BESTPlan
Box Elder Strategic Transportation Plan

Rapid City
MPO

BEST PLAN

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December 2014

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CITY OF BOX ELDER
STRATEGIC TRANSPORTATION PLAN

Prepared for:

City of Box Elder
420 Villa Drive
Box Elder, South Dakota 57719

Prepared by:

Felsburg Holt & Ullevig
6300 South Syracuse Way, Suite 600
Centennial, Colorado 80111
(303)721-1440
www.fhueng.com

Project Manager: Todd S. Frisbie, PE, PTOE
Principal-In-Charge: Lyle E. DeVries, PE, PTOE

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EXECUTIVE SUMMARY

Introduction

Background

The City of Box Elder is a western South Dakota community of nearly 9,000 residents. Box Elder, incorporated in 1965, is home to the Ellsworth Air Force Base (EAFB) (est. 1941) and Douglas School District. The City has been experiencing sharp growth in recent years, adding residents within historic City boundaries and increasing in population due to annexation of previously unincorporated neighborhoods. The population has more than doubled in the five years since 2009, and its current population makes Box Elder a Class 1 City according to South Dakota Department of Transportation (SDDOT) guidelines. Population growth is expected to continue into the future, and commercial development, which has lagged behind residential growth, may also accelerate.

The aggressive growth has taxed Box Elder's utility and transportation infrastructure. The City, in cooperation with the Rapid City Area Metropolitan Planning Organization (MPO) and SDDOT, has completed the Box Elder Strategic Transportation Plan, or *BESTPlan*, as a step toward addressing challenges to the transportation infrastructure. The first such plan developed by the City in nearly 20 years, the plan comes at a strategic time and its outcomes are intended to provide a blueprint for many years to come.

Purpose

The purpose of *BESTPlan* is to address a series of desired planning outcomes and transportation objectives, described as follows.

Planning Outcomes

BESTPlan integrates public and stakeholder involvement, transportation data and analysis, and regional planning considerations into a cohesive document that can be used to advance the City's economic, social, fiscal, and community engagement goals.

The *BESTPlan* planning process is designed to deliver the following:

- **A Strategic Plan**: Aligns the built environment with regional and local goals, ensuring that transportation projects support elements important to the community such as the ongoing mission of EAFB or safe pedestrian circulation around schools.
- **A Collaborative Effort**: Provides the public with a forum and a voice by opening the process to input from Box Elder's elected leaders, City staff, residents, institutions, and the general public.
- **Practical Results**: Provides the way to funding and building successful, sustainable transportation projects that will serve the City for many years. It positions the City to take advantage of multiple available funding streams to accomplish transportation priorities.
- **A Regional Focus**: Engages agencies and areas beyond Box Elder's borders to ensure that the City's transportation network helps connect Box Elder with the surrounding world.

Transportation Objectives

BESTPlan addresses the following transportation objectives:

1. Address how the transportation system can enhance livability within the Box Elder community, particularly emphasizing multimodal connectivity among neighborhoods, schools, and business districts.
2. Provide a major street plan that frames the existing system and identifies future improvements, not a road map.
3. Coordinate transportation planning efforts across multiple jurisdictions, including the City of Box Elder, Pennington and Meade counties, Rapid City, and the SDDOT.
4. Develop transportation engineering standards for use by new development in the City of Box Elder.
5. Identify priorities among future transportation improvement projects.
6. Support EAFB mission.
7. Identify logical truck routes.

Approach

The project team devised the approach shown on **Figure ES-1** to address the objectives.

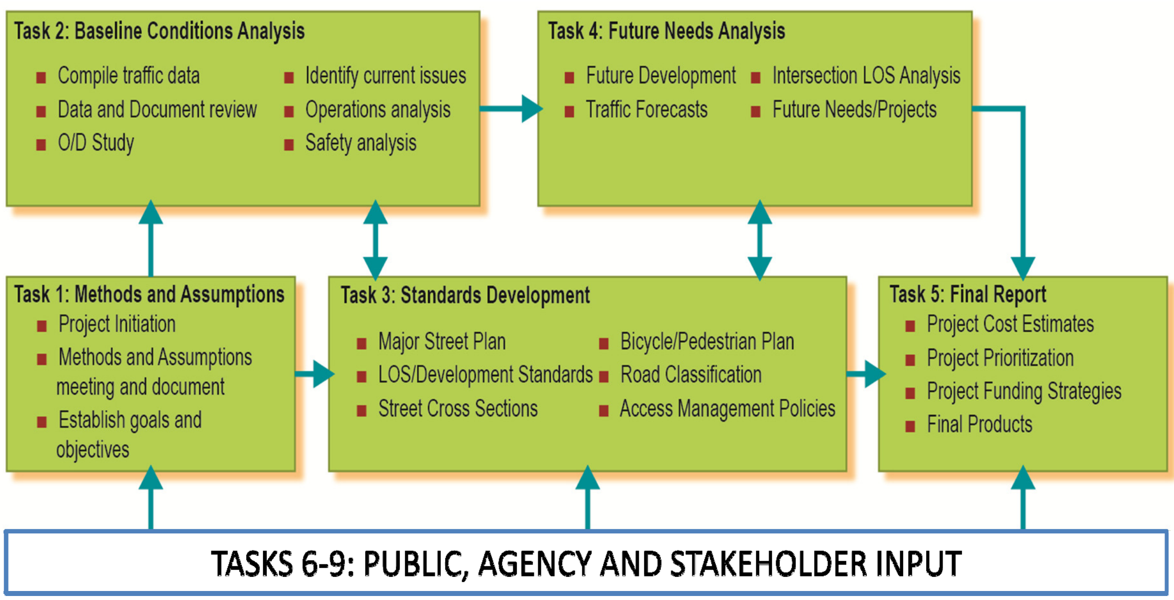


Figure ES-1. Work Flow Diagram

Upon developing the Methods and Assumptions that would govern the plan and gain SDDOT and Federal Highway Administration (FHWA) approval, the project team identified current traffic flow and safety issues throughout Box Elder's transportation network using analyses of traffic flow and safety history (Tasks 1 and 2). Task 3, Standards Development, provides a policy framework for the transportation plan and provides the City with a set of tools for addressing future development and transportation infrastructure improvements. Task 4 adds future growth to current traffic volumes to identify needs that may be triggered by traffic growth and projects that would address those needs. Task 5 provides the completion of this report, including a list of prioritized projects and policy guidelines. An extensive public involvement process, including public meetings and social media outreach, supported Tasks 2 through 5.

Elements of the Transportation Plan

The transportation plan includes the following elements:

- Inventory of Existing Conditions
- Forecasted Growth
- Major Street Plan
- Pedestrian and Bicycle Plan
- Transportation Standards
- Recommended Future Transportation Project Priorities

How to Use *BESTPlan*

BESTPlan is intended to serve as a planning tool for City decision makers well into the future. The following steps are recommended to maximize the plan's usefulness and sustainability:

- **Adoption**: The plan will be submitted to Box Elder staff and it is recommended that staff pursue official adoption of the plan by the City's governing bodies. Adoption of the plan will help to ensure its long-term viability. It is also anticipated that the Rapid City Area MPO will approve the document.
- **Funding pursuit**: Once officially approved and adopted, the plan can be used as a tool to plan for, pursue, and direct funding for transportation projects. *BESTPlan* provides a list of transportation projects prioritized based on urgency of need and ease of implementation. The prioritized listing should direct the limited available funding to the most important needs.
- **Future Updates**: Due to changes in travel patterns, financial circumstances, political leadership, population growth, and other influences, it is recommended that *BESTPlan* be updated regularly to ensure that transportation planning accurately reflects current conditions. A five-year update increment is appropriate.

Study Area

Figure ES-2 shows the *BESTPlan* study area.

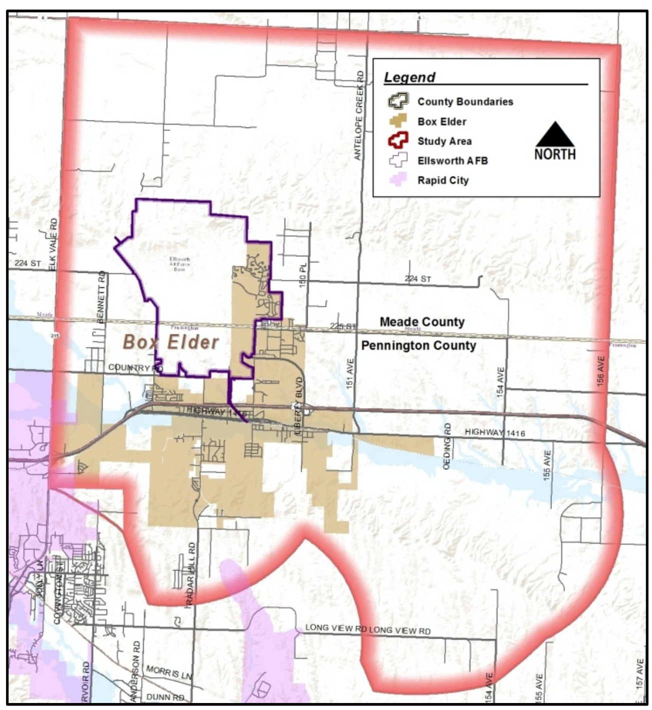


Figure ES-2. Study Area

Inventory of Existing Conditions

To understand how transportation is provided to Box Elder residents, businesses, and visitors, the project team took an inventory of the existing transportation system and conducted a public input meeting. The inventory of existing conditions includes the following aspects of Box Elder's transportation system:

- **Traffic conditions**, including current traffic volumes, roadway and intersection operations, and traffic crash experience.
- **Non-motorized facilities**, identifying accommodations for bicycle and pedestrian travel.
- **Ellsworth AFB**, identifying travel patterns to and from the base.

Land Use and Roadway Network

EAFB and development trends have affected the existing roadway locations and continuity within the study area. The *BESTPlan* study area is bifurcated by Interstate 90 (I-90). North of I-90, EAFB blocks east-west continuity. South of I-90, topography restricts north-south travel within the study area. Most development has occurred east of EAFB and is bounded by Tower Road to the east and Liberty Boulevard to the south. Commercial development has occurred along the Highway 1416 corridor, and recent residential development has occurred along the Radar Hill Road corridor. In recent years, new commercial and residential development has been occurring in the western part of the City near the I-90 / Elk Vale Road interchange.

Most roads within the study area provide two travel lanes (one in each direction). The only four-lane roads are I-90, Highway 1416 from I-90 to Ellsworth Road, and Liberty Boulevard between I-90 and Ellsworth Road.

Traffic Volumes

The highest levels of peak hour volumes in the City occur along Highway 1416, Ellsworth Road, Tower Road, and Liberty Boulevard and at the Tower Road / Liberty Boulevard at the Highway 1416 / Ellsworth Road intersections. Current traffic volumes along I-90 and Highway 1416 exceed 10,000 vehicles per day (vpd). A second tier of roadways, Ellsworth Road, Liberty Boulevard, Tower Road, Commercial Gate Drive, 225th Street, and Radar Hill Road, carries between 3,000 and 10,000 vpd. Most other roadways in the study area carry less than 3,000 vpd. In addition to the daily count data, 10 intersections were identified for peak hour turning movement counts and operational analyses.

Traffic Operations

Existing traffic operations were evaluated along roadways and at intersections. Roadway operations were evaluated using volume-to-capacity ratios for roadway segment. All roadways in the study area have a V/C ratio of less than 0.80 and are, therefore, shown as green. This finding generally means that roadways in the study area have a sufficient number of travel lanes to accommodate existing levels of traffic.

The 10 intersections selected for operational analyses included 9 unsignalized (STOP sign) controlled intersections and one signalized intersection. The intersections were analyzed using analytical procedures documented in the *Highway Capacity Manual* (Transportation Research

Board, Fourth Edition, 2010). Five intersections along Highway 1416 were included in the list, four of which are configured as "split" intersections along the divided highway. Movements through these intersections were found to operate at LOS C or better during peak hours, with the exception of the westbound Highway 1416 intersection with Ellsworth Road, which operates at LOS F during peak hours. All other analyzed intersections were found to operate at LOS C or better during peak hours.

Traffic Safety

The SDDOT currently maintains a Geographic Information Systems (GIS) crash database designed to monitor crash trends. As part of the Strategic Transportation Plan, crash data were compiled for a five-year period to identify the most hazardous intersections within the study area. The analysis was conducted for all crashes between 2008 and 2012. Issues identified at intersections included the high frequency of angle-type collisions, which often occur at busy unsignalized intersections as vehicles seek to complete left turns onto or cross the major street. Intersections along Highway 1416 represent four of the top five crash locations, with 10 or more crashes during the five-year period.

Pedestrian and Bicycle Facilities

An inventory of pedestrian and bicycle facilities was compiled based on a physical and aerial photograph review of current infrastructure. Currently, there are limited bicycle facilities in the City of Box Elder. Sidewalks exist in some residential areas and along roadways near the school area. Overall, there appears to be sidewalk connectivity between the residential areas in north Box Elder and the schools. However, outside this area there is inconsistent sidewalk connectivity throughout the City. In addition to the sidewalks, Box Elder has some off-system, shared-use paths. These paths are located in north Box Elder between Tower Road and Prairie Road and between Patriot Drive and Vista Drive and generally connect the schools to adjacent neighborhoods.

Identified Transportation Issues

The City, agencies, and the public identified several area wide issues by noting a general lack of north-south connectivity among vehicle and non-motorized facilities. Some also noted the lack of connectivity between neighborhoods and the inconsistent look and feel among City streets. City staff noted that the floodplain, railroad, Interstate, and EAFB runway approach zones are barriers not only to land development but also to developing a connected transportation network. Numerous more specific transportation issues and needs were identified by those participating in developing the *BESTPlan*. These issues were considered during the development of *BESTPlan* and recommendations incorporated into future project identification.

Forecasted Growth

Future Land Use and Traffic Volumes

The impact of future growth in population and development on traffic volumes was forecasted using the Rapid City Area MPO's regional travel demand model. The initial Year 2035 land use forecasts documented in the model were refined based on input from the Study Advisory Team (SAT) to arrive at an estimate of 1,900 new households and 1,700 new employees by the

Year 2035. The project team adjusted the regional travel demand model to incorporate roadway network modifications (including the reduction of Highway 1416 from four to three travel lanes) anticipated to occur by the Year 2035. By the Year 2035, I-90 and Highway 1416 are expected to carry more than 10,000 vph. Radar Hill Road traffic volumes are expected to grow by about 35 percent to about 6,000 vpd.

Traffic Operations

Year 2035 traffic operations were evaluated along roadways and at intersections. Overall, it is anticipated that existing roadways in the study area have a sufficient number of travel lanes to easily accommodate projected traffic levels. Some intersection capacity problems are anticipated to occur with build out of the development areas and the addition of future background traffic. Highway 1416 intersections with West Gate Road, Radar Hill Road, and Ellsworth Road and the Ellsworth Road/Liberty Boulevard intersection would require signalized or roundabout control to operate at LOS C or better by the Year 2035.

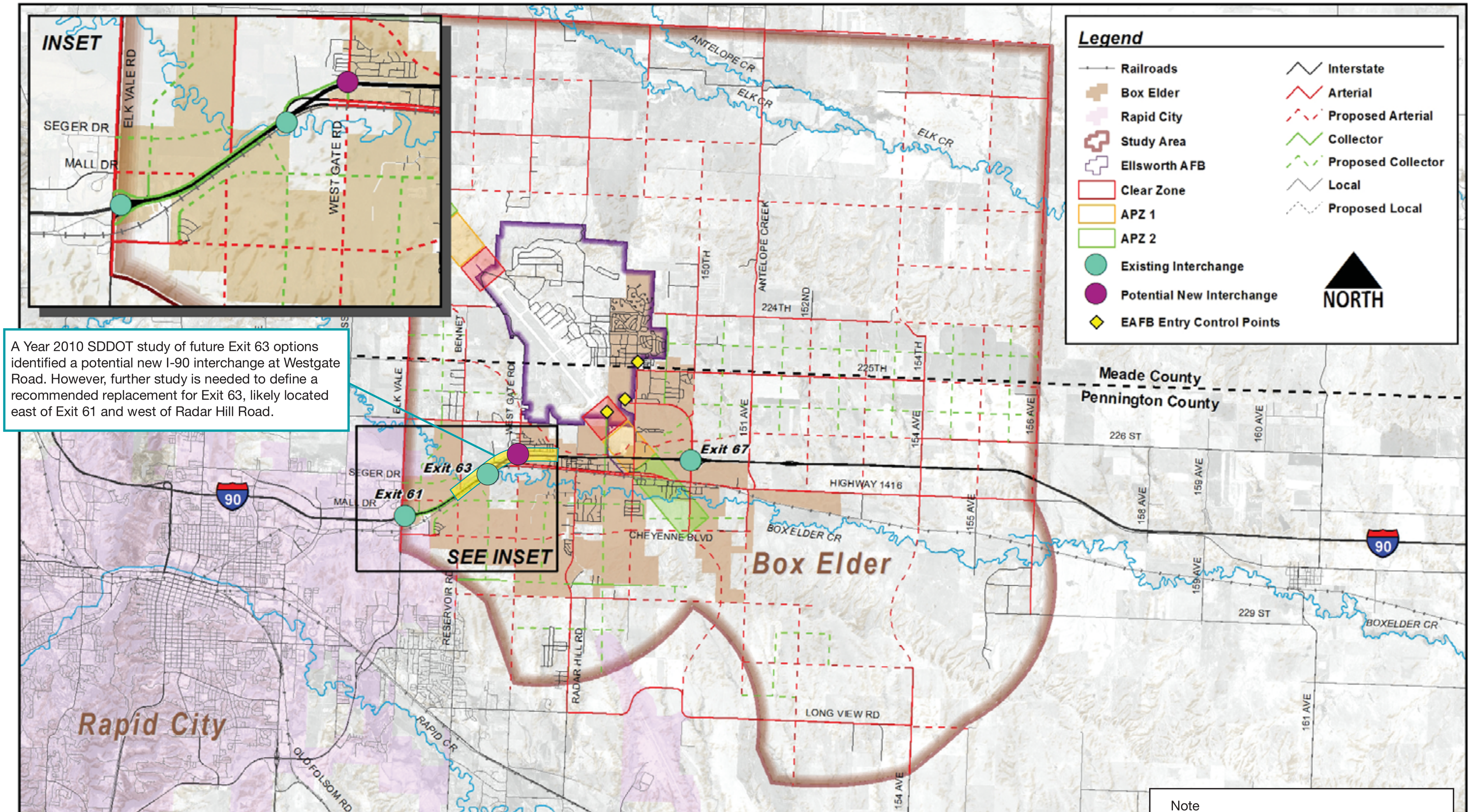
Long Range Transportation Plan

Major Street Plan

The Major Street Plan provides a framework for how the road network should be established as development occurs within the study area. The plan labels the classification of current roadways and identifies future roadway corridors designed to provide connectivity and access to new developments in rural portions of the study area. It is recognized that existing land uses may conflict with the roadway connections depicted, but it is not the intention of this plan to require immediate action. Instead, the Major Street Plan recognizes that over time, development patterns within the study area will evolve and certain areas will be more desirable for development. As development is pursued in these areas, the Major Street Plan should be consulted and appropriate right-of-way (ROW) allocated to fulfill this vision.

Figure ES-3 shows the Major Street Plan. An important topic for the City and the State is the future of Exit 63 on I-90. In view of this, the Major Street Plan recognizes further study is needed to define a recommended replacement for Exit 63.

Figure ES-3
Major Street Plan



A Year 2010 SDDOT study of future Exit 63 options identified a potential new I-90 interchange at Westgate Road. However, further study is needed to define a recommended replacement for Exit 63, likely located east of Exit 61 and west of Radar Hill Road.

Note
- Collectors are shown for information purposes; future alignments are to be determined by new development activity
- Arterial roadways as shown north of Ellsworth AFB would likely follow existing section lines

Pedestrian and Bicycle Master Plan

The Pedestrian and Bicycle Master Plan provides a framework for how the non-motorized network should be established within the study area as funds become available. The Plan builds on the existing system by offering improvements to the bicycle and pedestrian network where deficiencies exist and identifies new pedestrian and bicycle corridors designed to provide community connectivity and non-motorized access to new portions of the study area. In collaboration with the SAT, the project team determined that non-motorized improvements outside roadway curb lines such as sidewalks and paths would be the focus of this planning effort, as these are currently of primary importance and need improvement. However, it is important to note that on-street methods for accommodating cyclists, such as bicycle lanes, sharrows, widened shoulders, and bicycle boulevards remain valid strategies for Box Elder and should be considered in future planning efforts. **Figure ES-4** provides the Pedestrian and Bicycle Master Plan.

Plan Implementation

Roadway Project Plan

Recommended improvements to the Box Elder roadway transportation system have been derived from the Major Street Plan. Recommendations include a select list of projects generally within the City of Box Elder and identified through the public input process, traffic forecasting, intersection analysis, projects included in the State Transportation Improvement Plan (STIP), Rapid City Area MPO Transportation Improvement Program recommendations in the SDDOT Decennial Interstate Corridor Study, and projects identified by the SAT and City staff.

Project Funding Types

Projects are categorized either as public or private driven projects. Projects listed as public represent deficiencies within the roadway network that either currently exist or will occur with anticipated growth. These projects require complete funding from a public entity or group of entities: the City of Box Elder, Pennington and Meade counties, or SDDOT. Projects listed as private are those roadways driven by future development activity. These projects are, therefore, initiated by future growth and will require financial leading by a developer, to be supplemented where appropriate by a public agency.

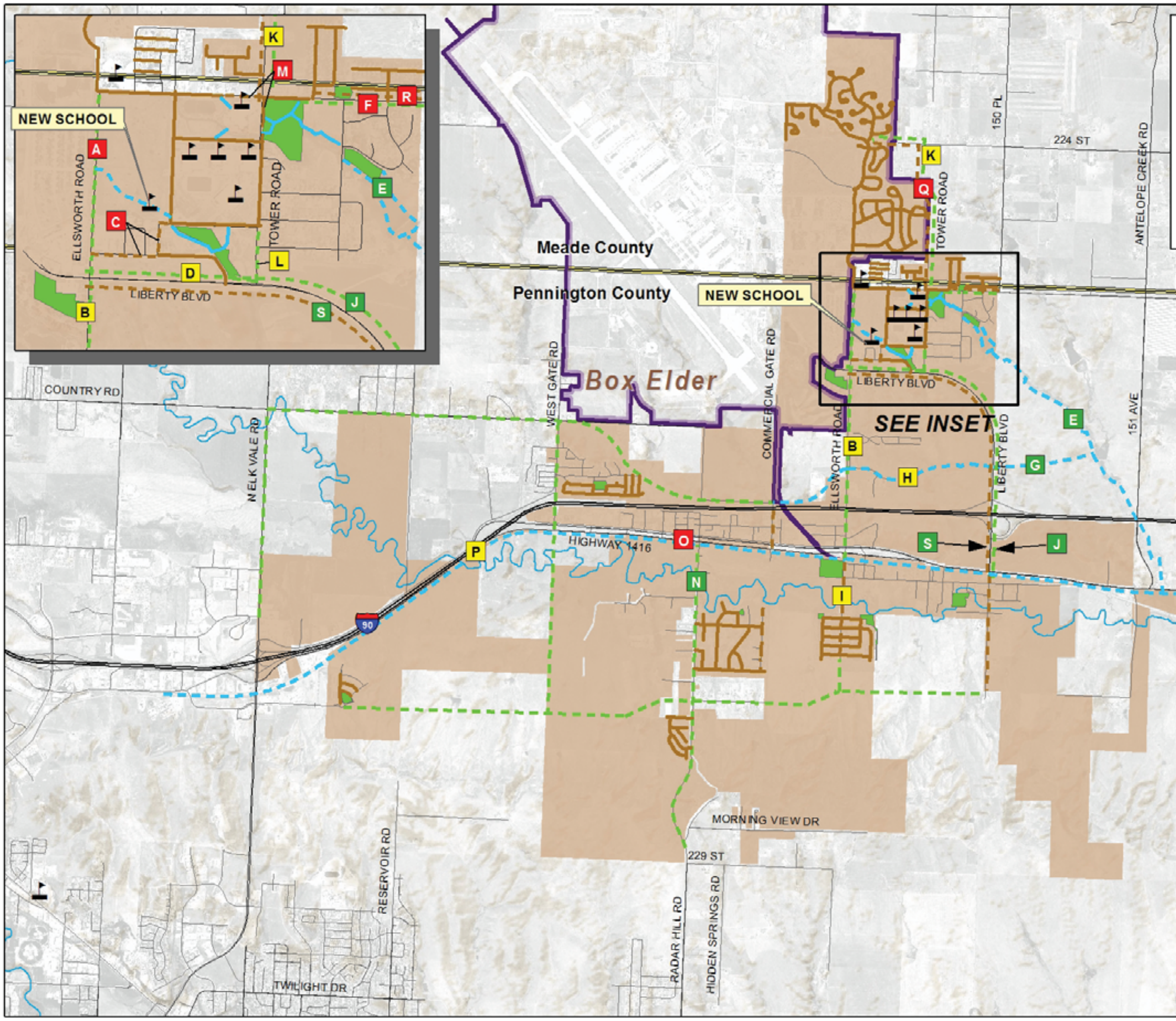
The City of Box Elder currently receives from SDDOT an allocation of Local Urban Systems Projects funds. Local roadways classified as rural major collectors and urban collectors and above are eligible for Federal-Aid funds. With the adoption of the Major Street Plan, the City can request changes in the functional class.

Project Prioritization

Recommended projects were prioritized into near-, mid-, and long-term categories. The prioritization was based on criteria that were derived from the values and goals that are important to the City of Box Elder, including the following:

- Neighborhood connectivity
- Economic development
- Congestion relief
- Safety
- Liberty interchange usage
- Regional connectivity
- Cost

Figure ES-4
Pedestrian and Bicycle Master Plan and Projects



Project ID	Project Description	Priority
A	Side path along Ellsworth Rd from Liberty Blvd to 225 St	High
B	Side path along Ellsworth Rd from 225 St to Highway 1416	Med
C	Sidewalks along Villa Dr and Briggs St	High
D	Side path along north side of Liberty Blvd from Tower Rd to Ellsworth Rd	Med
E	Shared use path from Prairie Rd to Highway 1416	Low
F	Side path on south side of 225 St from 150 Pl to existing connection	High
G	Shared use path from Liberty Blvd to new shared use path	Low
H	Shared use path along Cimarron alignment from Ellsworth Rd to Liberty Blvd	Med
I	Sidewalk along S. Ellsworth Rd from Hwy 1416 to neighborhood	Med
J	Side path along Liberty Blvd on east and north sides between Highway 1416 and Tower Rd	Low
K	Side path (east side) along Tower Rd from 224 St to 225 St	Med
L	New side path along Tower Rd from Liberty Blvd to Patriot Dr	Med
M	Complete sidewalk links around Middle School	High
N	Side path along Radar Hill Rd	Low
O	Shared use path along 1416 from Westgate Rd to Ellsworth Rd	High
P	Shared use path connection to Rapid City Path System	Med
Q	Sidewalk (west side) along Tower Rd from 224 St to 225 St	High
R	Sidewalk along north side of 225 St from Prairie Rd to 150 Pl	High
S	Sidewalk along Liberty Blvd on west and south sides	Low

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DREAM DESIGN INTERNATIONAL, INC.

Based on these criteria, projects were defined as either near, mid, or long term in their delivery as a complete project. Near-term projects are those anticipated to be funded and built within the next five years (2015 to 2020). These projects tend to be low-cost, publically funded projects that make new neighborhood connections to the roadway network, and address future capacity issues. Mid-term projects are those anticipated to be funded and built not immediately but within the next 5 to 15 years (2020 to 2030). Mid-term projects tend to be higher cost publically funded improvements and projects driven by development activity. Long-term projects are those anticipated to be funded and built in the long term (beyond 2030) by either the state or future investment by private entities.

Project List

Figure ES-5 shows the 22 projects that have been identified as roadway network improvements in the study area. The estimated costs associated with near-term projects reach approximately $11 million, mid-term $33 million, and long term $94 million.

Pedestrian and Bicycle Projects

The project team, in collaboration with the SAT, determined that the most important non-motorized needs are concentrated around the Douglas Schools area. Accordingly, the pedestrian and bicycle projects shown on **Figure ES-4** were prioritized based on proximity to the schools. Sidewalk and side paths costs were based on typical costs for concrete. Costs for shared use paths assumed 10 foot-wide gravel path. Based on 2013 construction cost estimates, the full set of identified projects would require an investment of about $1.8 million. Alone, the high priority projects would require $360,000 to complete.

Transportation Standards

Transportation standards developed for *BESTPlan* include roadway cross sections, a transportation development review process with traffic impact study guidance, access management standards, roadway surfacing considerations, and intersection and pedestrian crossing design guidelines.

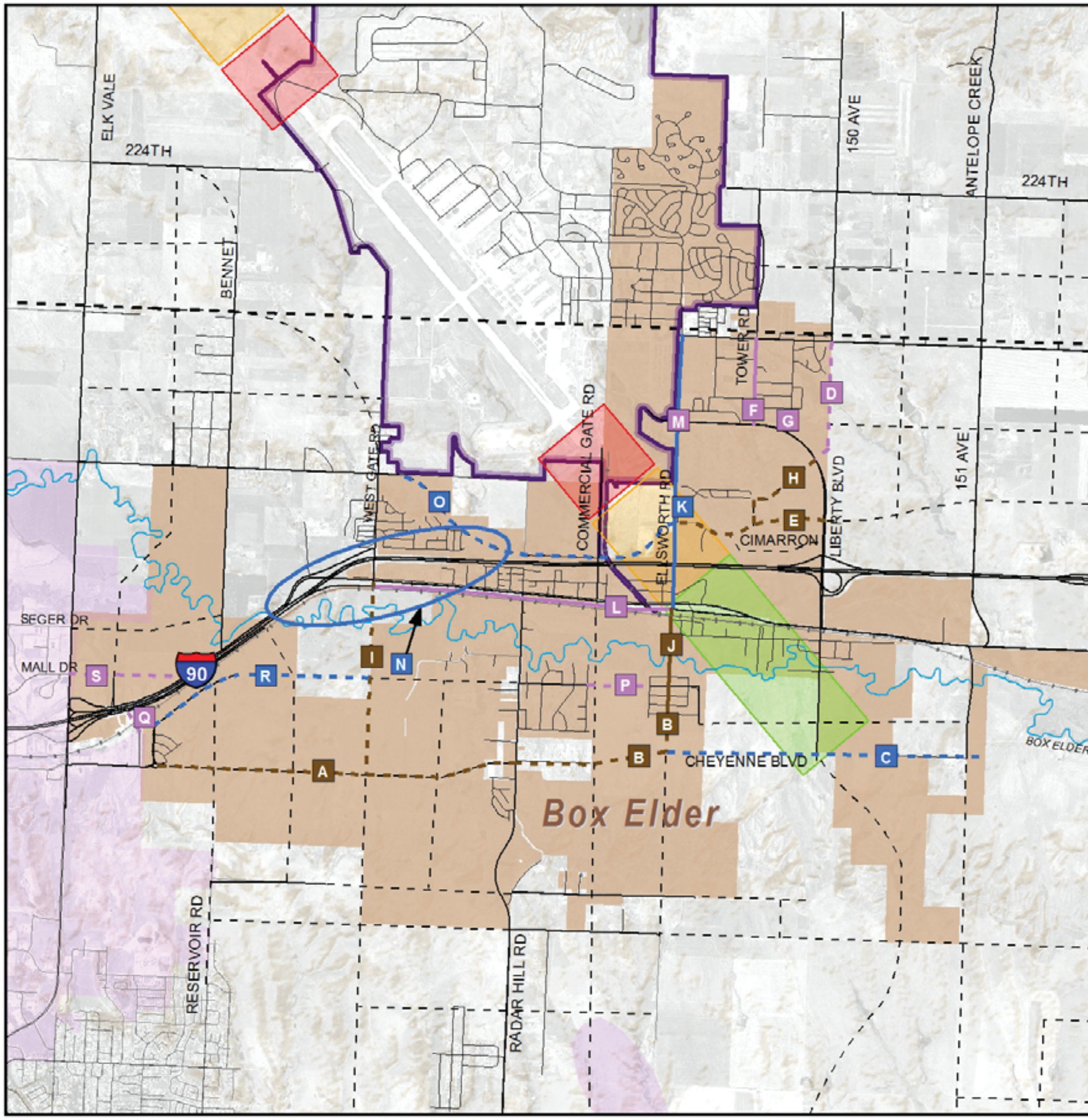
Roadway Cross Sections

Standards specify the characteristics of arterials, collectors, and local roadways. Characteristics include Right-of-way width (50-80 feet depending on classification), lane widths, design speed, and bike lane/shoulder width.

Transportation Development Review

It is recommended that transportation development review incorporate a level of service standard, and Traffic Impact Studies (TIS) for new development exceeding 1,000 vehicle-trips per day generated. The City of Box Elder will rely upon the City of Rapid City's published TIS guidelines. In addition to TIS's, development review should incorporate access management/spacing standards, sidewalk provision, and multi-modal travel accommodations.

Figure ES-5
Roadway Project Summary Map



Project ID	Street	Project Description	Priority	Funding Source
A	Cheyenne Blvd	New arterial from existing Cheyenne Blvd to Radar Hill Rd	Mid	Private
B	Cheyenne Blvd	New arterial from Radar Hill Rd to Ellsworth Rd and extend new arterial from neighborhood to Cheyenne Blvd	Mid	Public/Private
C	Cheyenne Blvd	New arterial from Ellsworth Rd to 151 Ave	Long	Private
D	150 Ave	New arterial from 225 St to Liberty Blvd	Near	Private/Public
E	Cimarron St	New arterial from Ellsworth St to Liberty Blvd	Mid	Private
F	Tower Rd	Improve to collector standards 225 St to Liberty	Near	Public
G	Prairie Rd	Extend Local Rd to Liberty Blvd	Near	Public
H	150 Ave	New collector from Liberty Blvd to Cimarron Blvd	Mid	Private
I	Westgate Rd	New arterial from Hwy 1416 to Cheyenne Blvd	Mid	Private
J	Ellsworth Rd	Upgrade to new arterial from neighborhood to 1416	Mid	Public
K	Ellsworth Rd	Upgrade to arterial from 1416 to 225 St	Long	Public
L	Hwy 1416	Convert to 3-lane from I-90 to Liberty Blvd	Near	Public
M	Intersection	Liberty Blvd/Ellsworth Rd traffic control improvements	Near	Public
N	Interchange Modifications	Interchange options study for Exit 63	Mid	Public
		Interchange improvements or replacement of Exit 63 per study recommendations	Long	Public/State
O	Cimarron St	New Arterial from Ellsworth to Westgate Rd	Long	Public
P	New Rd	New collector to connect Freude Ln to Creekside Dr	Near	Private/Public
Q	Degeest Dr	New local from the end of Degeest Dr to Frontage Rd	Near	Private/Public
R	Northern Lights Blvd	New Collector from Northern Lights Blvd to Westgate Rd extension	Long	Public/Private
S	Mall Dr	New Arterial from Elk Vale to Frontage Rd	Near	Private

Access Management

Access management techniques are recommended in *BESTPlan*, with different spacing standards for roadways of varying classification. In general, accesses to arterials should be placed farther apart than accesses to collectors.

Roadway Surfacing

BESTPlan provides factors for the decision to pave a gravel roadway, including traffic levels, continuity, traffic diversion caused by paving, traffic safety, design needs, cost and public input.

Intersection and Pedestrian Crossing Design

Throughout the planning process, City of Box Elder staff requested that standards be developed to assist the City in making decisions about pedestrian crossings of roadways. Standards address methods for determining whether any special crossing treatment is necessary, determining the type of treatment that is most appropriate (if needed), and determining design elements of pedestrian crossings. Final selection and design of the treatment should be developed using available industry resources and professional assistance.

Action Steps

The following list provides a summary of actions the City of Box Elder should implement to ensure that needed transportation improvements are planned for and funded:

- Officially adopt *BESTPlan* through the governing bodies, including MPO Committees, Box Elder Planning Commission, and City Council.
- Begin to plan and budget for completion of the eight roadway improvements and seven pedestrian and bicycle improvements identified for the short term. Leverage the existing Box Elder Capital Improvement Projects Committee to address these improvements.
- Initiate discussions with SDDOT on the alignment and intersection control for the planned modifications to Highway 1416 identified in the STIP.
- Implement the Transportation Standards identified in *BESTPlan*, including:
    - Require traffic impact studies from proposed developments that meet the size thresholds so that the requirements for internal roadways and impacts to the surrounding roadway system can be evaluated. Development projects should be responsible for improving the arterials and collectors adjacent to their developments to match Box Elder's standard cross-sections.
    - Use the Major Street Plan as the official future roadway plan for the City and as a tool to identify required street corridors as the City exercises its platting authority in Meade and Pennington counties.
    - Permit new accesses/approaches to City roadways based on the categories and guidelines included in *BESTPlan.*
    - Integrate pedestrian crossing design guidance into future crossing projects and enhancements to existing pedestrian roadway crossings.
    - Use the typical roadway sections provided in *BESTPlan* to provide guidance to development projects as to the required ROW dedication and provide a starting point for roadway design and construction projects.

I. INTRODUCTION

A. Background

The City of Box Elder is a western South Dakota community of nearly 9,000 residents. Box Elder, incorporated in 1965, is home to the Ellsworth Air Force Base (EAFB) (est. 1941) and Douglas School District. The City has been experiencing sharp growth in recent years, adding residents within historic City boundaries and increasing in population due to annexation of previously unincorporated neighborhoods. The population has more than doubled in the five years since 2009, and its current population makes Box Elder a Class 1 City according to South Dakota Department of Transportation (SDDOT) guidelines. Population growth is expected to continue into the future, and commercial development, which has lagged behind residential growth, may also accelerate.

The aggressive growth has taxed Box Elder's utility and transportation infrastructure. Current challenges to Box Elder's transportation system include:

Serving commuters and residents: As growth has occurred, the transportation network is faced with the challenge of accommodating a large group of commuters who enter the City to work at EAFB, as well as providing circulation for those who call Box Elder home. It is increasingly difficult to balance the need to get large numbers of people in and out every day and enhance livability for local residents and businesses.

Different standards: The annexed property and rapid growth have introduced roads and intersections that have been constructed to different standards and templates. The challenge is to develop a more unified system—enhancing the look and feel of the community while also improving transportation safety and efficiency.

More traffic: Growth has meant more traffic on the City's roads, triggering periodic congestion and revealing some traffic safety concerns along roadways and at intersections. The transportation system is now challenged to catch up to this growth and set the stage for sustainable future growth.

The City, in cooperation with the Rapid City Area Metropolitan Planning Organization (MPO) and SDDOT, has completed the Box Elder Strategic Transportation Plan, or *BESTPlan*, as a step toward addressing these and other challenges to the transportation infrastructure. The first such plan developed by the City in nearly 20 years, the plan comes at a strategic time and its outcomes are intended to provide a blueprint for many years to come.

B. Purpose

The purpose of *BESTPlan* is to address a series of desired planning outcomes and transportation objectives, described as follows.

Planning Outcomes

BESTPlan has been developed to fulfill citywide planning objectives. As shown in **Figure 1**, the transportation plan integrates public and stakeholder involvement, transportation data and analysis, and regional planning considerations into a cohesive document that can be used to advance the City's economic, social, fiscal, and community engagement goals.

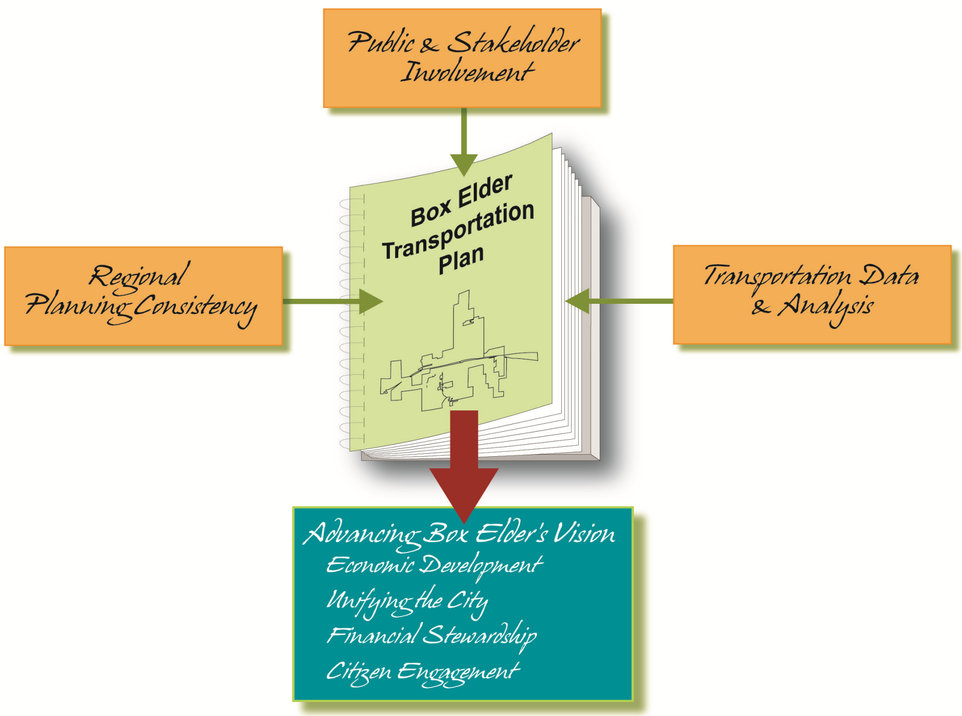


Figure 1. Planning Vision

The *BESTPlan* planning process is designed to deliver the following:

- **A Strategic Plan**: Aligns the built environment with regional and local goals, ensuring that transportation projects support elements important to the community such as the ongoing mission of EAFB or safe pedestrian circulation around schools.
- **A Collaborative Effort**: Provides the public with a forum and a voice by opening the process to input from Box Elder's elected leaders, City staff, residents, institutions, and the general public.
- **Practical Results**: Provides the way to funding and building successful, sustainable transportation projects that will serve the City for many years. It positions the City to take advantage of multiple available funding streams to accomplish transportation priorities.

- **A Regional Focus**: Engages agencies and areas beyond Box Elder's borders to ensure that the City's transportation network helps connect Box Elder with the surrounding world.

Transportation Objectives

Transportation objectives addressed in *BESTPla*n are as follows:

1. Address how the transportation system can enhance livability within the Box Elder community, particularly emphasizing multimodal connectivity among neighborhoods, schools, and business districts.
2. Provide a major street plan that frames the existing system and identifies future improvements, not a road map.
3. Coordinate transportation planning efforts across multiple jurisdictions, including the City of Box Elder, Pennington and Meade counties, Rapid City, and the SDDOT.
4. Develop transportation engineering standards for use by new development in the City of Box Elder.
5. Identify priorities among future transportation improvement projects.
6. Support EAFB mission.
7. Identify logical truck routes.

C. Project Governance

The Study Advisory Team (SAT) supervised the effort to develop *BESTPlan*. The following individuals representing the City of Box Elder, Rapid City Area MPO, EAFB, SDDOT, Federal Highway Administration (FHWA), and Pennington and Meade counties formed the SAT:

- William Griffiths, Mayor, City of Box Elder
- Ron Koan, City of Box Elder
- Al Todd, City of Box Elder
- Tricia Weathers, City of Box Elder
- Kip Harrington, Rapid City Area MPO
- Brad Remmich, SDDOT
- Dan Staton, SDDOT
- Dan Jennissen, Pennington County
- Wesley Tschetter, Pennington County
- Bill Welk, Pennington County
- Bill Rich, Meade County
- Karl Christiansen, EAFB
- Leonard Iverson, EAFB
- Mark Hoines, FHWA
- Mike Stanley, 42^{nd} St. Design Studio
- Terry Cash, Dream Design

The SAT convened five times during the planning process to facilitate key project decisions, provide input on major deliverables, and develop and oversee the public involvement process.

D. Approach

The project team devised an approach to accomplish the fundamental objectives identified at the outset of the project, which include:

1. A list of transportation issues and needs facing the City of Box Elder.
2. 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. Final products for use by the City of Box Elder, SDDOT, and Rapid City Area MPO, which will provide guidance to implement recommended improvements and anticipate future development plans within the area.

To accomplish these items, the project was organized into five planning tasks supported by a strong public, agency, and stakeholder input process covered by Tasks 6 through 9. **Figure 2** presents a work flow diagram to illustrate the approach.

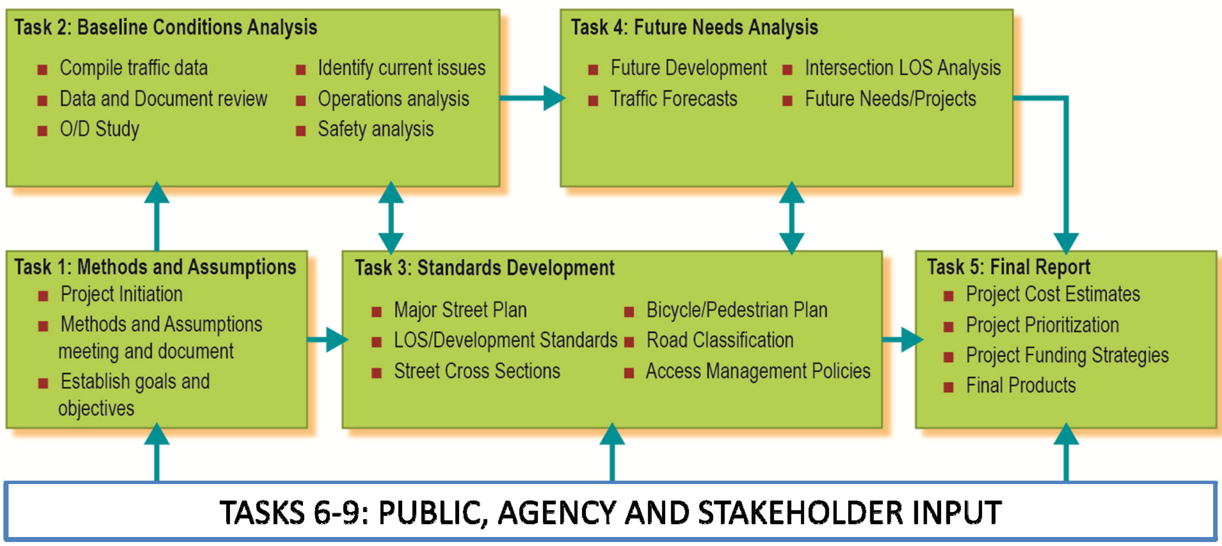


Figure 2. Work Flow Diagram

Upon developing the Methods and Assumptions (see **Appendix A**) that would govern the plan and gain SDDOT and FHWA approval, the project team identified current traffic flow and safety issues throughout Box Elder's transportation network using analyses of traffic flow and safety history (Tasks 1 and 2). Task 3, Standards Development, provides a policy framework for the transportation plan and provides the City with a set of tools for addressing future development and transportation infrastructure improvements. Task 4 adds future growth to current traffic volumes to identify needs that may be triggered by traffic growth and projects that would address those needs. Task 5 provides the completion of this report, including a list of prioritized projects and policy guidelines.

The public, agency, and stakeholder input process began in August 2013 with a face-to-face project kickoff meeting to confirm project goals and objectives and identify critical concerns for the project. Four more SAT meetings were held throughout the project, with a special Transportation Planning Workshop with City staff in July 2014.

An extensive public involvement process supported Tasks 2 through 5. Major public involvement activities are described as follows:

- **Public Input Open House**: The first public meeting, held in November 2013 in the Box Elder Events Center, provided attendees with an overview of existing transportation conditions and issues. Public input was gathered from individual conversations and comment sheets. **Appendix B** provides a summary of the public meeting.
- **Draft Plan Open House**: A public meeting held in July 2014 reported draft findings to the public and gathered feedback on project materials. **Appendix B** provides a summary.
- **Stakeholder Meeting**: The project team held a meeting with Douglas School District Officials in August 2013. School-related traffic is a major component of Box Elder's roadways, and the discussion helped the project team understand school needs and priorities.
- **Project Website**: The project website, www.boxelderstp.com, initially published in December 2013, provides basic information about *BESTPlan*, including project contacts, public meeting materials, and opportunities to provide feedback and ask questions.
- **Facebook Page**: A facebook page devoted to the plan, established in October 2013, directs visitors to the project website and announces upcoming events.

E. Elements of the Transportation Plan

The elements of the plan include:

- Inventory of Existing Conditions
- Forecasted Growth
- Major Street Plan
- Pedestrian and Bicycle Plan
- Transportation Standards
- Recommended Future Transportation Project Priorities

F. How to Use BESTPlan

BESTPlan is intended to serve as a planning tool for City decision makers well into the future. The following steps are recommended to maximize the plan's usefulness and sustainability:

- **Adoption**: The plan will be submitted to Box Elder staff and it is recommended that staff pursue official adoption of the plan by the City's governing bodies. Adoption of the plan will help to ensure its long-term viability. It is also anticipated that the Rapid City Area MPO will approve the document.
- **Funding pursuit**: Once officially approved and adopted, the plan can be used as a tool to plan for, pursue, and direct funding for transportation projects. Funding can come from various programs, including Urban Surface Transportation Program funds distributed by SDDOT, grant programs sponsored by various agencies, capital improvement funds made available by the City budgeting process, or other sources. *BESTPlan* provides a list of transportation projects prioritized based on urgency of need and ease of implementation. The prioritized listing should direct the limited available funding to the most important needs.
- **Future Updates**: Due to changes in travel patterns, financial circumstances, political leadership, population growth, and other influences, it is recommended that *BESTPlan* be updated regularly to ensure that transportation planning accurately reflects current conditions. A five-year update increment is appropriate.

II. INVENTORY OF EXISTING CONDITIONS

To understand how transportation is provided to Box Elder residents, businesses, and visitors, the project team took an inventory of the existing transportation system and conducted a public input meeting. This inventory is an important part of the planning process; it becomes the starting point to identifying areas in need of improvement. Similar to other cities of comparable size, Box Elder's transportation system centers on the roadway network, which serves automobile, freight, bicycle, and pedestrian movements throughout the study area. The growing network of paths and multi-use paths further enhance bicycle and pedestrian movement. **Figure 3** shows the *BESTPlan* study area. The area covers approximately 127 square miles and includes all of the City of Box Elder and portions of Meade and Pennington counties.

The inventory of existing conditions includes the following aspects of Box Elder's transportation system:

- **Traffic conditions**, including current traffic volumes, roadway and intersection operations, and traffic crash experience.
- **Non-motorized facilities**, identifying accommodations for bicycle and pedestrian travel.
- **Ellsworth Air Force Base (EAFB)**, identifying travel patterns to and from the base.

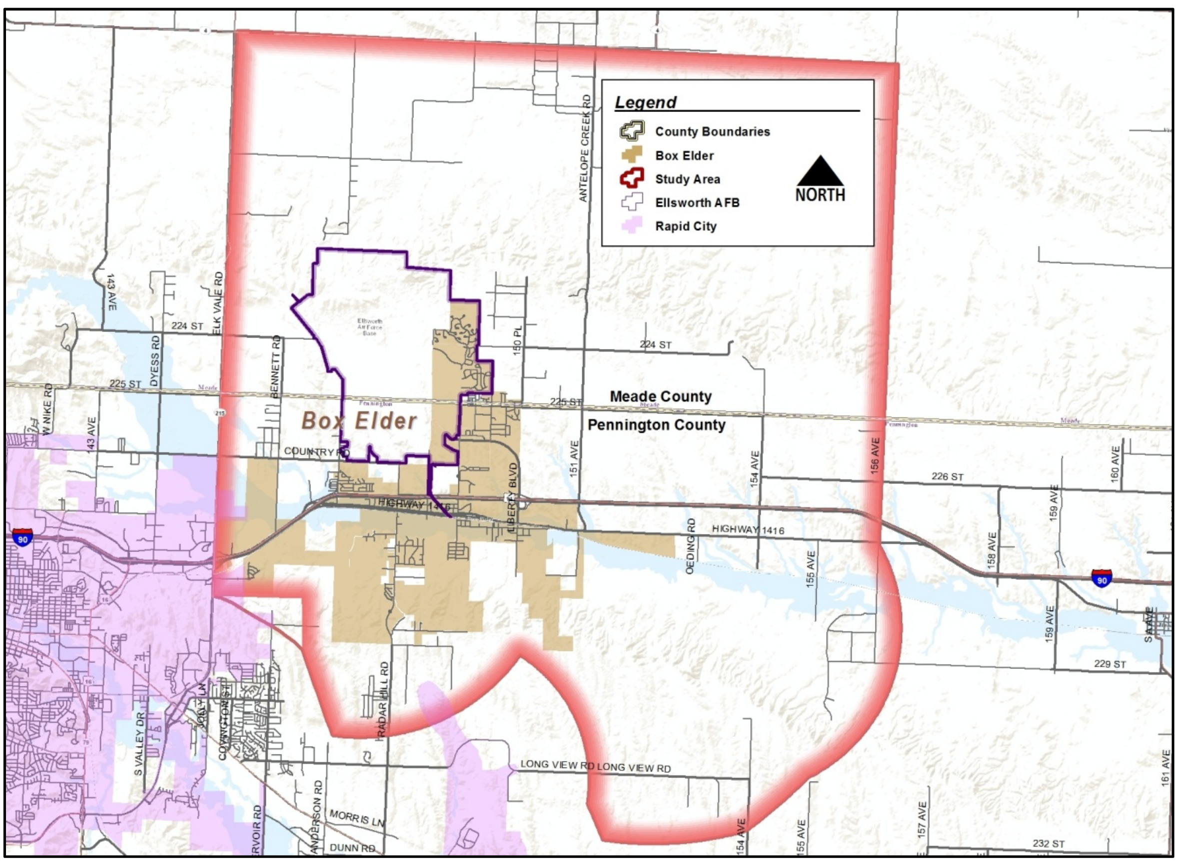


Figure 3. Study Area

A. Traffic Conditions

Land Use and Roadway Network

EAFB and development trends to date have affected the existing roadway locations and continuity within the study area. The *BESTPlan* study area is bifurcated by Interstate 90 (I-90). North of I-90, EAFB blocks east-west continuity. South of I-90, topography restricts north-south travel within the study area. Due to these physical and natural barriers, development has clustered in various pockets within the Box Elder city limits. Most development has occurred east of EAFB and is bounded by Tower Road to the east and Liberty Boulevard to the south. Commercial development has occurred along the Highway 1416 corridor, and recent residential development has occurred along the Radar Hill Road corridor. In recent years, new commercial and residential development has been occurring in the western part of the City near the I-90 / Elk Vale Road interchange.

Most roads within the study area provide two travel lanes (one in each direction). The only four-lane roads are I-90, Highway 1416 from I-90 to Ellsworth Road, and Liberty Boulevard between I-90 and Ellsworth Road. The following sections describe major roadways in the study area.

Interstate 90: I-90 is a four-lane interstate freeway that extends east-west throughout Pennington County and forms the backbone of the City of Box Elder area roadway network. The posted speed is 65 miles per hour (mph) along I-90 through the study area. Three interchanges provide Interstate access. Exit 61 is the Elk Vale Road interchange and is single point urban (SPUI) interchange. Exit 63 is the Highway 1416 interchange and is a partial movement interchange that only provides I-90 access to and from the west. Exits 67A and 67B are the Liberty Boulevard interchange, which is a partial cloverleaf configuration with a loop ramp to serve eastbound to northbound movements.

Highway 1416: Highway 1416 is a divided four-lane roadway extending east-west from I-90 to Ellsworth Road, where it then becomes two lanes through the City and the study area. The four-lane section is posted 55 mph and posted 65 mph outside the city limits.

Radar Hill Road: Radar Hill Road is a north-south arterial extending from Highway 1416 to State Highway (SH) 44. It is east of Elk Vale Road and is the only roadway in the study area that traverses the ridge south of Box Elder.

Ellsworth Road: Ellsworth Road is a two-lane north-south arterial running north from just south of Box Elder Creek, under I-90, to the Patriot Gate at EAFB.

Travel Patterns

EAFB is one of the largest employers in South Dakota, and as a result, personnel traveling to and from the base greatly influence travel patterns in the City of Box Elder. Furthermore, EAFB vehicle-trips concentrate at a few locations because base access is limited to three access control points located on the south and east sides of the base. Commercial Gate is on the south side of the base located along Commercial Gate Drive. Liberty Gate is located just west of the Liberty Boulevard / Ellsworth Road intersection. Patriot Gate is the northernmost gate and is located at the end of Ellsworth Road just north of 225th. With these gates clustered to the southeast corner of the base, it adds further strain to a Box Elder transportation network already lacking area wide connectivity.

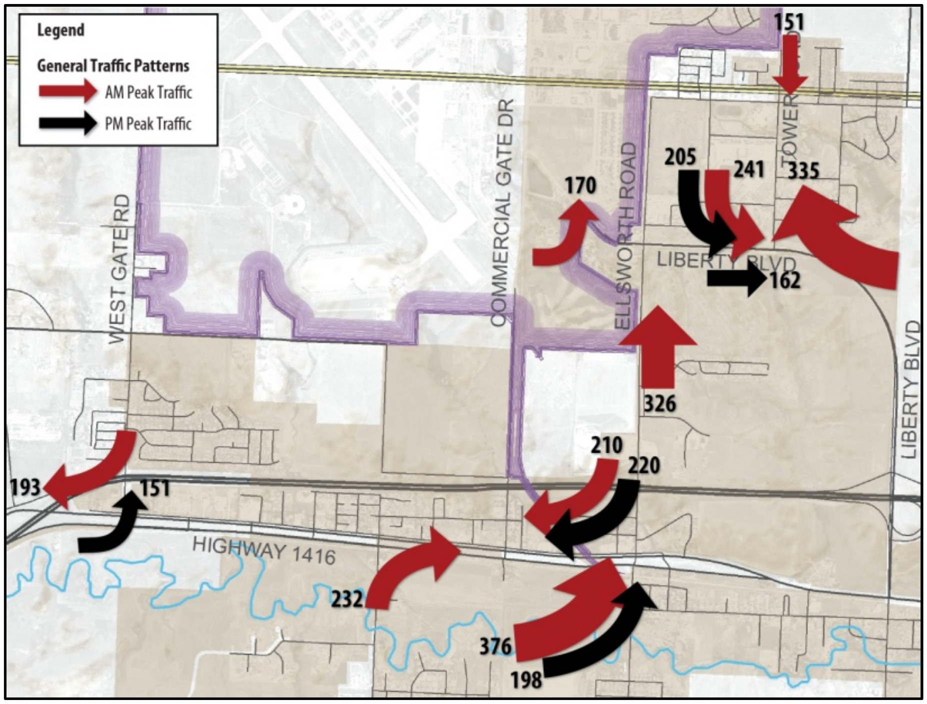


Figure 4. Box Elder Peak Hour Traffic Patterns

Figure 4 shows the magnitude of major peak hour travel pattern activity throughout the City of Box Elder. As shown, the highest levels of peak hour volumes in the City occur along Highway 1416, Ellsworth Road, Tower Road, and Liberty Boulevard. The highest peak hour volumes occur at the Tower Road / Liberty Boulevard at the Highway 1416 / Ellsworth Road intersections. The former is likely related to traffic generated by public school traffic accessing Tower Road, while the latter is related to a combination of school and EAFB traffic.

Access to EAFB is available only at its three access control points. Therefore, the traffic counts at intersections immediately outside these controlled access points give important insight into the travel patterns of EAFB personnel during peak hours.

Figure 5 shows most EAFB-related traffic uses Commercial Gate Drive to enter and leave the base during the morning and evening commutes. This is due to the relatively quick and easy access to Commercial Gate from I-90 via Highway 1416. Patriot Gate, located at the north end of Ellsworth Road, experiences the second highest level of traffic and, therefore, impacts the intersection of Ellsworth Road and 225th Street. Liberty Gate, which has direct access to I-90 via Liberty Boulevard, surprisingly, is the least used access control point by EAFB personnel and visitors during the morning and evening commutes.

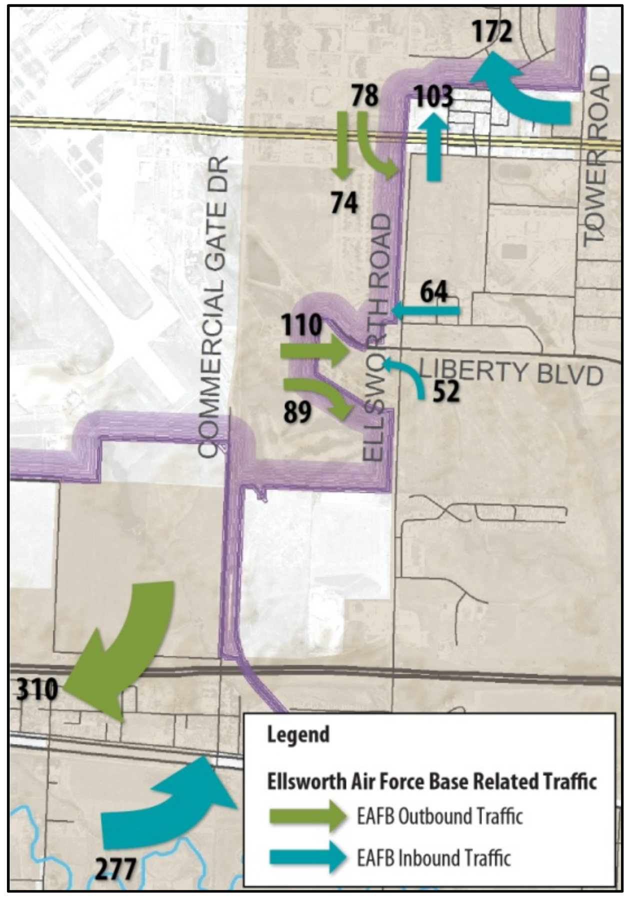


Figure 5. Ellsworth Air Force Base Peak Hour Traffic Patterns

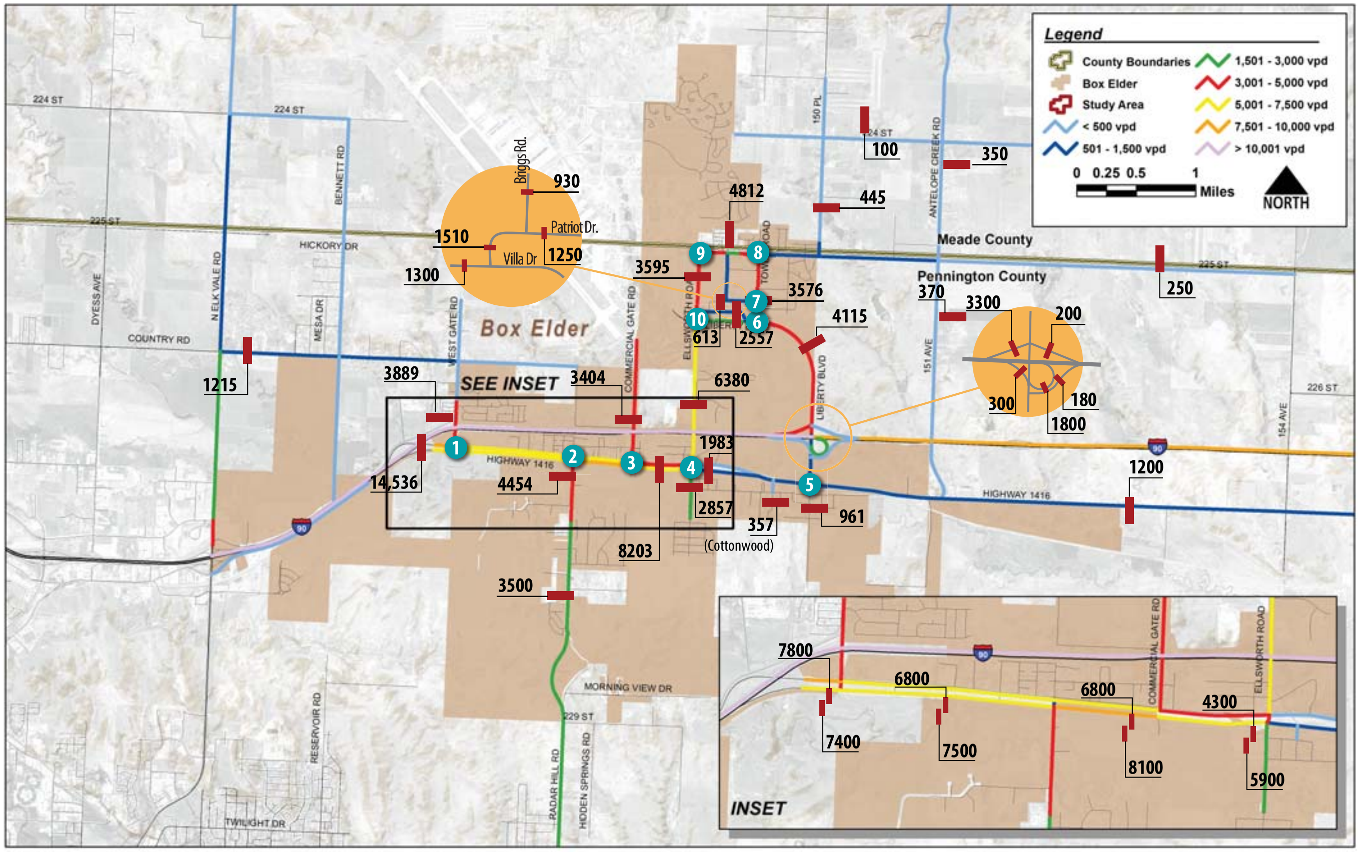
Traffic Volumes

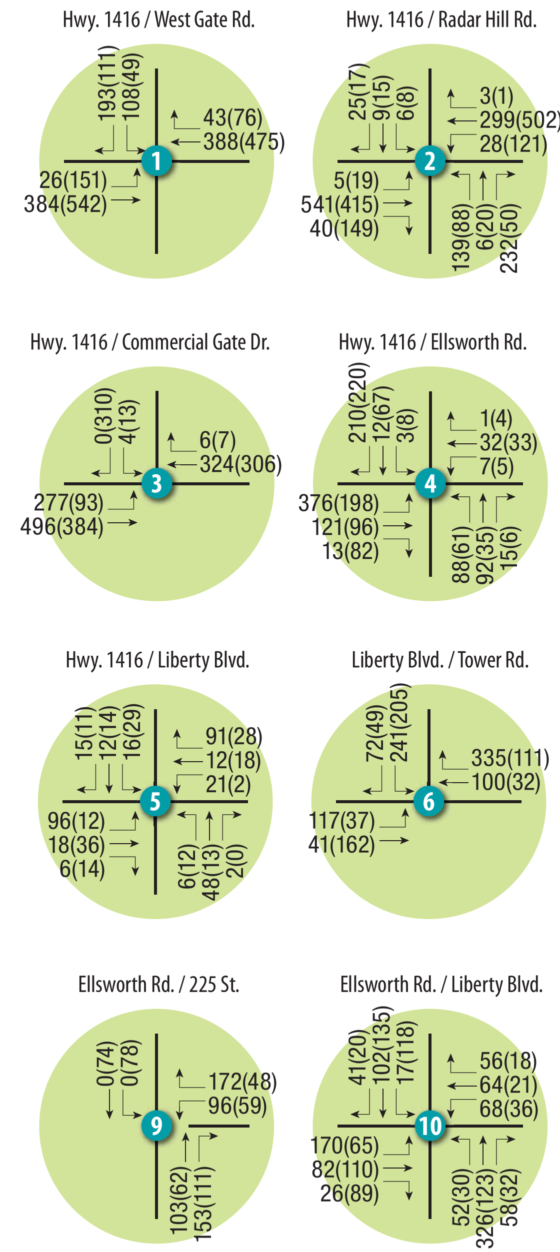
Figure 6 shows the extensive effort in collecting study area wide traffic volumes. Daily traffic volumes from 2012 and 2013 were obtained from existing County, City, State, and MPO databases with 2012 and 2013 volumes. These counts were supplemented by additional daily counts collected in spring 2014. As shown, current traffic volumes along I-90 and Highway 1416 exceed 10,000 vehicles per day (vpd). A second tier of roadways, Ellsworth Road, Liberty Boulevard, Tower Road, Commercial Gate Drive, 225th Street, and Radar Hill Road, carries between 3,000 and 10,000 vpd. Most other roadways in the study area carry less than 3,000 vpd.

In addition to the daily count data, 10 intersections were identified for peak hour turning movement counts. These intersections were identified based on delay, geometry, congestion, and input from the SAT and the public. **Figure 6** shows the peak hour turning movement data collected at the following intersections:

- Highway 1416 / West Gate Road
- Highway 1416 / Radar Hill Road
- Highway 1416 / Commercial Gate Drive
- Highway 1416 / Ellsworth Road
- Highway 1416 / Liberty Boulevard
- Liberty Boulevard / Tower Road
- Tower Road / Patriot Drive
- Tower Road / 225th Street
- Ellsworth Road / 225th Street
- Ellsworth Road / Liberty Boulevard

Figure 6
Existing Traffic Volumes





Legend

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

XXXX Daily Traffic Count

Count Location

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Traffic Operations

Existing traffic operations were evaluated along roadways and at intersections. Roadway operations were evaluated using volume-to-capacity ratios for roadway segments. Intersection operations were evaluated by determining the Level of Service of turn movements at the intersection. The following sections describe and document the operational characteristics of the existing transportation network in Box Elder.

Volume to Capacity Ratios

The operational characteristics of a roadway segment are based on the volume to capacity ratio (V/C). This ratio compares the existing daily traffic levels with the actual design capacity of the roadway. A V/C ratio of 1.0 means that there is roughly an equal balance between the number of lanes and the vehicular traffic using the roadway. The planning level daily capacity thresholds shown in **Table 1** are the basis for the V/C ratios estimated in this transportation plan. These thresholds are the maximum planning level capacities in vehicles per day (vpd) for various roadway types and travel lanes. Roads with higher functional classifications would accommodate more vehicles per lane roads with lower functional classifications.

Table 1. Planning Level Roadway Capacities

Functional Classification	Number of Lanes	Maximum Capacity
Interstate 90	4-Lane	60,000 vpd
Arterial / Collector	2-Lane	12,000 vpd
	3-Lane	15,000 vpd
	4-Lane	24,000 vpd
	5-Lane	27,000 vpd

Figure 7 graphically depicts the V/C ratios calculated on the streets within the planning area using existing daily volume data. Red segments represent roadways that carry traffic volumes in excess of the planning level roadway capacity (V/C ≥ 1.0). Yellow segments represent roadways that are operating at near capacity conditions (V/C between 0.80 and 1.0). Green segments represent roadways operating below capacity (V/C < 0.80).

As shown, all roadways in the study area have a V/C ratio of less than 0.80 and are, therefore, shown as green. This finding generally means that roadways in the study area have a sufficient number of travel lanes to accommodate existing levels of traffic.

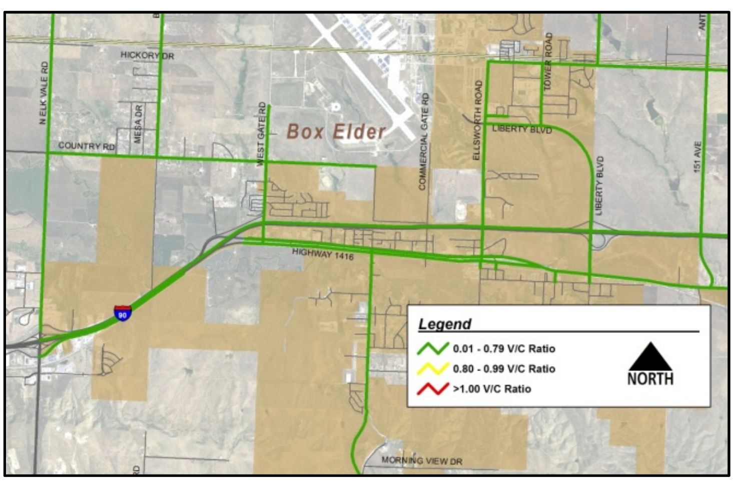
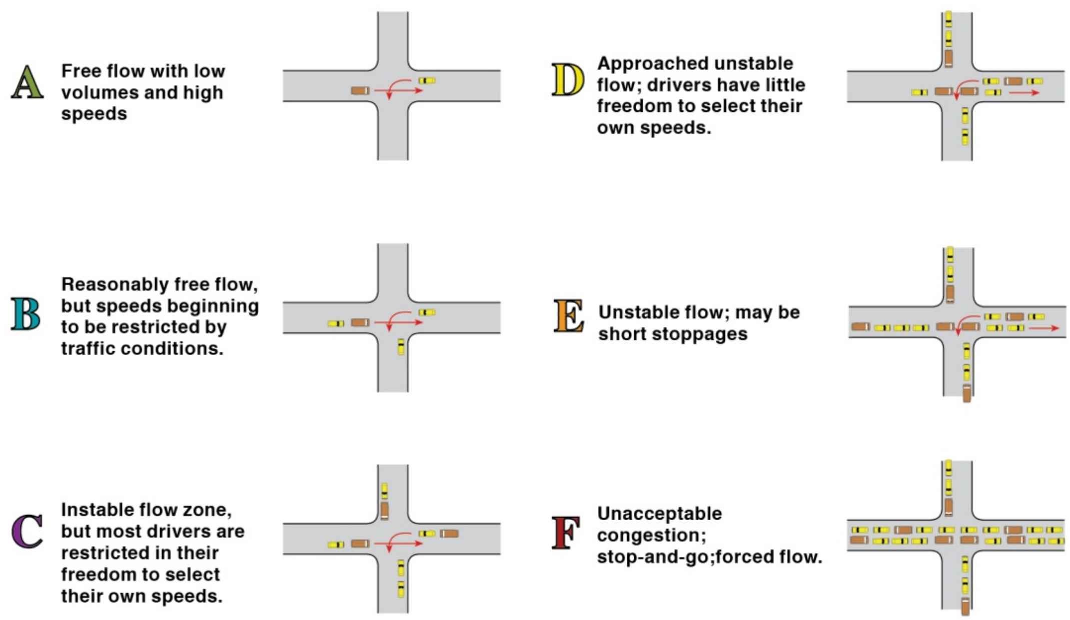


Figure 7. Existing Volume to Capacity Ratios – Roadway Segments

Intersection Level of Service

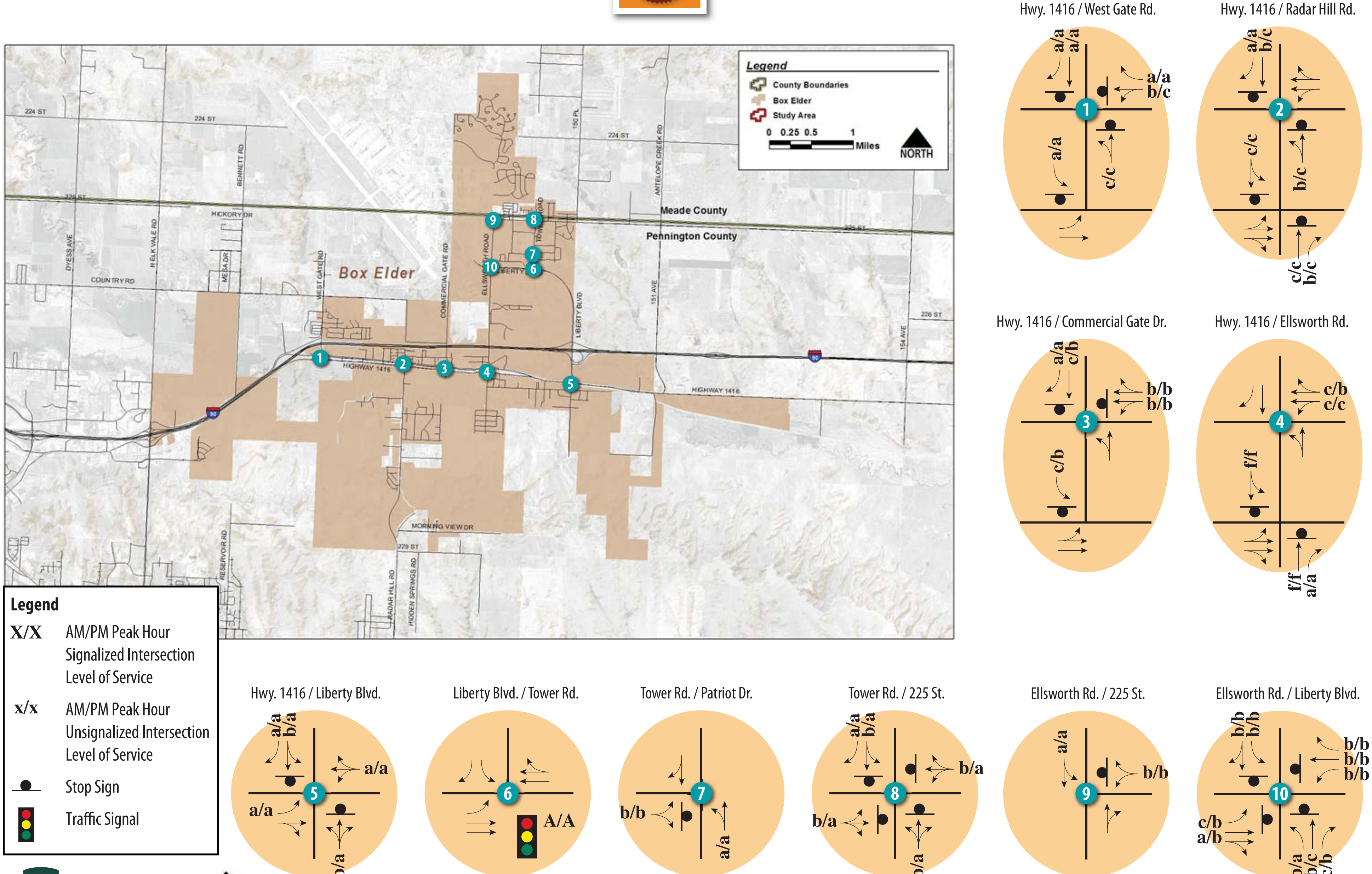
Another measure of roadway network operations is the Level of Service (LOS) of key network intersections. The LOS is the result of analytical procedures documented in the *Highway Capacity Manual* (Transportation Research Board, Fourth Edition, 2010). These analytical procedures provide a LOS, which is a quantitative measure based on the average delay per vehicle at a controlled intersection. A letter ranging from “A” to “F” describes LOS. LOS A represents minimal delay, LOS F represents excessive congestion and delay, and LOS B to E represents increasing levels of delay and congestion. The illustration below gives both a pictorial and a text definition for each LOS threshold.



Many agencies and municipalities publish standards for acceptable intersection LOS during peak hour traffic conditions. For example, SDDOT accepts intersection operations of LOS D or better during peak hours. The City of Rapid City seeks to provide LOS C or better intersection operations during peak hours. For the *BESTPlan*, LOS C or better is considered an acceptable level for intersection operations.

The project team, in collaboration with the SAT and general public, identified a list of 10 intersections for detailed operational study in *BESTPlan*. These intersections currently present operational or safety concerns or may do so in the future. The study intersections include nine unsignalized (STOP sign) intersection and one signalized intersections. Individual AM and PM peak LOS are provided for individual movements at stop-sign controlled intersections, while an overall intersection LOS is given for signalized intersections. **Figure 8** provides the results of the LOS analyses of existing conditions, while a more detailed description of intersection operations is provided in the following sections.

Figure 8
Existing Peak Hour Levels of Service



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The operational results are described as follows by intersection:

Highway 1416 Split Intersections: Four of the analyzed intersections along Highway 1416 are configured with a split between the eastbound and westbound directions of Highway 1416. This results in unusual intersection geometry and traffic control that is counter-intuitive to drivers and causes in elevated crash rates at some locations. Operational conditions at these intersections are described as follows:

Highway 1416 / West Gate Road: This intersection is located at the far west end of Highway 1416. Specifically at the West Gate Road intersection, the westbound Highway 1416 intersection is all-way stop controlled, while at the eastbound intersection, West Gate Road is the stop controlled approach. Given this intersection control and current lane geometry, the operational analyses indicate that all turn movements operate at LOS C or better during the peak hours.

Highway 1416 / Radar Hill Road: The Radar Hill Road approaches have STOP signs. The operational analyses show that all turn movements from Radar Hill Road operate at LOS C or better during the peak hours.

Highway 1416 / Commercial Gate Drive: Commercial Gate Drive intersects eastbound and ends at westbound Highway 1416. Traffic is controlled by STOP signs on southbound Commercial Gate Drive at both Highway 1416 intersections and on westbound Highway 1416. With this traffic control, turn movements currently operate at LOS C or better during the peak hours.

Highway 1416 / Ellsworth Road: At the westbound 1416 intersection, traffic is controlled by STOP signs on the westbound and southbound approaches, while the northbound approach is free flow. The LOS analysis of this intersection shows LOS C or better for turn movements. At the westbound Highway 1416 intersection, the Ellsworth Road approaches are controlled by STOP signs, and as a result, turn movements crossing the heavy traffic volumes from eastbound to northbound operate at LOS F during the peak hours.

Highway 1416 / Liberty Boulevard: At this intersection, the Liberty Boulevard approaches are controlled with STOP signs. Turn movements at this intersection currently operate well at LOS B or better during the peak hours.

Liberty Boulevard / Tower Road: This is the only signalized intersection in the study area. The operational analysis shows the intersection operating at LOS A during the peak hours.

Tower Road / Patriot Drive: This T-intersection has stop control on Patriot Drive. Turn movements at this intersection operate at LOS B during the peak hours. However, school-related congestion during pick-up and drop-off times may not be reflected in LOS results since the results are the average LOS over the entire peak hour, not the 15 minutes of pick-up and drop-off. The school-related congestion on Tower Road makes it difficult for Patriot Road traffic to turn onto Tower Road.

Tower Road / 225th Street: This intersection has stop control on all approaches. During the peak hours, all turn movements operate at LOS B or better. Like the Tower Road / Patriot Drive intersection, congestion during school pick-up and drop-off times may not be reflected in the level of service results since the analysis is the average LOS over the entire peak hour, not during the 15 minutes of pick-up and drop-off.

Ellsworth Road / 225th Street: This T-intersection has stop control on 225th Street. Turn movements at this intersection operate at LOS B during the peak hours.

Ellsworth Road / Liberty Boulevard: This intersection has stop control on all approaches. During the peak hours, all turn movements operate at LOS C or better.

B. Safety

The SDDOT currently maintains a Geographic Information Systems (GIS) crash database designed to monitor crash trends. As part of the Strategic Transportation Plan, crash data were compiled for a five-year period to identify the most hazardous intersections within the study area. The analysis was conducted for all crashes between 2008 and 2012.

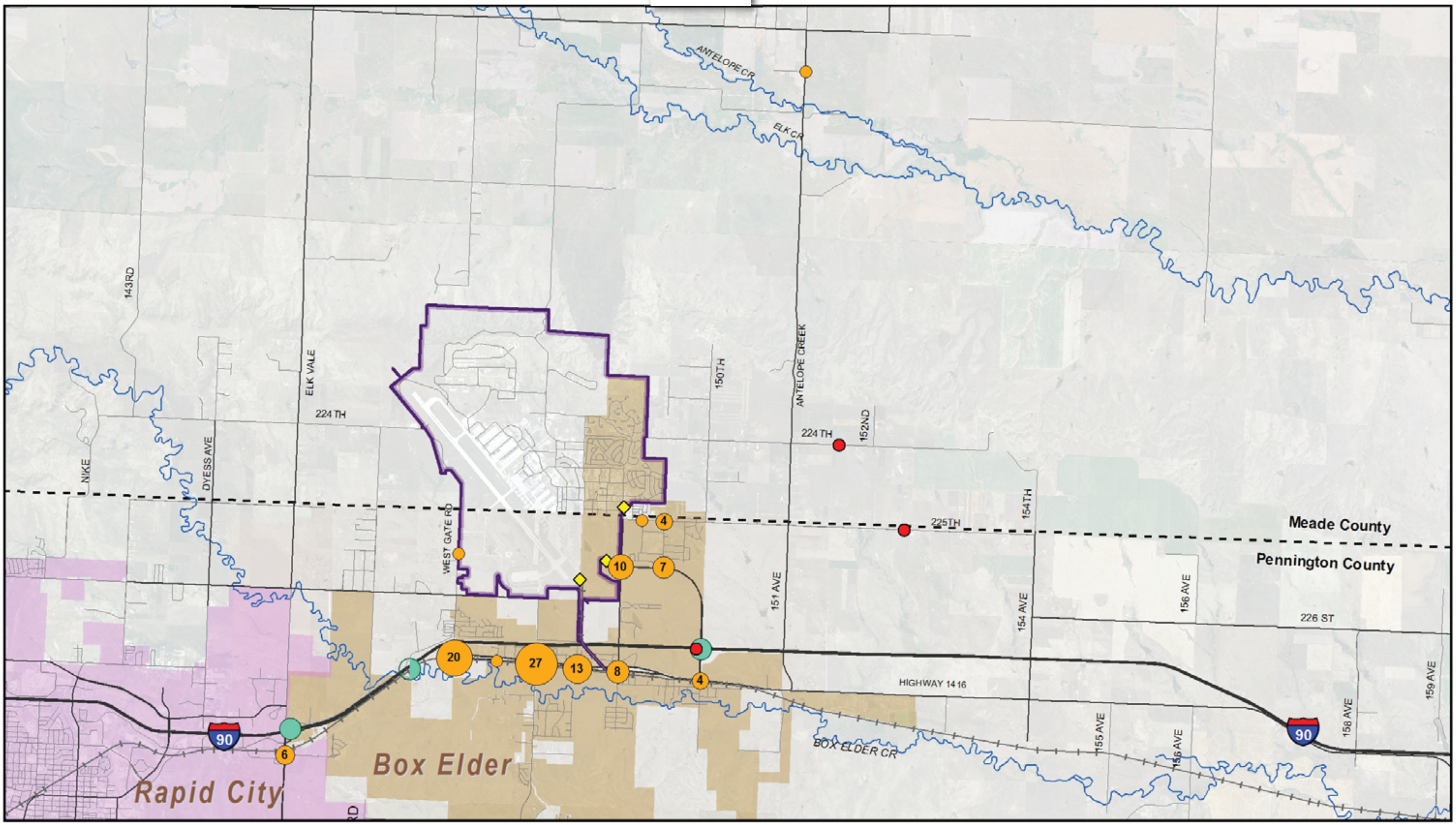
A total of 546 traffic crashes were reported in the study area between 2008 and 2012. There were three fatal crashes within the study area during the study period, all of which were roadway departure type crashes. In addition to these statistics, it is noteworthy that 44 percent of crashes were roadway departure crashes and 14 percent of crashes involved wildlife. Crashes that happened at night along unlighted roadway segments represented approximately 32 percent of all crashes. Sixty percent of crashes occurred on a dry roadway surface.

Figure 9 focuses on the top crash intersections within the study area in terms of crash frequency while also identifying in red any location where a fatal crash occurred. **Table 2** lists the intersections and the number of collisions at each, providing additional commentary about specific issues. Issues identified at intersections included the high frequency of angle-type collisions, which often occur at busy unsignalized intersections as vehicles seek to complete left turns onto or cross the major street. Intersections along Highway 1416 represent four of the top five crash locations.

Table 2. Top Crash Intersections in Study Area

Rank	Intersection	Number of Crashes 2008–2012			Prominent Crash Types
		Total	Property Damage Only	Injury and Fatal	
1	Hwy 1416 / Radar Hill Rd	27	14	13	Angle
2	HWY 1416 / Westgate Rd	20	9	11	Angle
3	Hwy 1416 / Commercial Gate Dr	13	9	4	Angle, Rear-End
4	Liberty Blvd / Ellsworth Rd	10	10	0	Angle, Rear-End
5	Hwy 1416 / Ellsworth Rd	9	6	3	No clear crash pattern
6	Liberty Blvd / Tower Rd	7	5	2	Angle
7	Elk Vale Rd / Frontage Rd	6	4	2	Rear-End
8	225th Street / Tower Rd	4	3	1	No clear crash pattern
9	Hwy 1416 / Liberty Blvd	4	2	2	No clear crash pattern

Figure 9
Crash Summary



Legend

High Accident Location	Box Elder	Ellsworth AFB	Full Interchange
Fatal Accident	Rapid City	EAFB Entry Control Points	Half Interchange
Railroads			

NORTH

0 0.35 0.7 1.4 Miles

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C. Pedestrian and Bicycle Facilities

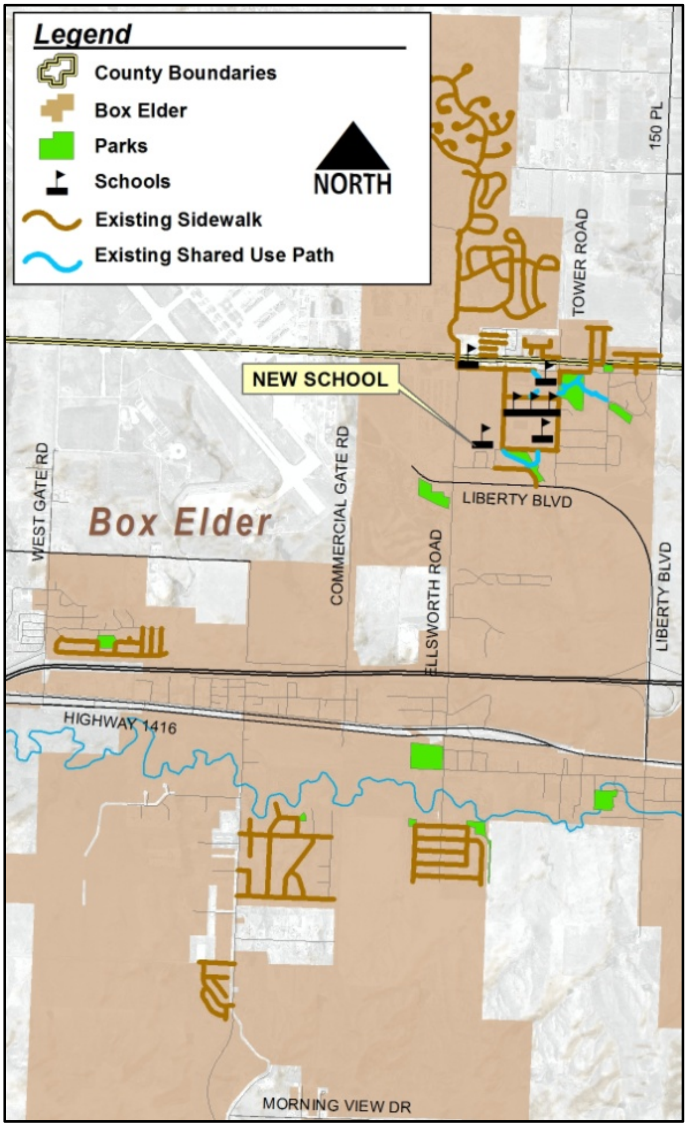


Figure 10. Sidewalk Inventory

The inventory of pedestrian and bicycle facilities, shown on **Figure 10**, was compiled based on a physical and aerial photograph review of current infrastructure. Currently, there are limited bicycle facilities in the City of Box Elder. Sidewalks exist in some residential areas and along roadways near the school area. Overall, there appears to be sidewalk connectivity between the residential areas in north Box Elder and the schools. However, outside this area, there is inconsistent sidewalk connectivity throughout the City. In addition to the sidewalks, Box Elder has some off-system, shared-use paths. These paths are located in north Box Elder between Tower Road and Prairie Road and between Patriot Drive and Vista Drive and generally connect the schools to some adjacent neighborhoods.

D. List of Current Issues

In addition to the technical analyses conducted by the project team, public input through the SAT and public meetings helped to identify and to understand the existing transportation issues within the study area. This process was a valuable tool in identifying the biggest transportation issues needing attention during the development of the *BESTPlan*.

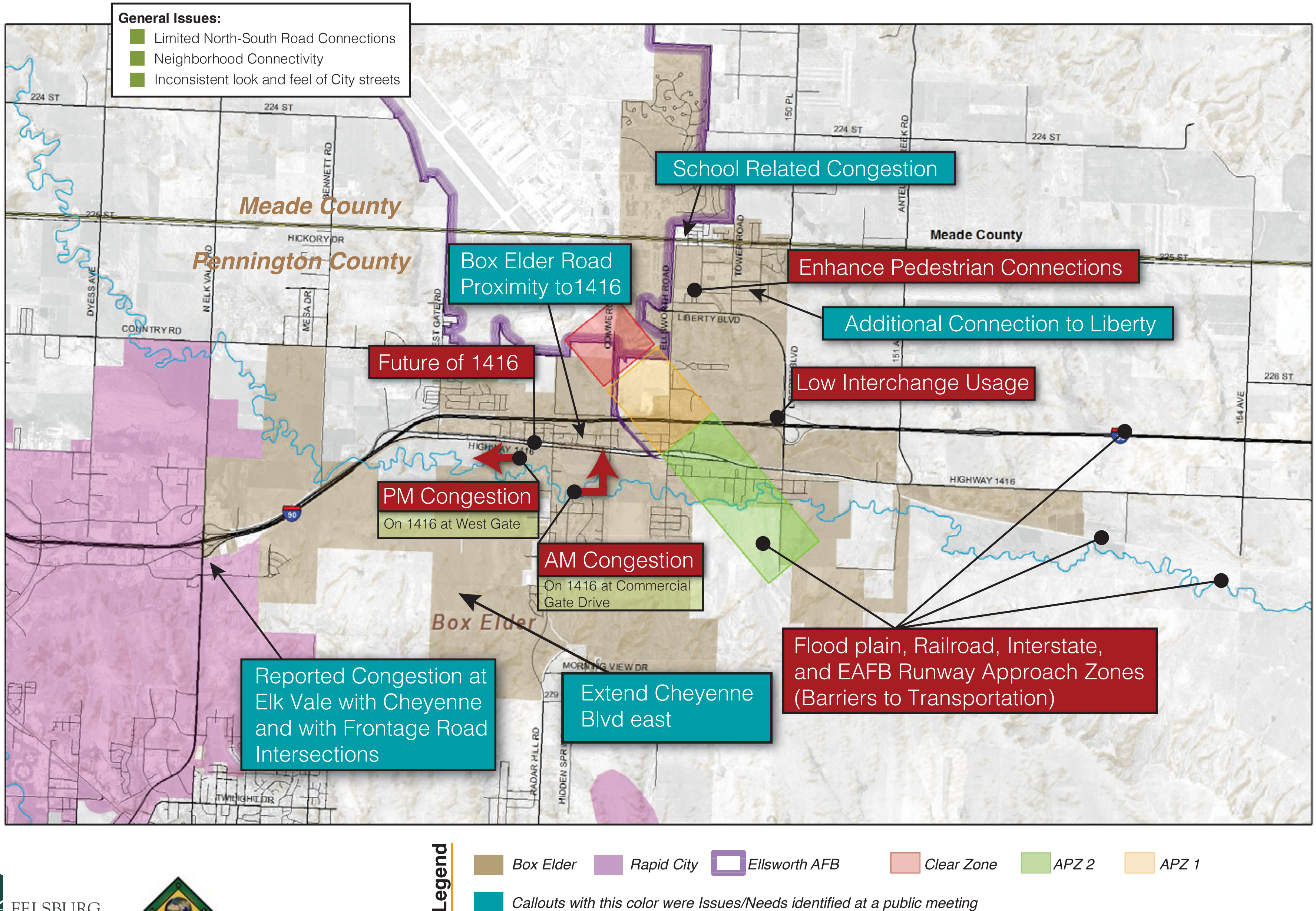
Figure 11 summarizes known needs and issues that helped to develop the *BESTPlan*. The City, agencies, and the public identified several area wide issues by noting a general lack of north-south connectivity among vehicle and non-motorized facilities. They also noted the lack of connectivity between neighborhoods and the inconsistent look and feel among City streets. City staff noted that the floodplain, railroad, Interstate, and EAFB runway approach zones are barriers not only to land development but also to developing a connected transportation network.

More specific transportation issues and needs identified by those participating in developing the *BESTPlan* included the following:

- The need to change the configuration of the I-90 interchange at Exit 63
- The relatively low usage of the Liberty Boulevard / I-90 interchange
- The need to extend Cheyenne Boulevard east to Radar Hill Road
- Congestion on Highway 1416, specifically eastbound at Commercial Gate during the AM peak and westbound at West Gate Road during the PM peak
- Lack of sidewalk/path along Ellsworth Road
- The need to provide a second point of access to the roadway network for neighborhoods with only one means of access
- The need to improve pedestrian connections around the school
- The proximity of Box Elder Road to Highway 1416
- The development of transportation standards for traffic impact studies, geometric design, and roadway typical sections
- The future configuration of Highway 1416
- Reported congestion at the Elk Vale Road / Cheyenne Boulevard intersection (this reported congestion was not studied)
- The need for congestion relief along 225th Street and Tower Road during school pick-up and drop-off

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

Figure 11
Identified Transportation Issues / Needs



III. FORECASTED GROWTH

A. Land Use

The City of Box Elder has experienced significant growth in the last 10 to 15 years. According to census data, the City has grown from about 3,500 residents in 2000 to nearly 8,000 residents in 2010, making it one of the fastest growing cities in the state. The City's growth has been catalyzed by annexation activity, regional growth, and proximity to EAFB. Box Elder is expected to continue to see residential growth complemented by new activity in commercial and light industrial uses.

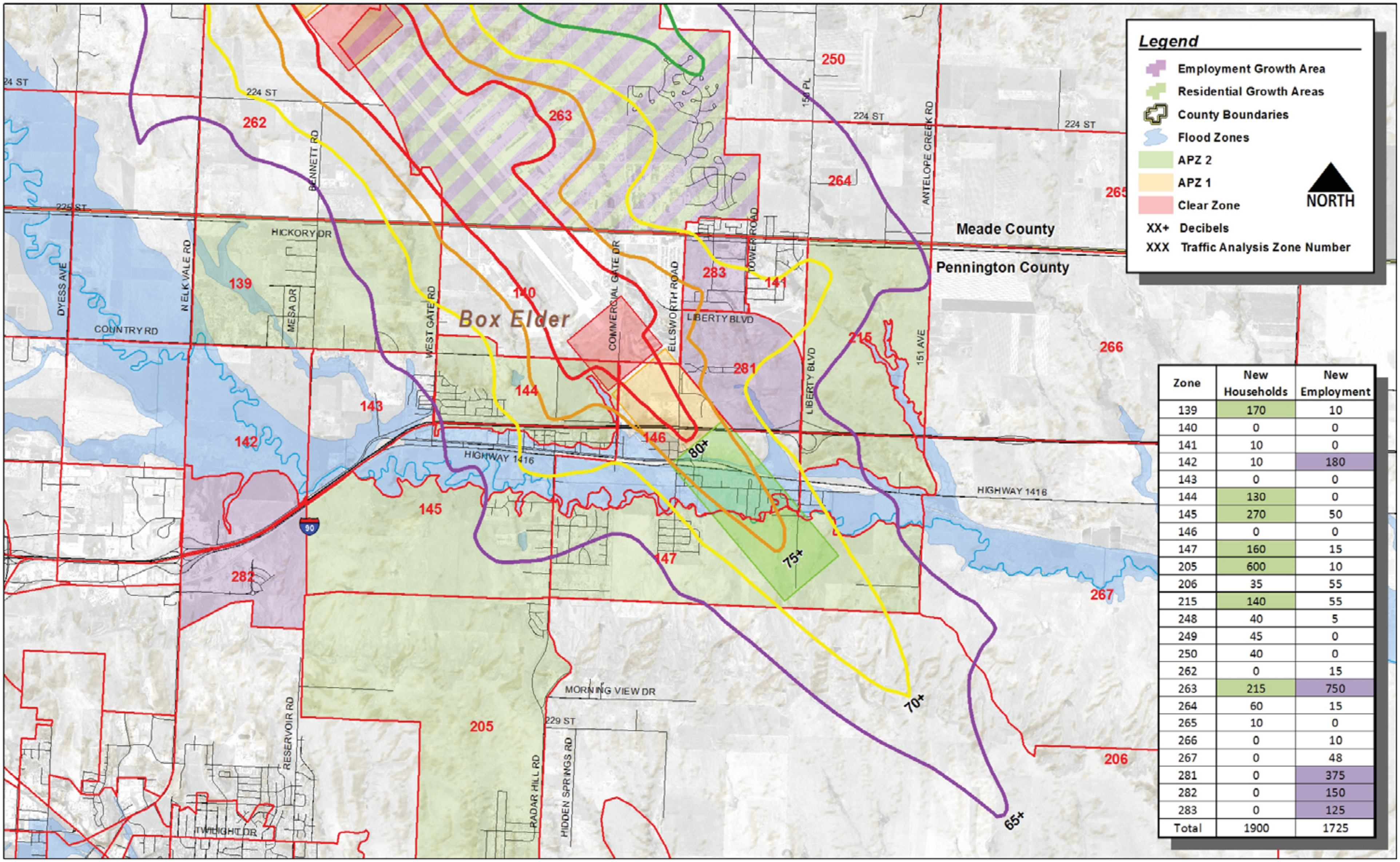
The City of Box Elder is part of the Rapid City Area MPO. One of the responsibilities of the Rapid City Area MPO is to develop regionwide forecasts for employment and households and to distribute these forecasts among smaller areas known as Traffic Analysis Zones (TAZs). Employment and household estimates are provided for each TAZ and are the basis for estimating the number of vehicle-trips generated in and out of the TAZ. Based on origin-destination patterns, these vehicle-trips are distributed among all other TAZs in the regional model. This assignment of vehicle-trips in and out of a TAZ is done for every TAZ in the model. The model then goes through an iterative process to distribute all of these vehicle-trips between TAZs to the region's supporting transportation network to develop a travel demand estimate for each roadway.

Figure 12 shows the Rapid City Area MPO TAZ structure for the City of Box Elder. For this project, a few modifications were made to the TAZ structure to group similar land use types and to represent existing roadway and topographical boundaries.

The Rapid City Area MPO provides Year 2035 forecasts for employment and households for each TAZ. The SAT reviewed and modified these forecasts based on their local knowledge of new development activity and trends in development activity within the City of Box Elder. Based on this input, the City is expected to add about 1,900 new households by 2035, which averages to about 175 to 200 residents per year. The City of Box Elder has grown historically at this rate. Most of the household growth is expected south of Highway 1416. In addition to the new households, the number of new employees is expected to increase by about 1,700 by 2035. Employment growth is expected to occur on EAFB and at the western end of Box Elder near the I-90 / Elk Vale Road interchange.

Figure 12

Forecasted Increase in Households and Employment by 2035



Zone	New Households	New Employment
139	170	10
140	0	0
141	10	0
142	10	180
143	0	0
144	130	0
145	270	50
146	0	0
147	160	15
205	600	10
206	35	55
215	140	55
248	40	5
249	45	0
250	40	0
262	0	15
263	215	750
264	60	15
265	10	0
266	0	10
267	0	48
281	0	375
282	0	150
283	0	125
Total	1900	1725

B. Future Traffic Volumes

The Rapid City Area MPO travel demand model was used to develop long range, Year 2035 traffic projections for study area roadways. Model runs used the TAZ structure and the land use forecasts shown in **Figure 12** and the base year 2035 transportation network was modified slightly to reflect existing and future roadway conditions with the City of Box Elder. Modifications to the roadway network included the following:

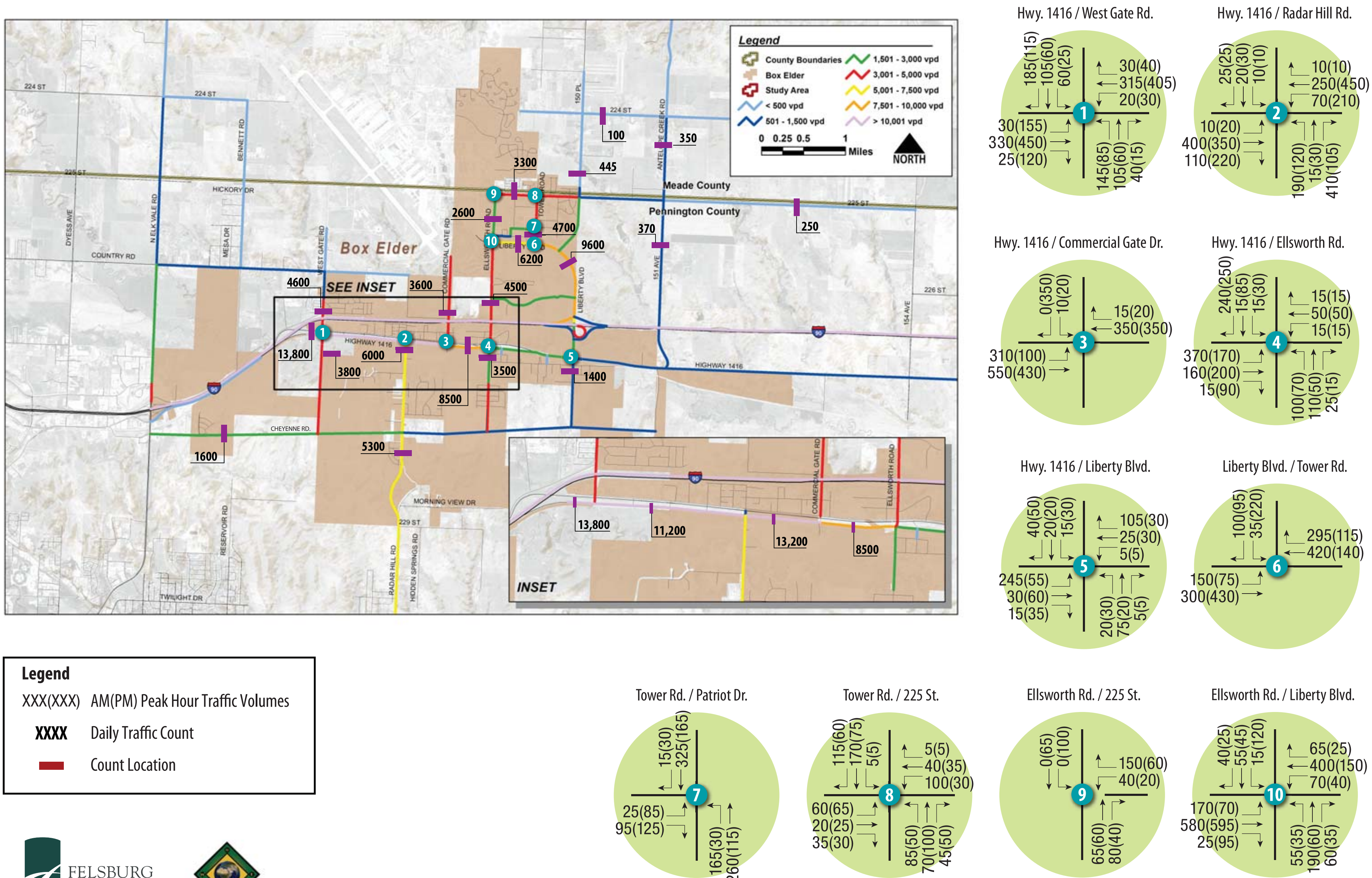
- Converting Highway 1416 from four lanes to a three lane roadway
- Adding roadway links between 225th and Liberty, along the 150th Place alignment
- Adding Cimarron Street between Ellsworth Road and Liberty Boulevard
- Adjusting modeled connections to better reflect how TAZ areas would access the adjacent roadway network

After these modifications to land use, TAZs, and the roadway network, daily traffic projections were developed for study area roadways. Transportation demand model results were adjusted using calibration factors developed from the relationship between existing traffic counts and results from the existing travel demand model.

Figure 13 depicts daily traffic volume projections in 2035. I-90 and Highway 1416 are expected to carry more than 10,000 vph. Highway 1416 projections are about the same or even slightly less than existing traffic counts, while Liberty Boulevard projections are more than twice the existing traffic volume. This likely reflects the reduced capacity and slower travel speeds with the three-lane Highway 1416 causing traffic to divert to I-90 to access EAFB via Liberty Boulevard. Radar Hill Road traffic volumes are expected to grow by about 35 percent to about 6,000 vpd.

Figure 13

Future (Year 2035) Traffic Volumes



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Volume-to-Capacity Ratios

Based on the capacity values discussed in **Section III.A**, the V/C ratios calculated on the streets within the study area with future forecast volumes are depicted graphically on **Figure 14**. Red segments represent roadways that carry traffic volumes in excess of the planning level roadway capacity (V/C ≥ 1.0). Yellow segments represent roadways that carry traffic volumes near the roadway capacity (V/C between 0.80 and 1.0). Green segments represent roadways with daily volumes less than the roadway capacity.

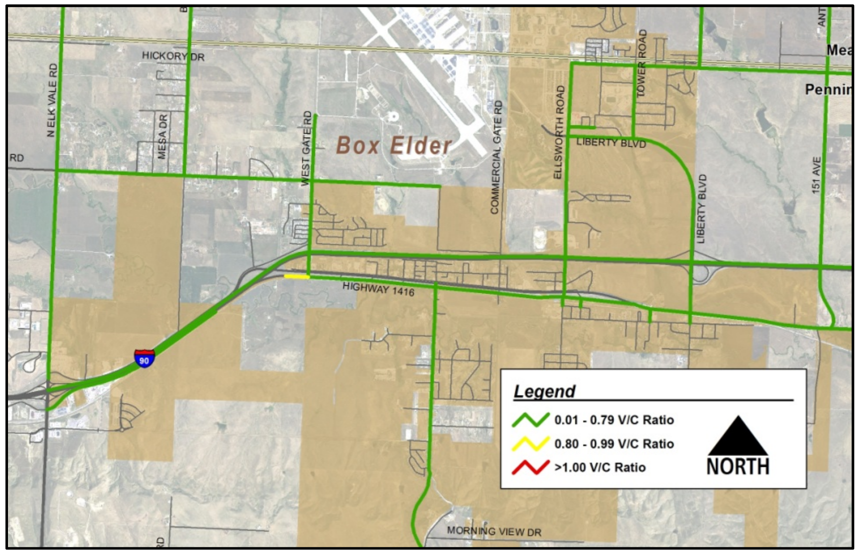


Figure 14. Long-Term Future (Year 2035) Volume to Capacity Ratios – Roadway Segments

As shown, nearly all roadways in the study area have a V/C ratio of less than 0.80 and are, therefore, shown as green. One segment of Highway 1416, west of West Gate Road, shows a V/C ratio between 0.80 and 1.0 indicating that this segment of road is expected to operate near its capacity in the long-term future. Overall, it is anticipated that existing roadways in the study area have a sufficient number of travel lanes to easily accommodate projected traffic levels.

Intersection Operations

The 10 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 15** provides the results of the LOS analysis for future conditions.

Year 2035 operational results are described by intersection as follows. Please note all Highway 1416 intersections were analyzed with the planned reconstruction of Highway 1416 from a four-lane divided highway to a three-lane undivided highway with two travel lanes and a center left turn lane.

Highway 1416 / West Gate Road: This intersection is located at the far west end of Highway 1416 and is anticipated that by 2035 the intersection will have a south leg. With STOP sign control on the West Gate Road approaches, critical movements from West Gate Road would operate at LOS F during the peak hours. Given these conditions it is likely that this intersection will need either signalized or roundabout control. If either of these traffic control options is implemented, the intersection would operate at LOS C or better during the peak hours.

Highway 1416 / Radar Hill Road: If the Radar Hill Road approaches continue to have STOP signs, then future traffic growth on Radar Hill Road would cause critical turn movements to operate at LOS F during the peak hours. Like the West Gate Road intersection, if roundabout or signal control is implemented at this intersection, then the intersection should operate well at LOS C or better during the peak hours.

Highway 1416 / Commercial Gate Drive: This intersection will likely continue to be a T-intersection. In this condition the left turn movements from Commercial Gate Drive to eastbound Highway 1416 could complete the maneuver in two stages by using the center left turn lane to wait for a gap in eastbound traffic. The opportunity for this two stage turn maneuver helps to maintain at least LOS C conditions for critical movements at this intersection. This suggests that signalization or roundabout control may not be needed in the future.

Highway 1416 / Ellsworth Road: If the Ellsworth Road approaches continue to have STOP signs, then future traffic growth would cause critical turn movements to operate at LOS F during the peak hours. Roundabout or signal control would provide at least LOS B conditions during the peak hours.

Highway 1416 / Liberty Boulevard: At this intersection the Liberty Boulevard approaches are controlled with STOP signs. Turn movements at this intersection would continue to operate at LOS C or better during the peak hours.

Liberty Boulevard / Tower Road: The LOS analysis shows the intersection would continue to operate at LOS A during the peak hours.

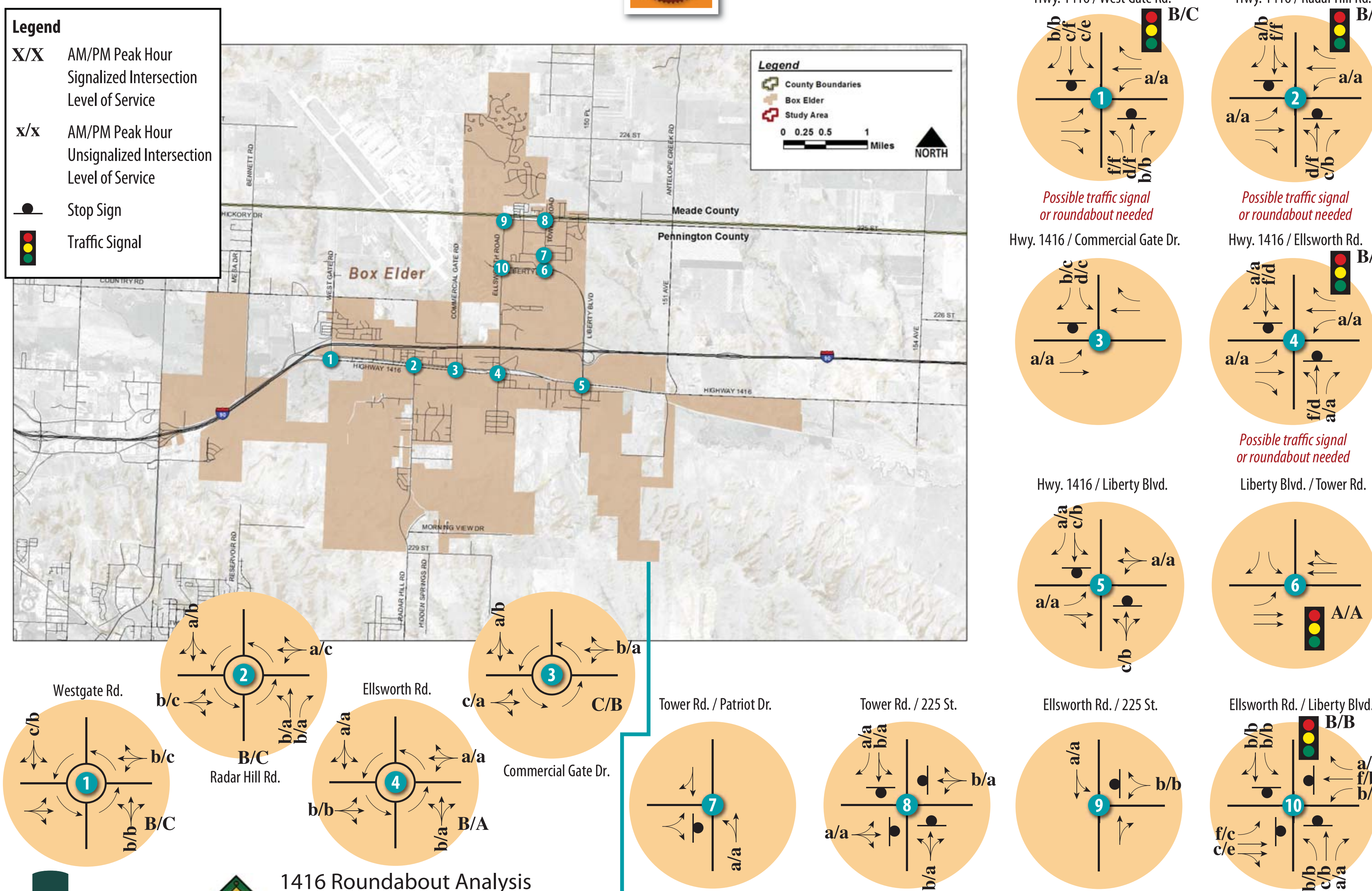
Tower Road / Patriot Drive: This T-intersection would continue to have stop control on Patriot Drive. As shown, turn movements at this intersection would operate at LOS C during the peak hours. During school pick up and drop off times, congestion on Tower Road would continue to make it difficult for Patriot Drive traffic to turn onto Tower Road. However, this plan's recommendation to upgrade Tower Road to collector road standards could help to alleviate some congestion during school pick up and drop off times.

Tower Road / 225th Street: This intersection has stop control on all approaches and could continue to operate this way into the future. During the peak hours all turn movements operate at LOS B or better. Like the Tower Road / Patriot Drive intersection, congestion during school pick up and drop off times may not be reflected in the level of service since the analysis is conducted over the entire peak hour and not during the 15-minutes of pick-up and drop-off.

Ellsworth Road / 225th Street: This T-intersection has stop control on 225th. Turn movements at this intersection operate at LOS B during the peak hours.

Ellsworth Road / Liberty Boulevard: Projected traffic increases would cause the current all-way stop condition to fail. Roundabout or signal control would provide at least LOS C or better operations during the peak hours.

Figure 15
Future (Year 2035) Peak Hour Levels of Service



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IV. LONG RANGE TRANSPORTATION PLAN

A. Major Street Plan

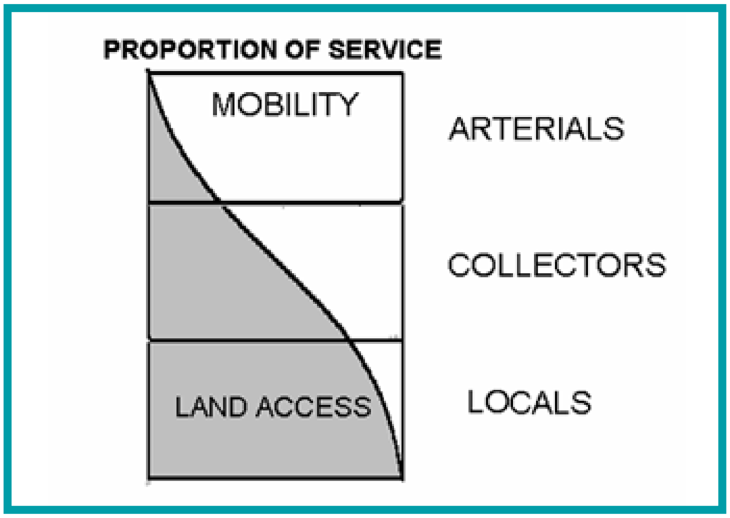
The centerpiece of the Box Elder Strategic Transportation Plan as it relates to the road network is the Major Street Plan. The Major Street Plan provides a framework for how the road network should be established as development occurs within the study area. The plan labels the classification of current roadways and identifies future roadway corridors designed to provide connectivity and access to new developments in rural portions of the study area.

The Major Street Plan is a high-level planning document that details the eventual roadway connections to be built over the next 20 to 50 years. This document does not suggest that development should and will begin immediately, nor does it detail the exact alignment the roadway connections should follow. Instead, the plan serves as a basic roadway framework, with the eventual goal of constructing roadway segments that provide the continuity envisioned in this plan. It is recognized that existing land uses may conflict with the roadway connections depicted, but it is not the intention of this plan to require immediate action. Instead, the Major Street Plan recognizes that over time, development patterns within the study area will evolve and certain areas will be more desirable for development. As development is pursued in these areas, the Major Street Plan should be consulted and appropriate right-of-way (ROW) allocations and fulfill this vision.

The Major Street Plan is provided on **Figure 16**. This plan distinguishes existing roadways (solid line) from proposed roadways (dashed line) in addition to identifying the roadway as State Highway, arterial, collector, and local roads. An important topic for the City and the State is the future of Exit 63 on I-90. In 2010, SDDOT completed its decennial study that evaluated and recommended a relocation of Exit 63 to West Gate Road (see **Appendix C** for more details). However, it needs to be noted that this is a preliminary recommendation and is currently a low priority interchange improvement for the State. Therefore, the Major Street Plan recognizes further study is needed to define a recommended replacement for Exit 63.

Road Classification

A roadway network includes a hierarchy of roads whose functional classification is defined by their usage. In general, streets serve two functions: they provide mobility between destinations 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 *BESTPlan* study area.



Interstates

SDDOT maintains Interstate freeways, which provide lengthy regional and inter-regional trips at high travel speeds. Freeways are completely access controlled, with no at-grade intersections. Grade-separated interchanges accommodate access from Arterial roadways and are typically separated by a minimum of one mile.

Interstate 90 (I-90) is the study area's only interstate, defined by high speeds and access provided by widely spaced, grade-separated interchanges. I-90 passes through the center of the study area as part of the east-west Interstate route connecting across South Dakota and the northern United States.

Arterial Roads

Arterial roadways are City or County maintained mobility roads that carry longer-distance trips for regional, inter-community, and major commuting purposes. Arterials have a limited number of at-grade intersections and provide only direct property access when lower classification street 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.

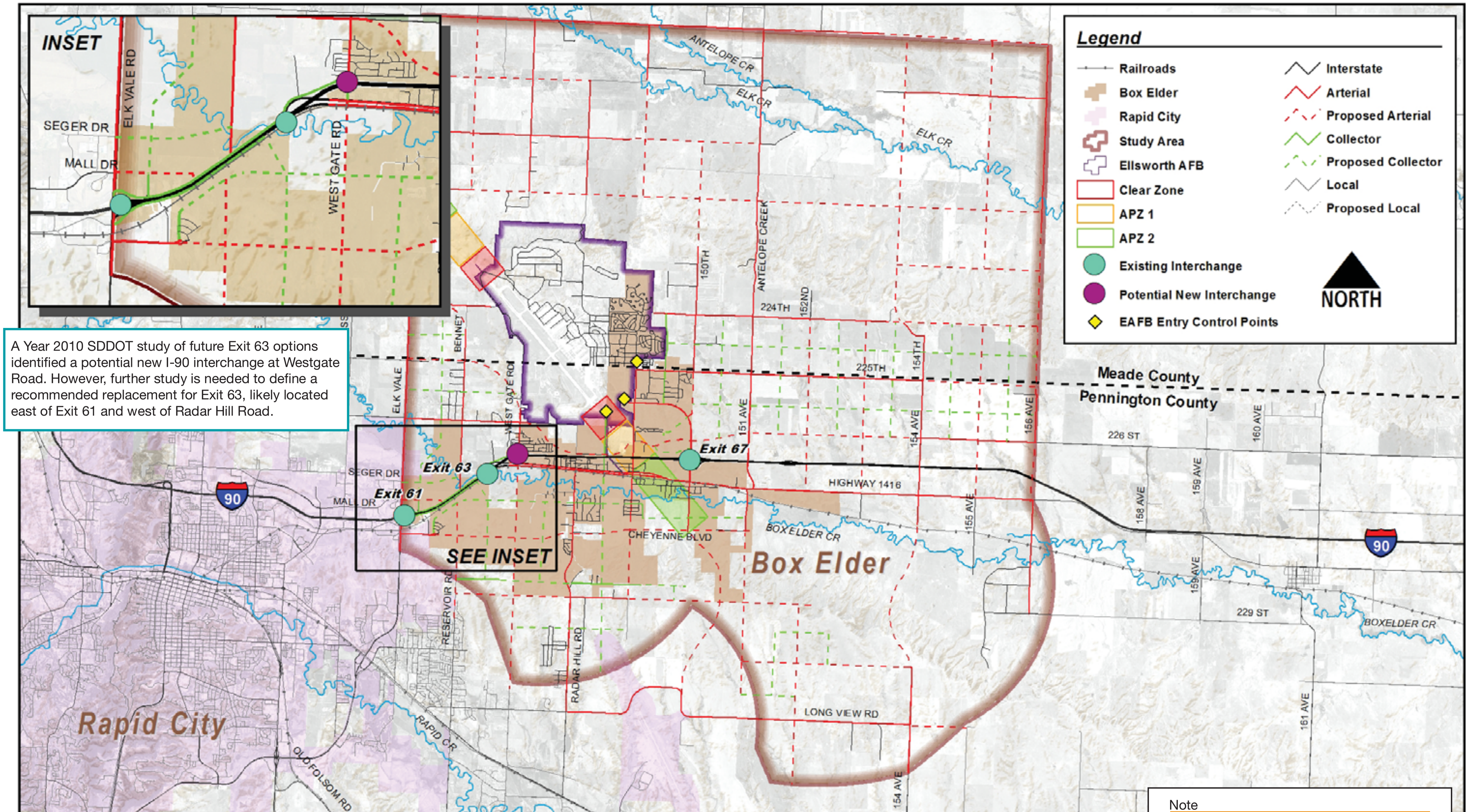
Collector Roads

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

Local Roads

Local roads provide access to adjacent land uses. Local streets 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.

Figure 16
Major Street Plan



A Year 2010 SDDOT study of future Exit 63 options identified a potential new I-90 interchange at Westgate Road. However, further study is needed to define a recommended replacement for Exit 63, likely located east of Exit 61 and west of Radar Hill Road.

Note
- Collectors are shown for information purposes; future alignments are to be determined by new development activity
- Arterial roadways as shown north of Ellsworth AFB would likely follow existing section lines

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B. Pedestrian and Bicycle Master Plan

The Pedestrian and Bicycle Master Plan provides a framework for how the non-motorized network should be established within the study area as funds become available. The Plan builds on the existing system by offering improvements to the bicycle and pedestrian network where deficiencies exist. Additionally, the Plan identifies new pedestrian and bicycle corridors designed to provide community connectivity and non-motorized access to new portions of the study area.

In collaboration with the SAT, the project team determined that non-motorized improvements outside roadway curb lines such as sidewalks and paths would be the focus of this planning effort, as these are currently of primary importance and need improvement. However, it is important to note that on-street methods for accommodating cyclists, such as bicycle lanes, sharrows, widened shoulders, and bicycle boulevards remain valid strategies for Box Elder and should be considered in future planning efforts.

The Pedestrian and Bicycle Master Plan, provided on **Figure 17,** distinguishes existing sidewalks and shared use paths (solid lines) from proposed facilities (dashed lines). Taken as a whole, the existing and future path corridors and sidewalk connections will provide more safe and efficient ways for people on foot or bicycle to reach their chosen destinations throughout and beyond the community.

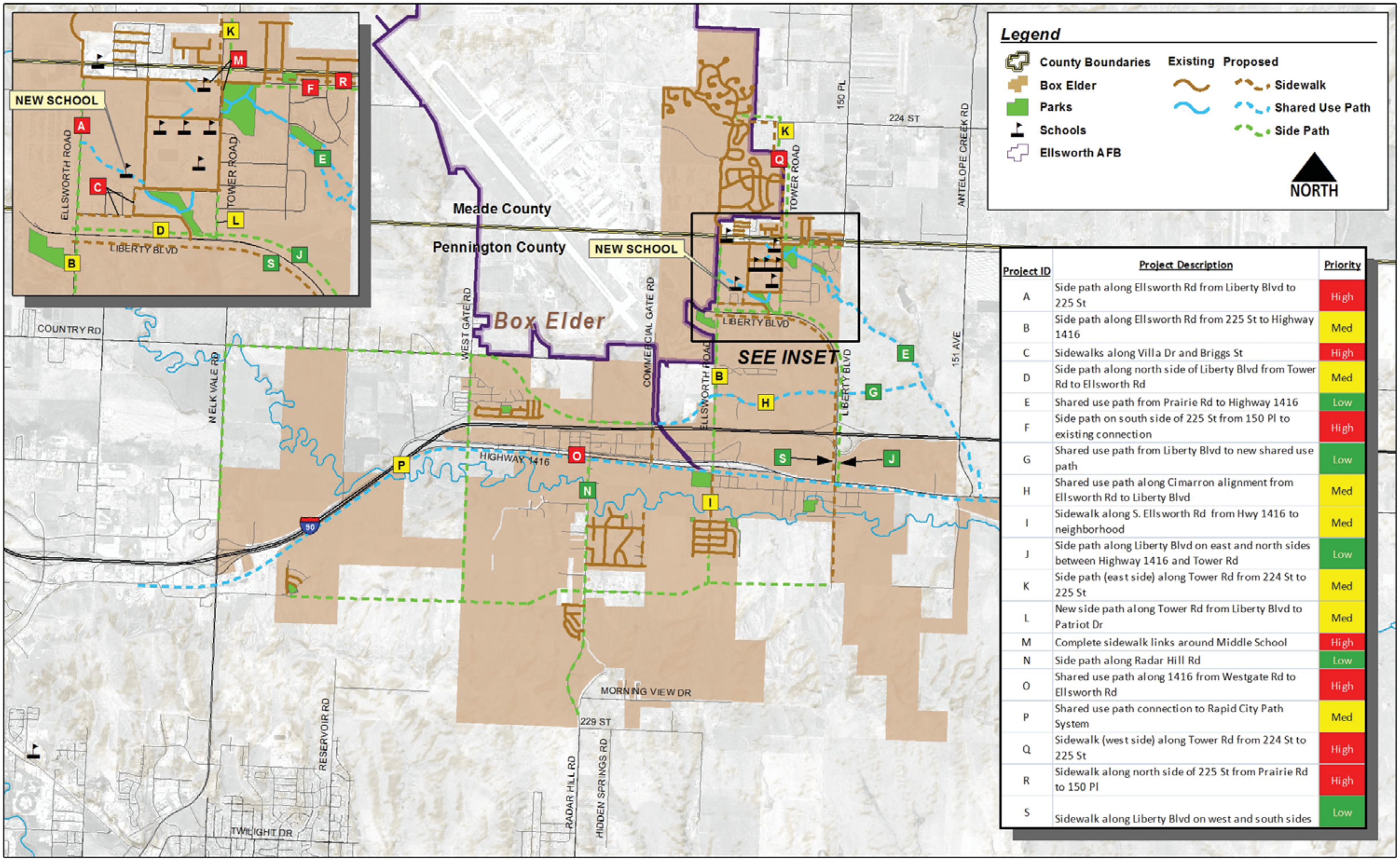
Basic project types are described as follows:

Sidewalks: The sidewalk inventory conducted in the review of existing conditions revealed inconsistency across the City. In general, more recently constructed neighborhoods included sidewalks along all roadways. Also evident in the inventory are missing linkages in the sidewalk network. For example, sidewalks are provided along roads bordering the cluster of Douglas schools east of EAFB, but sidewalks linking the schools to the surrounding neighborhoods are lacking in continuity. Accordingly, many sidewalk extensions have been identified as projects in the Plan.

Side Paths: Side paths are bicycle and pedestrian paths that run parallel alongside roadways, typically within the ROW. The paths are a minimum of 10 feet wide and provide an increased level of safety for non-motorized travelers, especially along busier roadways. There are currently no side paths in the study area. As shown on **Figure 17**, side paths are proposed to be constructed along major community routes, including Radar Hill Road, Liberty Boulevard, Ellsworth Road, and the future Cheyenne Boulevard.

Shared Use Paths: Shared use paths are bicycle and pedestrian paths that typically extend across open spaces or along drainages and connect to major amenities within the community and often extend to nearby communities. These facilities are not constructed within roadway ROW. There are a number of existing shared use paths in the study area, including a short network of paths in the arboretum park located east of the schools and a path connecting Villa Drive to Patriot Drive. It is recommended that the current network of shared use paths be extended to include a new east-west path along Highway 1416 that could eventually provide a regional connection west into Rapid City. Additional shared use paths are identified between the Arboretum and Highway 1416, and along the proposed new Cimarron Road alignment.

Figure 17
Pedestrian and Bicycle Master Plan and Projects



Project ID	Project Description	Priority
A	Side path along Ellsworth Rd from Liberty Blvd to 225 St	High
B	Side path along Ellsworth Rd from 225 St to Highway 1416	Med
C	Sidewalks along Villa Dr and Briggs St	High
D	Side path along north side of Liberty Blvd from Tower Rd to Ellsworth Rd	Med
E	Shared use path from Prairie Rd to Highway 1416	Low
F	Side path on south side of 225 St from 150 Pl to existing connection	High
G	Shared use path from Liberty Blvd to new shared use path	Low
H	Shared use path along Cimarron alignment from Ellsworth Rd to Liberty Blvd	Med
I	Sidewalk along S. Ellsworth Rd from Hwy 1416 to neighborhood	Med
J	Side path along Liberty Blvd on east and north sides between Highway 1416 and Tower Rd	Low
K	Side path (east side) along Tower Rd from 224 St to 225 St	Med
L	New side path along Tower Rd from Liberty Blvd to Patriot Dr	Med
M	Complete sidewalk links around Middle School	High
N	Side path along Radar Hill Rd	Low
O	Shared use path along 1416 from Westgate Rd to Ellsworth Rd	High
P	Shared use path connection to Rapid City Path System	Med
Q	Sidewalk (west side) along Tower Rd from 224 St to 225 St	High
R	Sidewalk along north side of 225 St from Prairie Rd to 150 Pl	High
S	Sidewalk along Liberty Blvd on west and south sides	Low

V. PLAN IMPLEMENTATION

A. Roadway Project Plan

Recommendations for improvements to the Box Elder roadway transportation system have been derived from the Major Street Plan. The recommendation includes a select list of projects generally within the City of Box Elder and identified through the public input process, traffic forecasting, intersection analysis, projects included in the State Transportation Improvement Plan (STIP), Rapid City Area MPO Transportation Improvement Program recommendations in the Decennial Interstate Corridor Study by SDDOT (see **Appendix C**), and projects identified by the Study Advisory Team (SAT) and City staff.

Public versus Private Driven

The project listing has been divided between public and private driven projects. Projects listed as public represent deficiencies within the roadway network that either currently exist or will occur with anticipated growth. These projects require complete funding from a public entity or group of entities: the City of Box Elder, Pennington and Meade counties, or SDDOT.

Projects listed as private are those roadways associated with future development activity. These projects are, therefore, initiated by future growth and will require financial leading by a developer, to be supplemented where appropriate by a public agency.

Local Urban Systems Projects Eligibility for Box Elder Roadways

The City of Box Elder currently receives from SDDOT an allocation of Local Urban Systems Projects funds. Local roadways classified as rural major collectors and urban collectors and above are eligible for Federal-Aid funds. **Appendix D** shows the local roadways eligible for these funds, which include City roadways such as West Gate Boulevard, Cheyenne Boulevard, Radar Hill Road, Liberty Boulevard, Tower Road, Ellsworth Road, Highway 1416, and a portion of 225th Street. With the adoption of the Major Street Plan, the City can request changes in the functional class. This request is submitted through SDDOT, and SDDOT forwards the functional class changes to FHWA for approval.

Project Prioritization

Recommended projects were prioritized into near, mid, and long term categories. The prioritization was based on criteria that were derived from the values and goals that are important to the City of Box Elder. The criteria are as follows:

- **Safety:** This involves evaluating projects on their potential to improve safety at intersections and along roadways for all modes of travel.
- **Neighborhood Connectivity:** This includes making roadway linkages to provide a second point of access for isolated neighborhoods and/or connecting existing neighborhoods.
- **Economic Development:** This involves evaluating projects that have the potential to be a catalyst to new development opportunities. For example, new roadways connecting existing major roadways that provide access to largely undeveloped land are likely to encourage new development in undeveloped areas.

- **Congestion:** This involves evaluating projects on their potential to relieve existing or future congestion.
- **Liberty Interchange:** This involves evaluating projects that increase the usage of the Liberty interchange and/or encourages EAFB personnel to use the interchange for trips to and from the base.
- **Regional Connectivity:** This involves projects that connect Box Elder to surrounding communities.
- **Cost:** This involves the estimated total cost based on the city's ability to implement the project using its annual STP (surface transportation planning) funding.

Based on these criteria, projects were defined as either near, mid, or long term in their delivery as a complete project. Near-term projects are those anticipated to be funded and built within the next five years (2015 to 2020). These projects tend to be low-cost, publically funded projects that make new neighborhood connections to the roadway network, and address future capacity issues. Mid-term projects are those anticipated to be funded and built not immediately but within the next 5 to 15 years (2020 to 2030). Mid-term projects tend to be higher cost publically funded improvements and projects driven by development activity. Long-term projects are those anticipated to be funded and built in the long term (beyond 2030) by either the state or by future investment by private entities.

Project Cost

Project costs have been developed for each recommended roadway project. These conceptual costs were based on the construction of the recommended typical section for Box Elder arterial, collector, and local roadways. Typical sections were two-lane (one lane in each direction) roadway segments, complete with curbs, gutter, and sidewalks on either one or both sides of the street. Cost estimates also include bridges when roadways spanned waterways. Existing roadways upgraded to the typical sections recommended in this report, it was assumed the improvement included minor drainage upgrades. For new roadways, it was assumed it would consist of an underground storm sewer system completes with inlets and pipes.

While ultimately not every roadway segment or improvement may be built to these specifications, this cost procedure provides the most conservative view of construction costs. Cost opinions included construction-related items based on 2013 unit costs, a 25 percent contingency factor applied to these items and smaller percentages to account for other costs such as ROW, utilities, design, mobilization, and construction engineering. In addition, a 4.43 percent per year inflation factor was applied to item costs to estimate costs in the anticipated year of expenditure. **Appendix E** provides more detailed explanations of cost opinions by project.

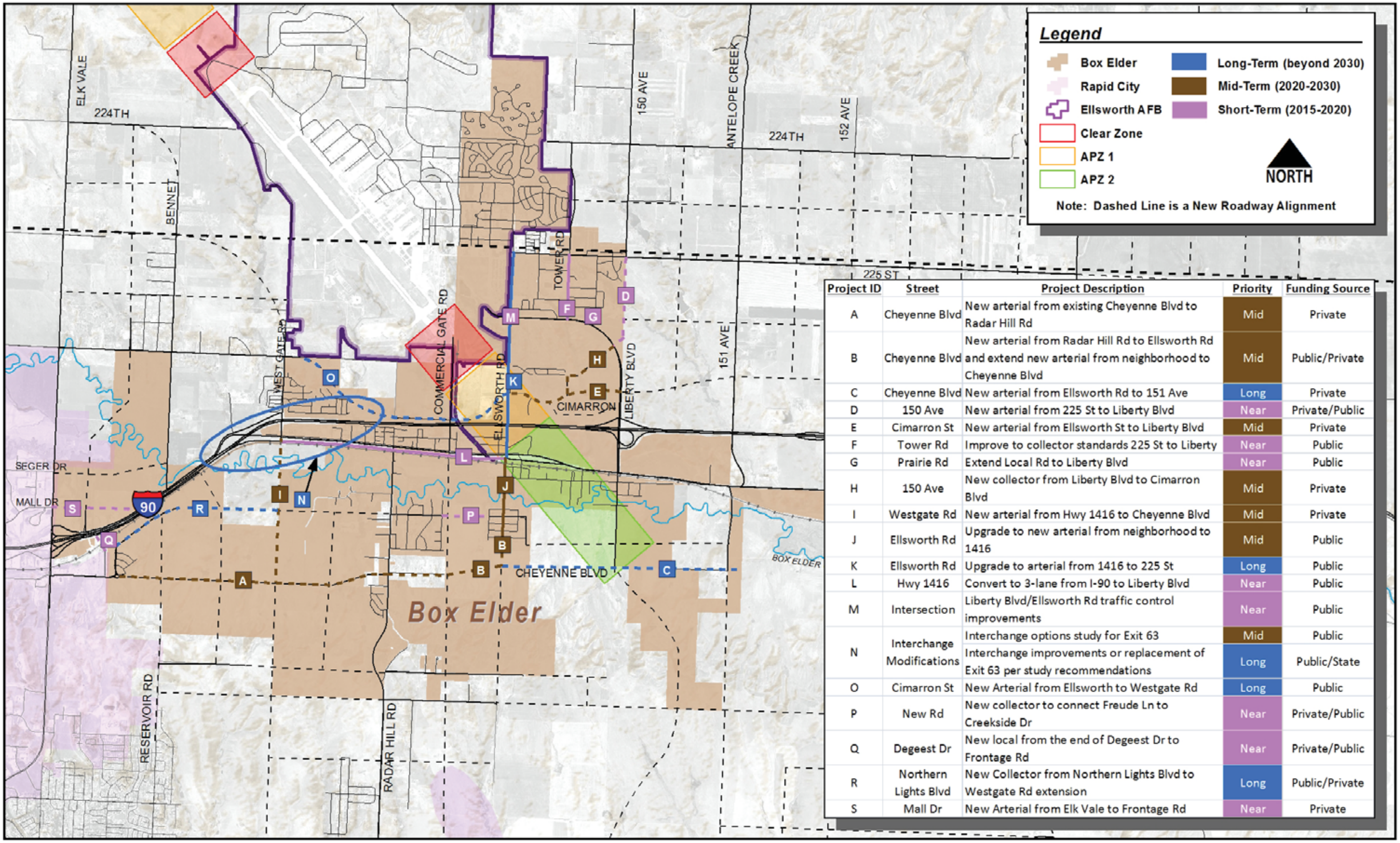
Project List

Recommended projects are shown on **Figure 18**. A total of 22 projects have been identified as needed roadway network improvements for the City of Box Elder. These projects are listed in **Table 3**, which provides the estimated cost for each project, a general description of each project, and the prioritization of the project. As shown, construction of the full set of identified projects would require an investment of approximately $139 million. Alone, the near-term priority projects would require $11.1 million to complete.

Table 3. Prioritized Roadway Projects

ID	Street	Project Description	Funding Source	Cost (millions $)	Priority
D	150 Avenue	New arterial extension from 225th to Liberty Boulevard	Private / Public	1.9	Near
F	Tower Road	Widen existing roadway to provide curb and gutter and left turn lane according to the collector typical section standard recommended in Section VI-A.	Public	0.7	Near
G	Prairie Road	Construct new local road to allow access location on Liberty Boulevard	Public	0.27	Near
L	Highway 1416	Convert existing four-lane highway to a two lane undivided roadway with a center left turn lane per the STIP	Public	3.5	Near
M	Intersection	Replace existing all-way stop traffic control with signalized control when warranted	Public	0.35	Near
P	Freude Lane	Construct new collector from Freude Lane west to Creekside Drive to connect existing neighborhoods and to provide a second point of access.	Public / Private	1.0	Near
Q	Degeest Drive	Extend new collector from the end of Degeest Drive north across railroad tracks and connect to I-90 service Road	Private / Public	0.85	Near
S	Mall Drive	Extend new arterial from Elk Vale to Service Road	Private	2.5	Near
A	Cheyenne Boulevard	Extend new arterial from existing Cheyenne Boulevard east to Radar Hill Road	Private	12.0	Mid
B	Cheyenne & Ellsworth	Build new arterial from Radar Hill Road to a new Ellsworth arterial extension south from existing neighborhood	Private / Public	6.1	Mid
E	Cimarron Drive	Extend new arterial from Ellsworth Road to Liberty Boulevard	Private	4.4	Mid
H	150 Avenue	Build new collector from Liberty Boulevard to Cimarron Drive	Private	2.5	Mid
I	West Gate Road	Construct new arterial from the West Gate / 1416 intersection south to the future Cheyenne Boulevard extension (see project A)	Private	7.2	Mid
J	Ellsworth Road	Widen existing roadway from existing neighborhood to 1416 to provide curb and gutter and left turn lane according to the arterial typical section standard recommended in Section VI-A.	Public	0.83	Mid
N	Interchange Options Study	Study interchange options for Exit 63	Public	0.15	Mid
C	Cheyenne Boulevard	Build new arterial from Ellsworth Road to 151 Avenue	Private	15.4	Long
K	Ellsworth Road	Widen existing roadway from 1416 north to 225th to provide curb and gutter and a left turn lane according to the arterial typical section standard recommended in Section VI-A	Public	5.3	Long
N	Interchange Modification	Interchange improvements or replacement of Exit 63 per the recommendations of the Interchange Options Study	Public	50.0	Long
O	Cimarron Drive	Build new arterial from West Gate Road east to Cimarron Drive intersection with Ellsworth Road	Public	16.9	Long
R	Northern Lights Boulevard	Extend new collector from Northern Lights Boulevard east to the future extension of West Gate Road (see Project I)	Public / Private	6.7	Long

Figure 18
Roadway Project Summary Map



Project ID	Street	Project Description	Priority	Funding Source
A	Cheyenne Blvd	New arterial from existing Cheyenne Blvd to Radar Hill Rd	Mid	Private
B	Cheyenne Blvd	New arterial from Radar Hill Rd to Ellsworth Rd and extend new arterial from neighborhood to Cheyenne Blvd	Mid	Public/Private
C	Cheyenne Blvd	New arterial from Ellsworth Rd to 151 Ave	Long	Private
D	150 Ave	New arterial from 225 St to Liberty Blvd	Near	Private/Public
E	Cimarron St	New arterial from Ellsworth St to Liberty Blvd	Mid	Private
F	Tower Rd	Improve to collector standards 225 St to Liberty	Near	Public
G	Prairie Rd	Extend Local Rd to Liberty Blvd	Near	Public
H	150 Ave	New collector from Liberty Blvd to Cimarron Blvd	Mid	Private
I	Westgate Rd	New arterial from Hwy 1416 to Cheyenne Blvd	Mid	Private
J	Ellsworth Rd	Upgrade to new arterial from neighborhood to 1416	Mid	Public
K	Ellsworth Rd	Upgrade to arterial from 1416 to 225 St	Long	Public
L	Hwy 1416	Convert to 3-lane from I-90 to Liberty Blvd	Near	Public
M	Intersection	Liberty Blvd/Ellsworth Rd traffic control improvements	Near	Public
N	Interchange Modifications	Interchange options study for Exit 63	Mid	Public
		Interchange improvements or replacement of Exit 63 per study recommendations	Long	Public/State
O	Cimarron St	New Arterial from Ellsworth to Westgate Rd	Long	Public
P	New Rd	New collector to connect Freude Ln to Creekside Dr	Near	Private/Public
Q	Degeest Dr	New local from the end of Degeest Dr to Frontage Rd	Near	Private/Public
R	Northern Lights Blvd	New Collector from Northern Lights Blvd to Westgate Rd extension	Long	Public/Private
S	Mall Dr	New Arterial from Elk Vale to Frontage Rd	Near	Private

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B. Pedestrian and Bicycle Projects

The project team, in collaboration with the SAT, determined that the most important non-motorized needs are concentrated around the Douglas Schools area. Accordingly, the Pedestrian and Bicycle projects shown on **Figure 17** were prioritized based on proximity to the schools.

Project List

Table 4 lists the projects, priorities and opinions of probable costs. Sidewalk and side paths costs were based on typical costs for concrete. Costs for shared use paths assumed 10 foot-wide gravel path. Based on 2013 construction cost estimates, the full set of identified projects would require an investment of about $1.8 million. Alone, the high priority projects would require $360,000 to complete.

Table 4. Prioritized Pedestrian and Bicycle Projects

Figure 15 Project ID	Project Description	Length (ft.)	Priority	Estimated Cost (thousands)
A	Side path along Ellsworth Rd from Liberty Blvd to 225th St	1,500	High	40
C	Sidewalks along Villa Dr and Briggs St	1,800	High	24
F	Side path on south side of 225th St from 150 Pl to existing connection	2,000	High	52
M	Complete sidewalk links around Middle School	900	High	12
O	Shared use path along Highway 1416 from Westgate Rd to Ellsworth Rd	10,600	High	135
Q	Sidewalk (west side) along Tower Rd from 224 St to 225th St	5,300	High	70
R	Sidewalk along north side of 225th St from Prairie Rd to 150 Pl	1,800	High	24
B	Side path along Ellsworth Rd from 225th St to Highway 1416	9,700	Med	250
D	Side path along north side of Liberty Blvd from Tower Rd to Ellsworth Rd	2,700	Med	70
H	Shared use path along Cimarron alignment from Ellsworth Rd to Liberty Blvd	4,500	Med	116
I	Sidewalk along S. Ellsworth Rd from Highway 1416 to neighborhood	2,400	Med	31
K	Side path (east side) along Tower Rd from 224th St to 225th St	5,300	Med	137
L	New side path along Tower Rd from Liberty Blvd to Patriot Dr	900	Med	23
P	Shared use path connection to Rapid City Path System	14,000	Med	180
E	Shared use path from Prairie Rd to Highway 1416	12,500	Low	160
G	Shared use path from Liberty Blvd to new shared use path	4,000	Low	51
J	Side path along Liberty Blvd on east and north sides between Highway 1416 and Tower Rd	8,700	Low	224
N	Side path along Radar Hill Rd	900	Low	23
S	Sidewalk along Liberty Blvd on west and south sides	11,300	Low	150

VI. TRANSPORTATION STANDARDS

A. Proposed Roadway Cross Sections

Figure 19 and **Figure 20** depict typical cross sections for arterial, collector and local roadways. Historically, Box Elder has used the Rapid City Standards for roadway typical sections. *BESTPlan* provides typical sections specific to the Box Elder area that can be used as a starting point for design of arterials and collectors in various contexts. Typical sections for arterial, collector and local classifications are not divided into "Urban" or "Rural" categories. This is done to provide the City with flexibility to implement particular sections when deemed appropriate. Typical sections for trails and paths are not included in this document, but the *Rapid City Area Bicycle and Pedestrian Master Plan* may be used as a design reference for trails and paths. In addition, minimum sidewalk and side path widths are depicted on **Figure 19** and **Figure 20**. **Table 5** provides summary information for each cross section.

REASONS FOR THIS STANDARD:
- Reminds City staff of elements that can be incorporated into roadway design
- Provides ROW widths for preservation
- Helps with cost estimating/budgeting
- Clear guidance for developers
- Enhances identity and unity of Box Elder

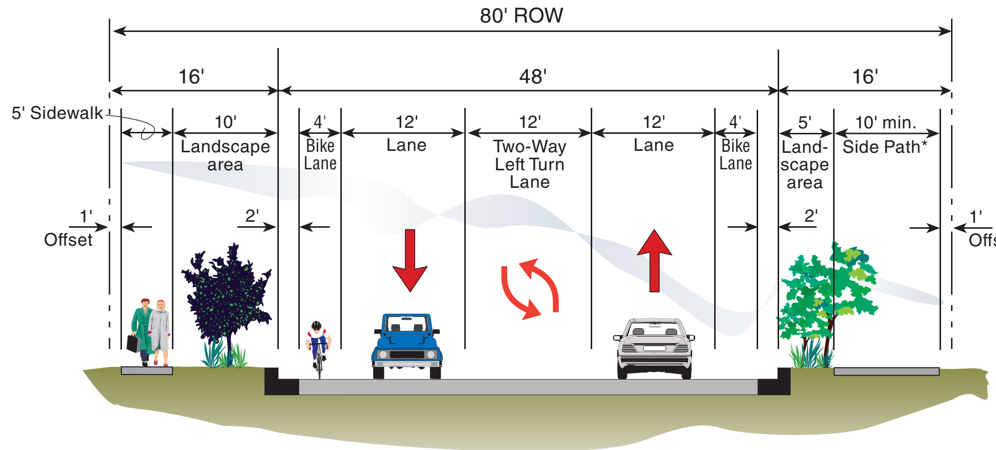
Table 5. Typical Section Characteristics

Classification	ROW (ft.)	Traveled Way (ft.)	Amenity Zone (ft.)	Number/ width of Travel Lanes	Speed (mph)		Shoulder/Bike Lane
					Design	Posted	
Arterial (2-3 lane)	80	48	16	2+Center Left Turn Lane / 12 ft.	50	30-45	4 ft Bike Lane
Arterial (4 lane)	100	64	20	4 / 12 ft.	50	35-45	n/a
Collector	66	46	10	2 / 11 ft.	35	30-35	4 ft. Bike Lane
Collector with on-street parking	66	46	10	2 / 11 ft.	35	30-35	6 ft. On-Street Parking
Local-Residential (Attached Walk)	50	32	9	2 / 10 ft.	25	25	6 ft. On-Street Parking
Local-Residential (Detached Walk)	60	32	14	2 / 10 ft.	25	25	6 ft. On-Street Parking

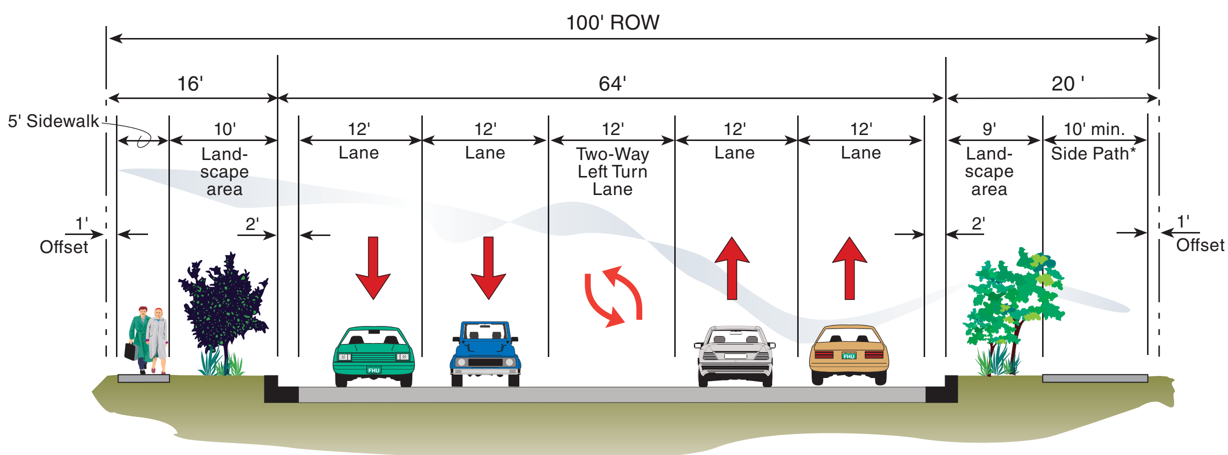
The roadway cross sections shown reflect a "Complete Streets" philosophy of designing streets to accommodate all roadway users. Providing detached walks and bicycle lanes are two distinctive aspects of the Complete Streets approach, which is intended to help build a road network that is safer, more livable, and welcoming to everyone (www.completestreets.org). While the City of Box Elder has not officially adopted a Complete Streets policy, the typical sections included in *BESTPlan* are intended to accommodate all users.

Figure 19

Arterial and Collector Cross Sections

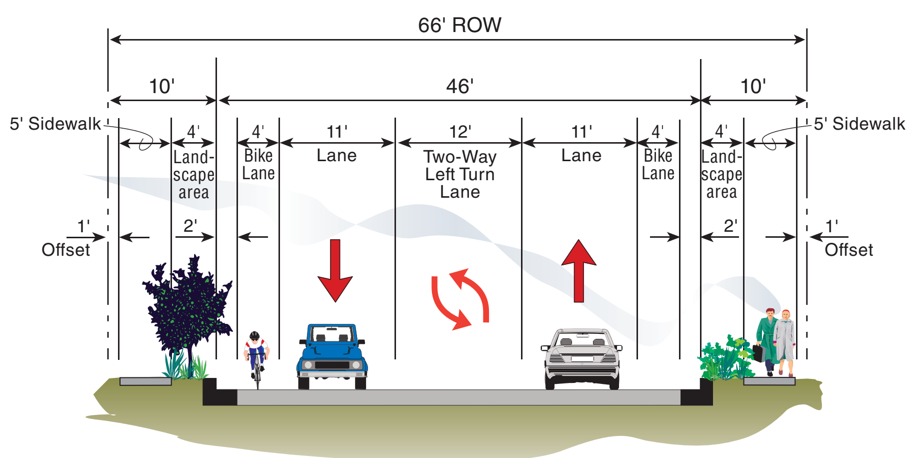


Two - Three Lane Arterial
(e.g. Ellsworth Road)



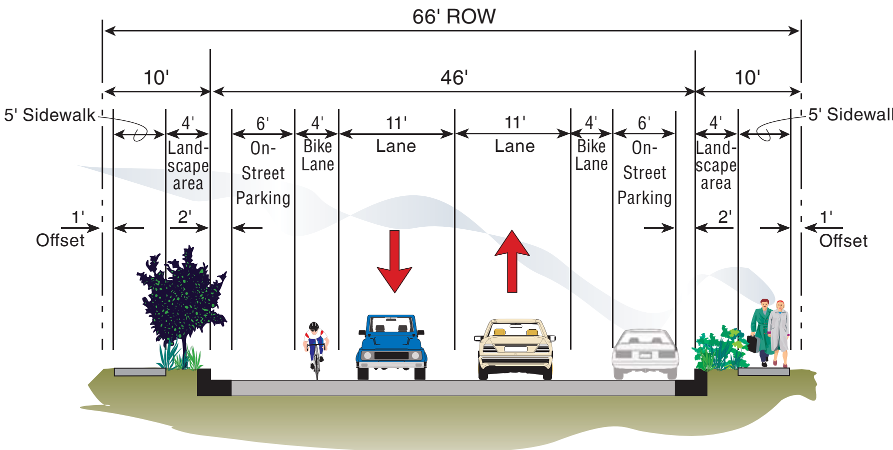
Four Lane Arterial
(e.g. Liberty Boulevard)

*Side Paths should be at least 5' away from edge of curb

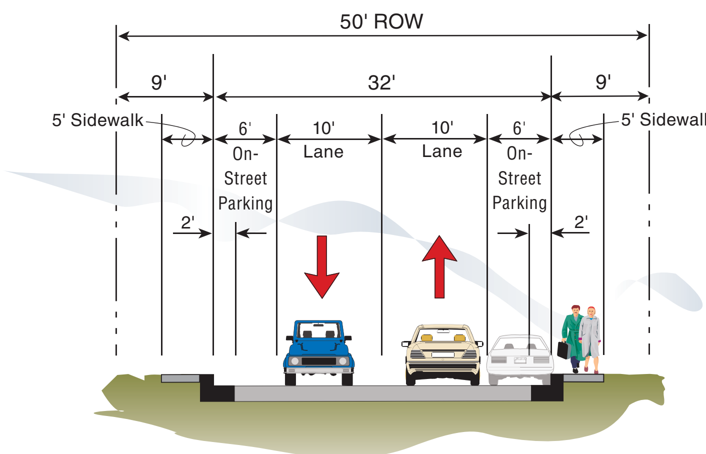


Collector

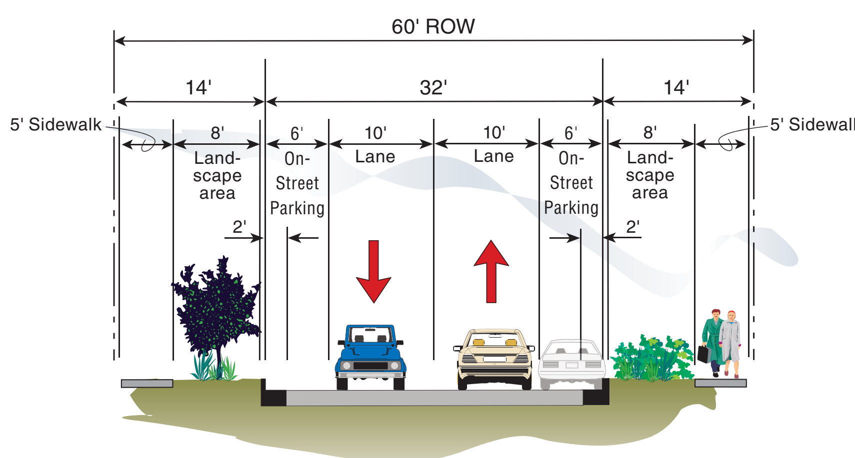
Figure 20
Collector (with Parking) and Local Street Cross Sections



Collector With On-street Parking



Local-Residential Attached Walk



Local-Residential Detached Walk

B. Transportation Development Review

Box Elder is currently known as a development-friendly community, which will continue to help the community to grow and develop economically. To ensure that transportation needs are met as growth happens, this plan provides a process by which new development and redevelopment efforts will address transportation needs.

Level of Service Standard

Consistent with the Rapid City Infrastructure Design Criteria Manual, it is recommended that Level of Service C serve as the design objective for the peak hour. Levels of Service are defined in the *Highway Capacity Manual*.

REASONS FOR THIS STANDARD:

- Ensures that developers are mindful of transportation needs when planning
- Helps to provide a basis for requests to the developer for improvements
- Maintains acceptable operating conditions as growth happens

Traffic Studies

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 fund and 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 6** are recommended in consideration of the need for a TIS.

Table 6. Traffic Impact Study Requirements

Daily Traffic Volume Generated by Proposed Development (Vehicle-trips per day)[1]	Study Requirements
1,000 or more	Traffic Impact Study Required
0–1,000	Traffic Impact Study may be required at the discretion of the City of Box Elder

1 Daily Traffic Volume generated by development may be calculated based on proposed land uses using Trip Generation, Ninth Edition (Institute of Transportation Engineers, 2012). Using these rates, 1,000 vehicles per day corresponds to approximately 23,000 Square Feet of Shopping Center Retail or approximately 105 single-family detached homes.

The City of Rapid City has published guidelines for conducting a TIS. These guidelines provided in **Appendix F** could be used as a reference for Box Elder when requesting that a developer provide a TIS.

Other Development Review Considerations

To ensure that the development review process fully captures the transportation priorities of Box Elder, it is recommended that the following issues also be incorporated into the review:

- **Access Management:** The type and spacing of accesses should be permitted in a manner consistent with standards for Access Management and the classification of the roadway being accessed. Access Management techniques are to be incorporated with the development plan, such as:
  - Providing opportunities for interconnectivity and circulation between adjacent parcels and sharing of accesses
  - Limiting access movements to right-turn only or ¾ movement to enhance safety and efficiency
  - Avoiding offset intersections that create the potential for interlocking left turns
  - Providing appropriately-sized turn lanes for movements entering the site
  - Ensuring that adequate separation from adjacent accesses is provided
- **Sidewalk provision:** Development and redevelopment plans should include sidewalk linkages across the property, even when such connections are not well-developed outside the property. Americans with Disabilities Act (ADA) accessibility should be provided in accordance with Federal law.
- **Multi-modal accommodations:** Development and redevelopment plans should take advantage of opportunities to enhance the safety and efficiency of multi-modal travel, including bicycle parking, on-site walking paths, and parking lot pavement markings.
- New development should occur only where existing transportation facilities are adequate or where necessary improvements will be made as part of the development project.
- Development should pay its equitable share for necessary improvements to the City transportation system.
  - City of Box Elder ordinances should require construction of improvements identified through a traffic impact study.

C. Access Management

Currently, applicants request vehicular accesses and the City of Box Elder reviews access proposals. Access is granted or denied on a case-by-case basis. The establishment of access management guidelines is intended to guide the City in determining allowance of access to a particular property, and under what circumstances or restrictions that an access might be allowed. The guidelines are not intended to be a full comprehensive access manual, but rather some principles to determine if access would be allowed

REASONS FOR THIS STANDARD:

- Secure safe and efficient flow of traffic into the future
- Preserve functionality of roadway network
- Provide guidance to developers on number and location of accesses
- Provide objective, uniform standards for access to prevent constant need for re-interpretation

and references to determine the need for auxiliary turn lanes. It is recognized that City staff would look at each access case by case to determine any need for acceleration/deceleration lanes.

Access guidelines will be specific to the functional classification of the roadway being accessed, with the following guidelines:

- **Access Permitting:** It is recommended that access permit applications be required for gaining access to any City roadway. A permit application will also be required when there are changes to the property that increase the traffic volume to the site by 20 percent or more.
- **Arterial Roads:** Direct access to abutting land is subordinate to providing service to the through traffic movements. Access will normally not be granted to individual property that has a reasonable alternative means of access to a lower classification of roadway. Consideration of reasonable alternative access will take into consideration the function of the alternative roadway, its purpose, its capacity, its operation, its safety, and the means of improving the alternative roadway. Ideally, accesses should be limited to only arterial and collector cross-streets.

  Intersections with the potential for eventual signalization should be spaced at one-quarter-mile intervals based on section lines where feasible and subject to the roadway's grade and to the driver's entering sight distance. Allowed accesses or intersections spaced at intervals other than one-quarter mile will be restricted to right-in/right out only unless an engineering study clearly demonstrates that there are benefits to allowing additional movements and that the access location would not be a significant detriment to the integrity of the arterial roadway.

  All necessary means shall be pursued to ensure that any access granted to an arterial roadway serves as many properties as possible; this may require the stipulation of cross access through the subject property to serve neighboring properties. Additional access will not be provided to parcels along the arterial which are subdivided or are under a common ownership. Single family homes will not be allowed to front onto an arterial.
- **Collector Roads:** Direct access onto a collector roadway is reasonably balanced with the roadway's mobility function. A minimum of one access will be allowed to serve each property provided that it does not create a hazard or a detriment to the roadway's integrity and is at least 500 feet from another existing or future access or intersection. Access will normally be full movement, unsignalized unless such access creates an operation or a safety problem. In such a case, a restriction of movements may be required. A second access to individual properties may be granted if this access is not detrimental to existing or future access serving the adjacent property or to the operation of an existing or a planned cross-street intersection.
- **Local Roads:** The intent of local roads within developing areas is to provide direct access to abutting properties. Minimum spacing between access/intersections should be 50 feet; greater or lesser spacing may be required in unique circumstances subject to specific traffic conditions.

Table 7 outlines the spacing requirements for access to roadways of various functional classification categories.

Table 7. Access Spacing Standards

Functional Classification	Distance between Full Movement Accesses	Distance between Limited Movement Accesses
State / US Highway	See SDDOT Standards	See SDDOT Standards
Arterial	¼ mile (1,320 feet)	660 feet
Collector	500 feet	250 feet
Local Road	50 feet	50 feet

It is recognized that some access drives will be used very little, such as those serving agricultural purposes or oil and gas purposes. If the access is to experience very little use (no more than twice a month), the policy stated above may be waived barring any other unusual circumstances.

D. Roadway Surfacing of Existing Roadways

The decision to pave an existing gravel roadway is complex, requiring consideration of multiple factors. Based on a review of available resources and standard practices, the following elements should be considered in making the decision to pave a gravel roadway:

REASONS FOR THIS STANDARD:

- Provide rationale for making decision to pave
- Allocate funding to surfacing projects
- Minimize dust impacts of gravel roads

- Daily traffic volumes and type of traffic along the roadway. Past data from SDDOT indicate that it is economically viable to provide surface treatment to gravel roads carrying in excess of 250 to 300 vpd. Roads carrying in excess of 660 vpd are typically reviewed to determine whether an alternate roadway surface should be considered.
- The continuity and functional classification of the roadway should be considered. Arterial roads should generally be paved before collector or local roads. As another consideration, a local street may be economically sealed or paved while a road with heavy truck usage may best be surfaced with gravel and left unpaved until sufficient funds are available to place a thick load-bearing pavement on the road.
- The tendency of drivers to divert away from gravel surfaces and onto paved surfaces to make their trip should be considered. If the new paved roadway would provide the first paved surface serving a particular demand pattern within the area, it should be designed to accommodate higher levels of traffic and routes leading to it may require some improvement to provide adequate traffic safety.
- Traffic safety should be addressed. Paved roads encourage higher travel speeds, and sight distance, curvature, lane width, surface friction and superelevation should be tailored to the anticipated travel speed. As stated in the Gravel Roads Manual, it makes no sense to pave a gravel road which is poorly designed and hazardous.

- It is important to build up the road base and improve drainage before paving. If water is not drained away from the road, the pavement fails.
- The decision to pave a gravel road is ultimately based on economic considerations. Accordingly, SDDOT published a research report in June 2004 intended to assist local governments with the roadway surfacing decision. The report provides a detailed cost model addressing the agency and user costs associated with various roadway surfaces.
- Public opinion should be weighed in the decision process and leaders should inform the public about the factors considered in the decision process.

E. Intersection and Pedestrian Crossing Design

Throughout the planning process, City of Box Elder staff has requested that standards be developed to assist the City in making decisions about pedestrian crossings of roadways. Standards should address methods for determining whether any special crossing treatment is necessary, determining the type of treatment that is most appropriate (if needed), and design elements of pedestrian crossings.

REASONS FOR THIS STANDARD:

- Enhance pedestrian safety in Box Elder
- Provide guidance for designers on proper midblock and intersection crossing protocols

1. Needs Assessment

The initial assessment of whether any special crossing treatment is necessary should be undertaken as an analytical study of crossing conditions to see if crossing treatment(s) is/are needed. Among the technical items that a needs assessment should address for a given potential pedestrian crossing treatment include:

Data Collection

- Number of pedestrians crossing
- Traffic volumes and vehicle types
- Vehicular travel speeds
- Records of traffic crashes
- Review of sight distance for peds seeking to cross
- Collect data regarding available gaps in traffic

Analysis

An engineering study should be prepared documenting the above data collected and providing an assessment of whether current and/or future conditions justify installation of a pedestrian crossing signal or a different special treatment. Resources for supporting this need include the *Manual on Uniform Traffic Control Devices* (MUTCD), the Rapid City Area MPO's *Bicycle and Pedestrian Master Plan*, and the City of Boulder, Colorado's *Pedestrian Crossing Treatment Installation Guidelines* (November 2011).

2. Selection of Treatment

There are many existing means and methods to provide pedestrian crossing of a roadway. These include installing crosswalks, pedestrian-actuated signals, standard intersection traffic signals, raised pedestrian refuge islands, in-pavement lit crosswalks, curb "bulb-outs," and curb ramps. **Table 8** contains a partial list of crossing treatments for the City's consideration. It is recommended that these treatments and other innovative ideas be considered for implementation at locations with a demonstrated need. Other resources, such as *Alternative Treatments for At-Grade Pedestrian Crossings* (Lalani, 2001) provide many more crossing treatments.

Table 8. Pedestrian Crossing Treatments

Pedestrian Crossing Treatment	Description
Crosswalk	Common intersection treatment. Use only when can be protected in some fashion, such as at signalized intersection or locations with pedestrian-actuated crossings.
Pedestrian actuated signalized crossing	Use at midblock locations with high pedestrian and vehicular traffic. Consult Manual on Uniform Traffic Control Devices.
Raised pedestrian refuge islands	Use in combination with pedestrian-actuated traffic signals or other traffic warning devices. Creates two-stage crossing, a helpful safety measure.
Bulb-outs	Use when crossing distance is excessive and improved pedestrian visibility is needed. Can be combined with landscape enhancements to help with pedestrian visibility.
Curb ramps	All pedestrian crossings should have curb ramps available for use by disabled individuals.
Grade Separation	Construction of tunnel or overpass exclusively for pedestrian use.

3. Crossing Design

Design of pedestrian crossing treatments should be developed using available industry resources. Design components include elements such as pavement marking dimensions, appropriate roadway and pedestrian signage, signal placement and indications, ADA components, visibility enhancements, and material selection. **Appendix G** provides a document published by the FHWA regarding design of pedestrian crossings.

F. Truck Routes

The City currently maintains a listing of identified truck routes. No modifications to this listing are proposed with *BESTPlan*. Needed adjustments to the truck routes to accommodate changing growth or travel patterns may be incorporated into future editions of *BESTPlan* and/or City ordinances.

VII. SUMMARY AND ACTION STEPS

The intent of the Box Elder Strategic Transportation Plan (*BESTPlan*) is to ensure that the City of Box Elder has a plan in place to effectively upgrade the transportation plan and a vision for the transportation needs as future development occurs. The prioritized roadway project listing includes intersection improvements, roadway improvements, capacity projects, and completing new roadway links. The prioritized pedestrian and bicycle project listing includes new sidewalk locations and additions to the existing path system. The projects discussed in **Section V** include public projects that will be the responsibility of public agencies and will require coordination among the City, Meade and Pennington counties, and SDDOT. The Major Street Plan and project listing also detail private driven projects located in undeveloped portions of the study area that will be the responsibility of future development to finance and construct.

The following list provides a summary of actions the City of Box Elder should consider taking to ensure that needed transportation improvements are planned for and funded:

- Officially adopt *BESTPlan* through the governing bodies, including MPO Committees, Box Elder Planning Commission, and City Council.
- Begin to plan and budget for completion of the eight roadway improvements and seven pedestrian and bicycle improvements identified for the short term. Leverage the existing Box Elder Capital Improvement Projects Committee to address these improvements.
- Initiate discussions with SDDOT on the alignment and intersection control for the planned modifications to Highway 1416 identified in the STIP.
- Implement the Transportation Standards identified in *BESTPlan*, including:
  - Require traffic impact studies from proposed developments that meet the size thresholds so that the requirements for internal roadways and impacts to the surrounding roadway system can be evaluated. Development projects should be responsible for improving the arterials and collectors adjacent to their developments to match Box Elder's standard cross-sections.
  - Use the Major Street Plan as the official future roadway plan for the City and as a tool to identify required street corridors as the City exercises its platting authority in Meade and Pennington counties.
  - Permit new accesses/approaches to City roadways based on the categories and guidelines included in *BESTPlan.*
  - Integrate pedestrian crossing design guidance into future crossing projects and enhancements to existing pedestrian roadway crossings.
  - Use the typical roadway sections provided in *BESTPlan* to provide guidance to development projects as to the required ROW dedication and provide a starting point for roadway design and construction projects.

6300 S. Syracuse Way, Suite 600 | P 303.721.1440 | F 303-721-0832
Centennial, CO 80111 www.fhueng.com

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