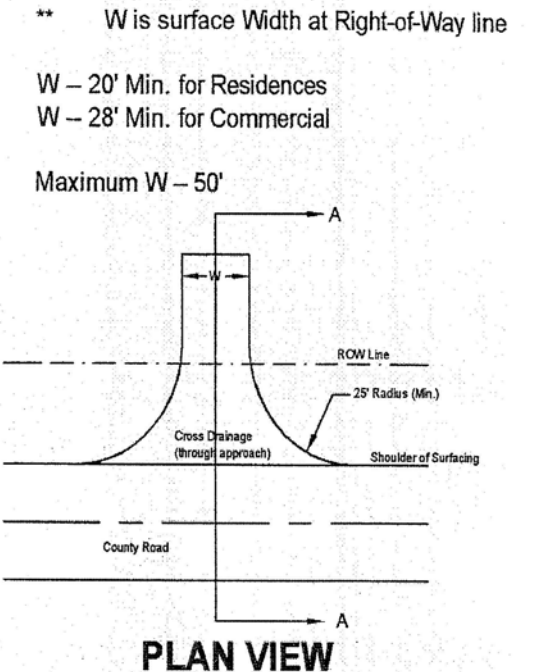
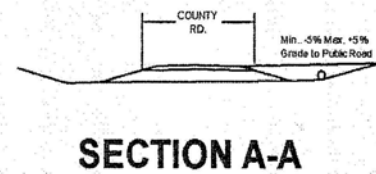
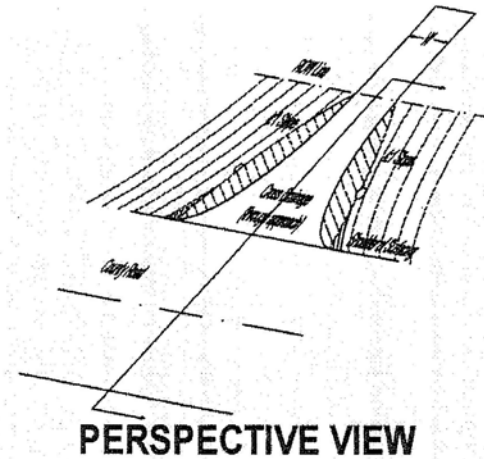
The crown of the presently traveled surface, including shoulder, to be continued at a distance of 20 feet from the nearest edge of the traveled surface of the road shoulder facing the property.

Remarks: \_\_\_\_\_  
\_\_\_\_\_

PERMIT APPROVED \_\_\_\_\_ or DENIED \_\_\_\_\_

FINAL INSPECTION: Date: \_\_\_\_\_ By: \_\_\_\_\_

**EXHIBIT B  
PENNINGTON COUNTY HIGHWAY DEPARTMENT  
SPECIFICATION FOR COUNTY APPROACHES**



The above Typical Approach Detail shall be followed in the construction of roads within Public right-of-ways under the jurisdiction of Pennington County. Road construction materials and methods shall conform to the current published edition of the "Standard Specifications for Roads and Bridges" of the South Dakota Department of Transportation, when referenced in the standards below. A copy of these Specifications is on file at the County Highway Department Office.

The following are standards, which shall be met:

1. Maximum grade on an approach shall be five percent (5 %) within the right-of-way.
2. Culverts shall be sized to assure proper drainage. The minimum size of culvert will be eighteen inches (18") in diameter Fifteen inches (15") may be allowed under certain conditions. The minimum length of culvert shall be thirty-two feet (32').
3. Gravel surfacing shall meet the requirements of the "Standards Specification for Base or Surfacing". Minimum depth of gravel surfacing shall be four inches (4").
4. Approaches shall be constructed perpendicular as practical to the County Road.
5. Only one (1) approach per residence will be allowed. Approaches to General Commercial, Highway Service, General or Limited Agriculture Districts, large tracts or parcels of land will be per South Dakota Codified Law (SDCL) 31-24-3 through 31-24-7.
6. Sight distance of approaches shall meet published Standards of the "American Association of State Highway Transportation Officials".





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