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.

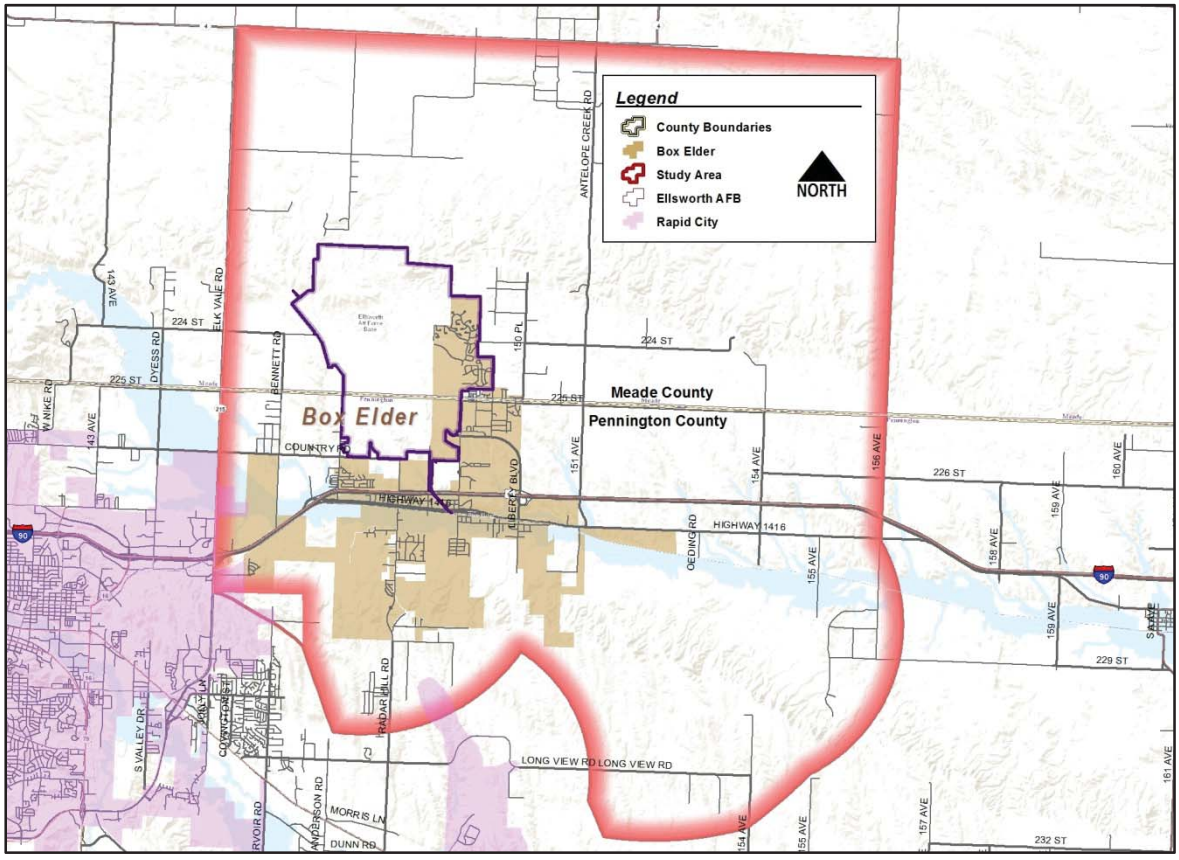


Figure 3. Study Area

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.

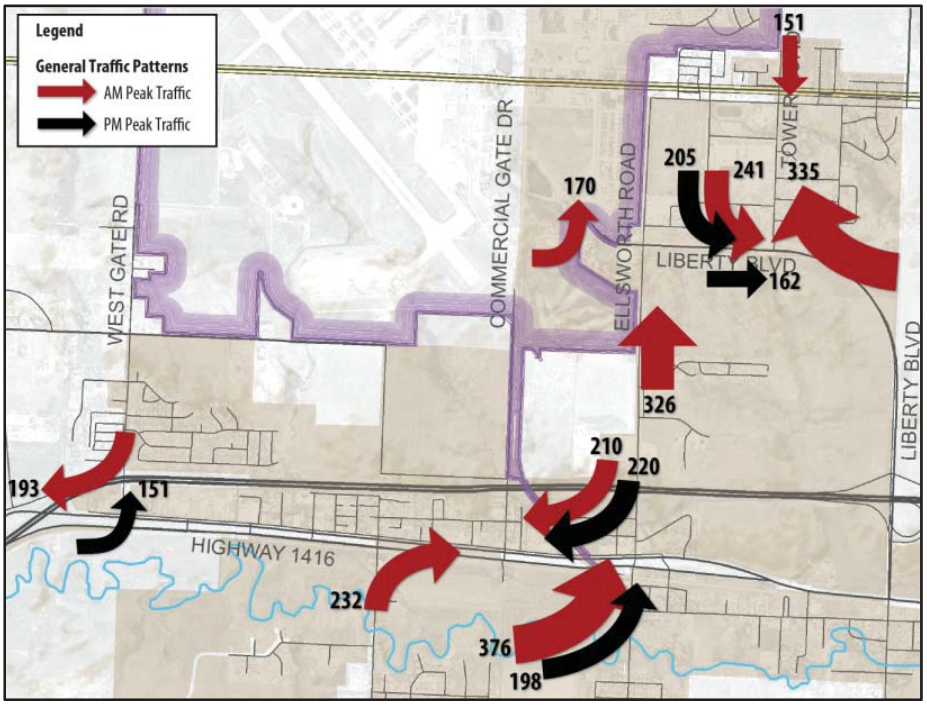


Figure 4. Box Elder Peak Hour Traffic Patterns

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.

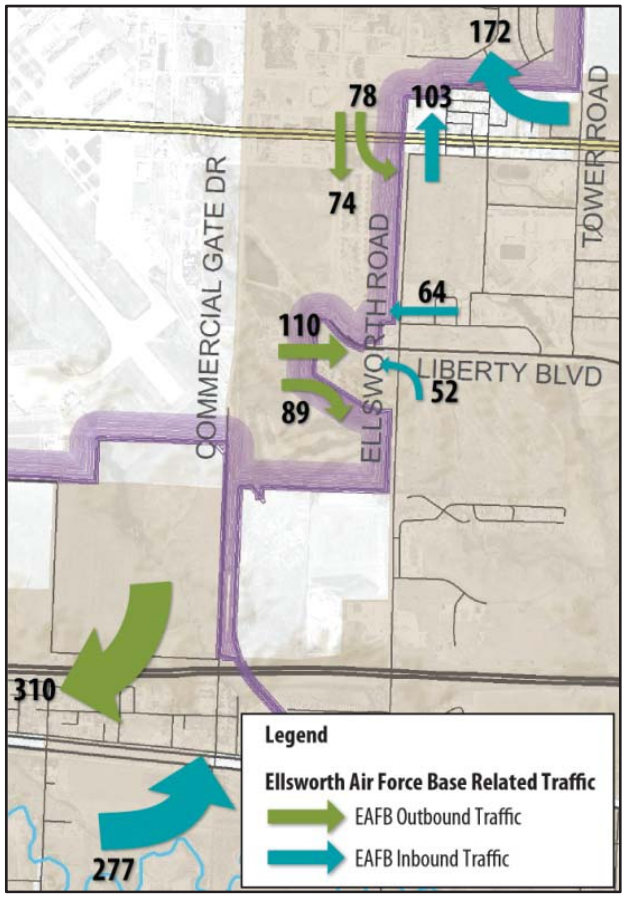


Figure 5. Ellsworth Air Force Base Peak Hour Traffic Patterns

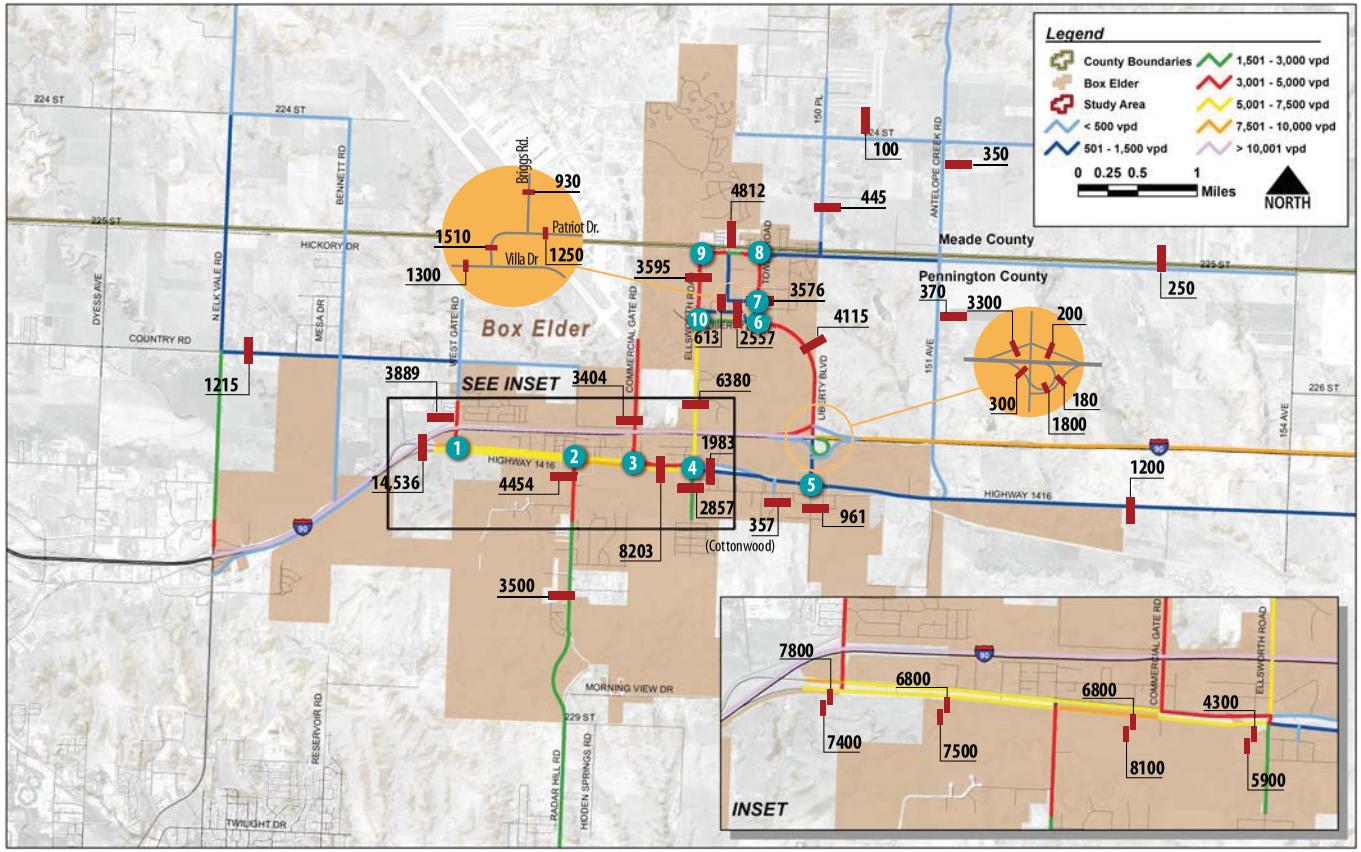
Traffic Volumes

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.

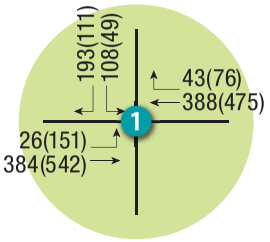
In addition to the daily count data, 10 intersections were identified for peak hour turning movement counts. These intersections were identified based on delay, geometry, congestion, and input from the SAT and the public. **Figure 6** shows the peak hour turning movement data collected at the following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

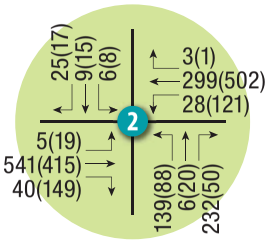
Figure 6
Existing Traffic Volumes



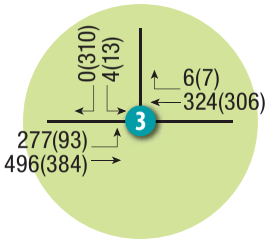
Hwy. 1416 / West Gate Rd.



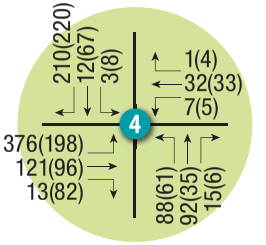
Hwy. 1416 / Radar Hill Rd.



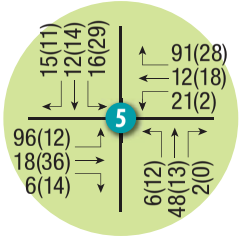
Hwy. 1416 / Commercial Gate Dr.



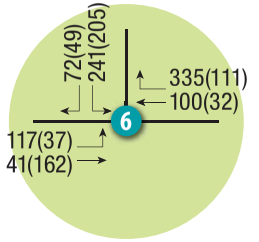
Hwy. 1416 / Ellsworth Rd.



Hwy. 1416 / Liberty Blvd.



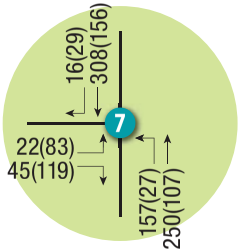
Liberty Blvd. / Tower Rd.



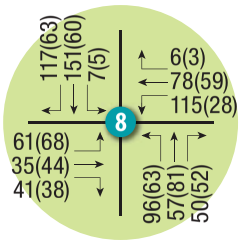
Legend

XXX(XXX)	AM(PM) Peak Hour Traffic Volumes
XXXX	Daily Traffic Count
▬	Count Location

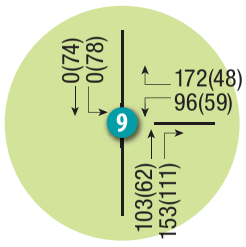
Tower Rd. / Patriot Dr.



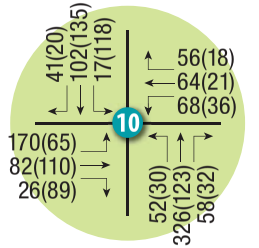
Tower Rd. / 225 St.



Ellsworth Rd. / 225 St.



Ellsworth Rd. / Liberty Blvd.



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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).

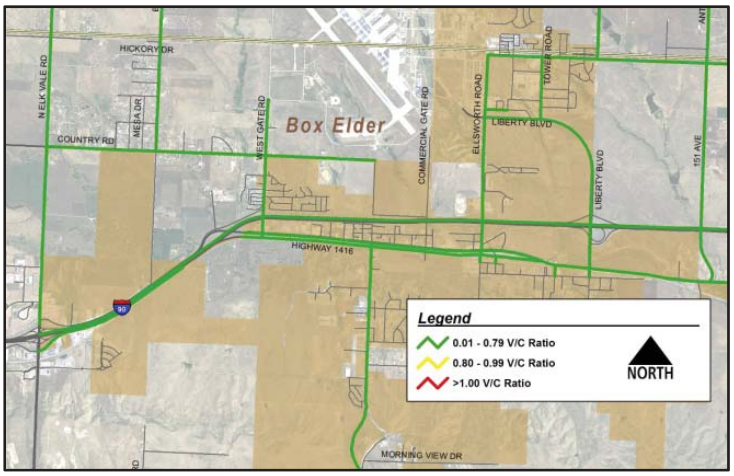
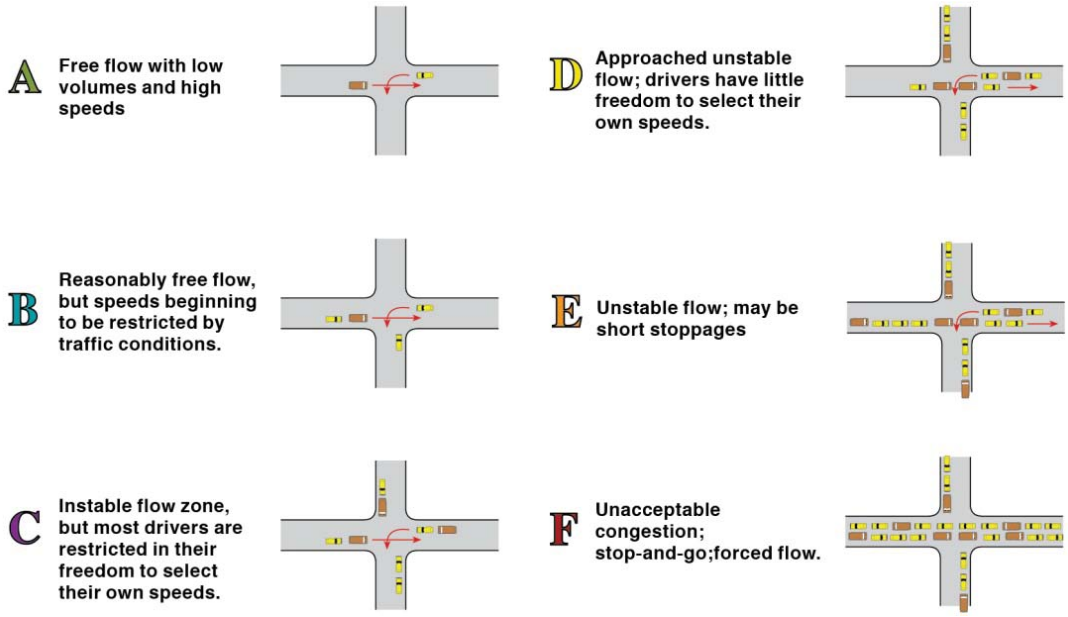


Figure 7. Existing Volume to Capacity Ratios – Roadway Segments

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.

Intersection Level of Service

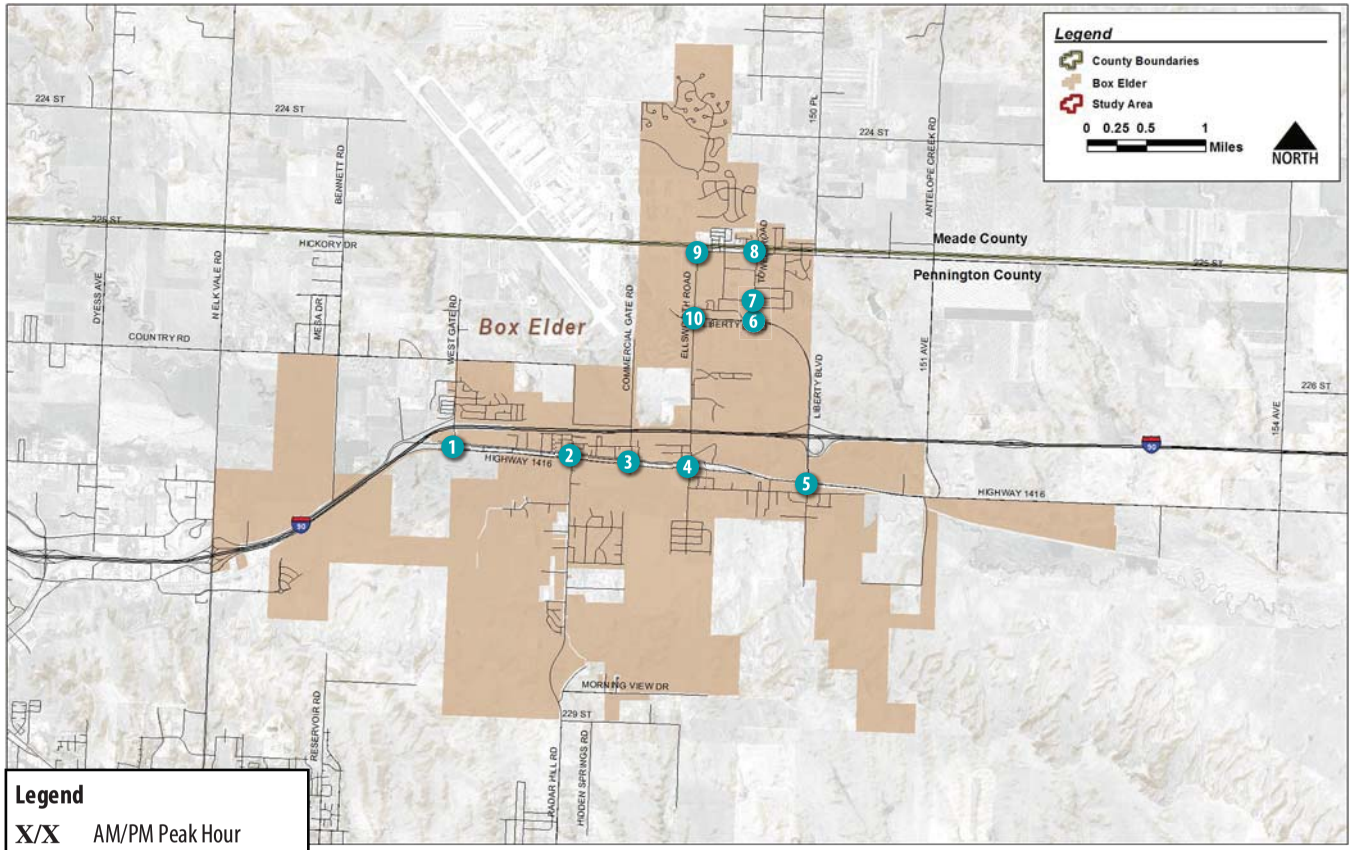
Another measure of roadway network operations is the Level of Service (LOS) of key network intersections. The LOS is the result of analytical procedures documented in the *Highway Capacity Manual* (Transportation Research Board, Fourth Edition, 2010). These analytical procedures provide a LOS, which 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.



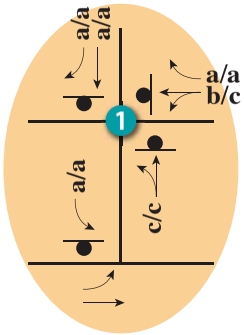
Many agencies and municipalities publish standards for acceptable intersection LOS during peak hour traffic conditions. For example, SDDOT accepts intersection operations of LOS D or better during peak hours. The City of Rapid City seeks to provide LOS C or better intersection operations during peak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

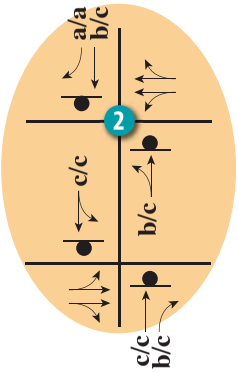
Figure 8
Existing Peak Hour Levels of Service



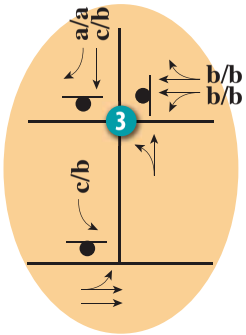
Hwy. 1416 / West Gate Rd.



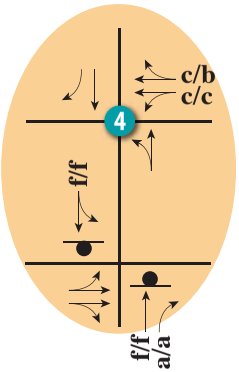
Hwy. 1416 / Radar Hill Rd.



Hwy. 1416 / Commercial Gate Dr.



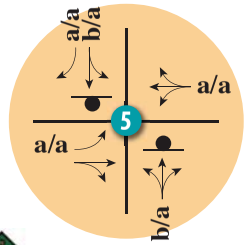
Hwy. 1416 / Ellsworth Rd.



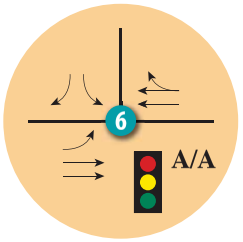
Legend

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

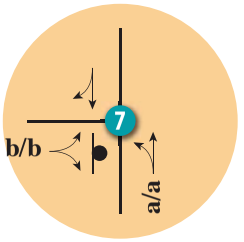
Hwy. 1416 / Liberty Blvd.



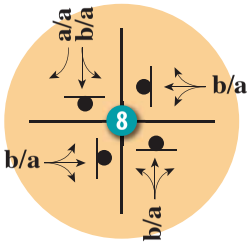
Liberty Blvd. / Tower Rd.



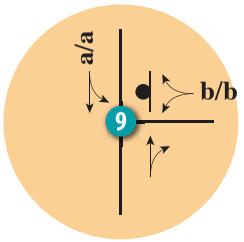
Tower Rd. / Patriot Dr.



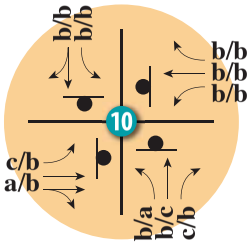
Tower Rd. / 225 St.



Ellsworth Rd. / 225 St.



Ellsworth Rd. / Liberty Blvd.



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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.

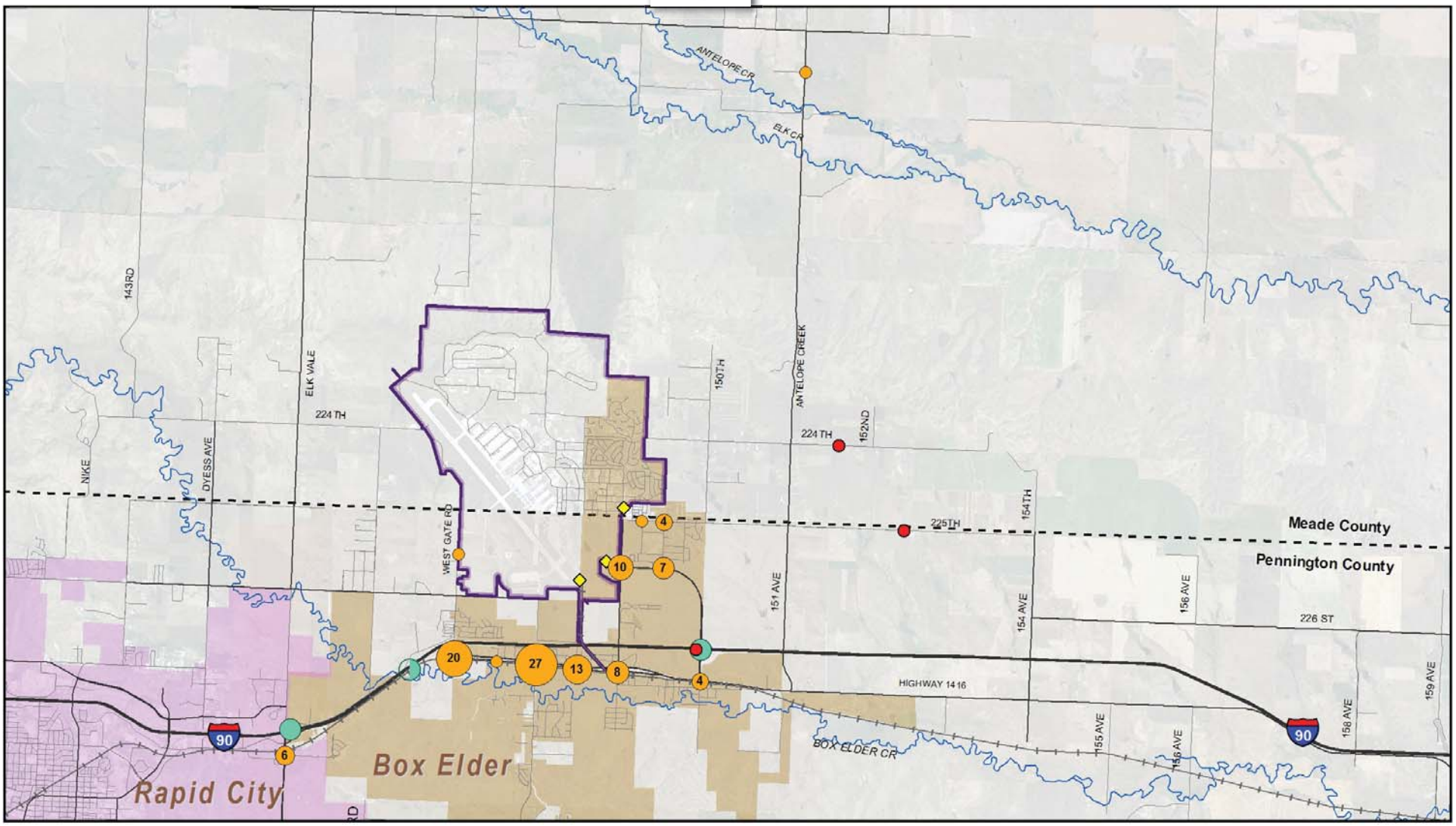
A total of 546 traffic crashes were reported in the study area between 2008 and 2012. There were three fatal crashes within the study area during the study period, all of which were roadway departure type crashes. In addition to these statistics, it is noteworthy that 44 percent of crashes were roadway 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
- Fatal Accident
- Box Elder
- Rapid City
- Ellsworth AFB
- EAFB Entry Control Points
- Full Interchange
- Half Interchange
- Railroads

NORTH

0 0.35 0.7 1.4 Miles

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C. Pedestrian and Bicycle Facilities

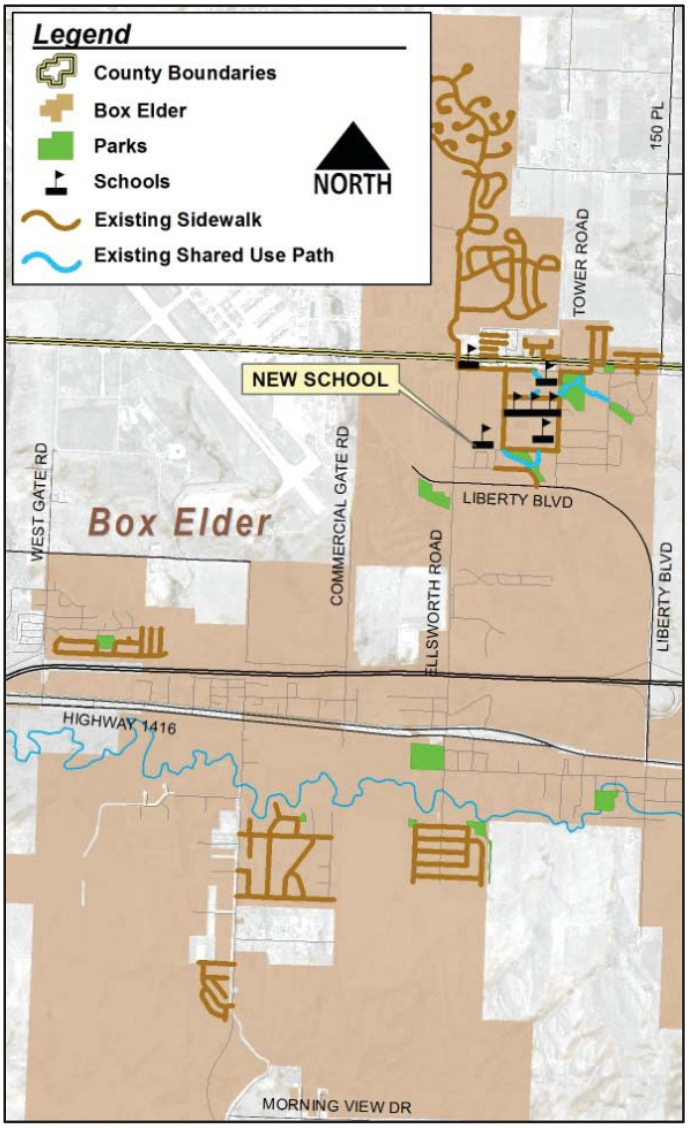


Figure 10. Sidewalk Inventory

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*.

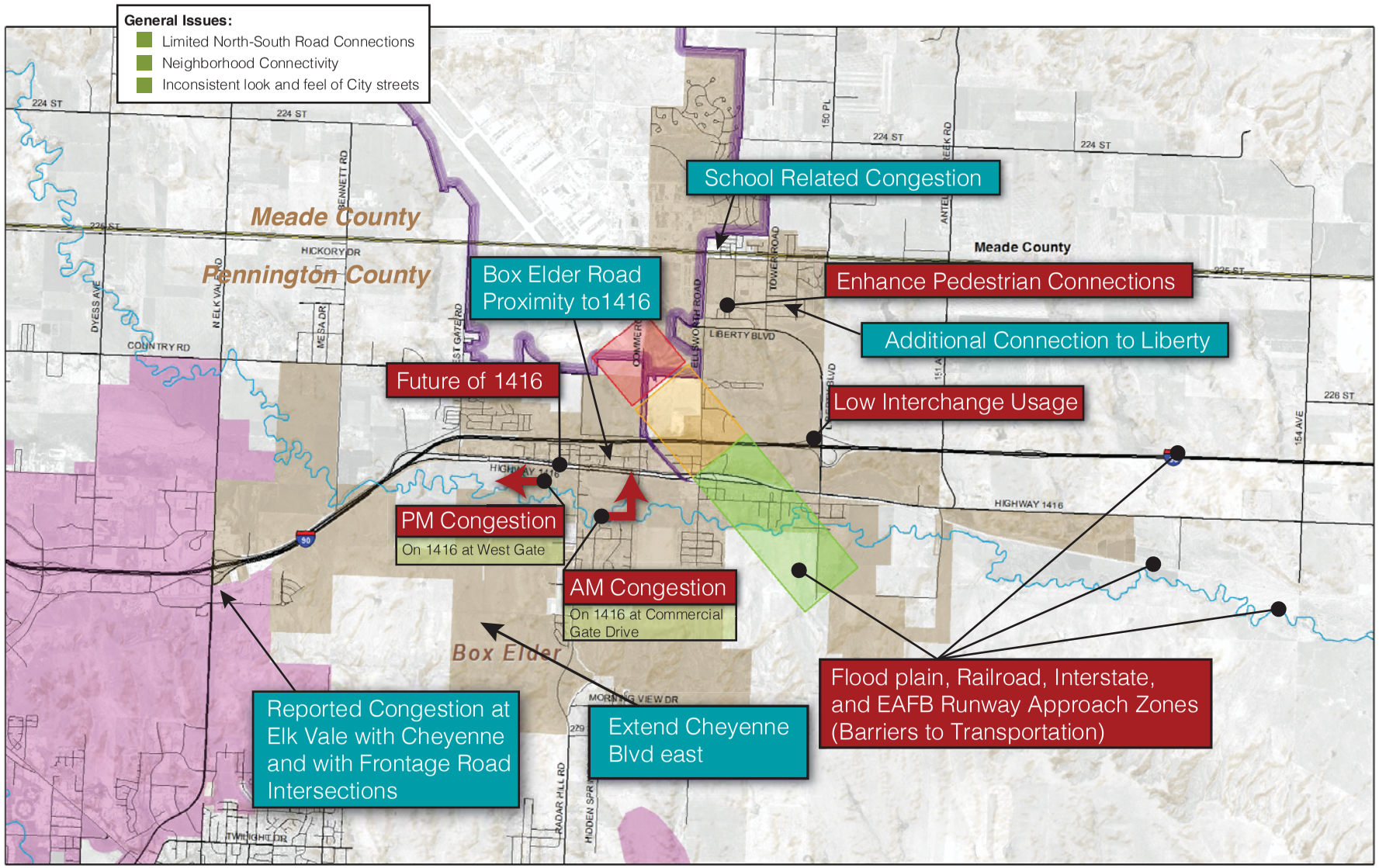
Figure 11 summarizes known needs and issues that helped to develop the *BESTPlan*. The City, agencies, and the public identified several area wide issues by noting a general lack of north-south connectivity among vehicle and non-motorized facilities. They also noted the lack of connectivity between neighborhoods 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



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III. FORECASTED GROWTH

A. Land Use

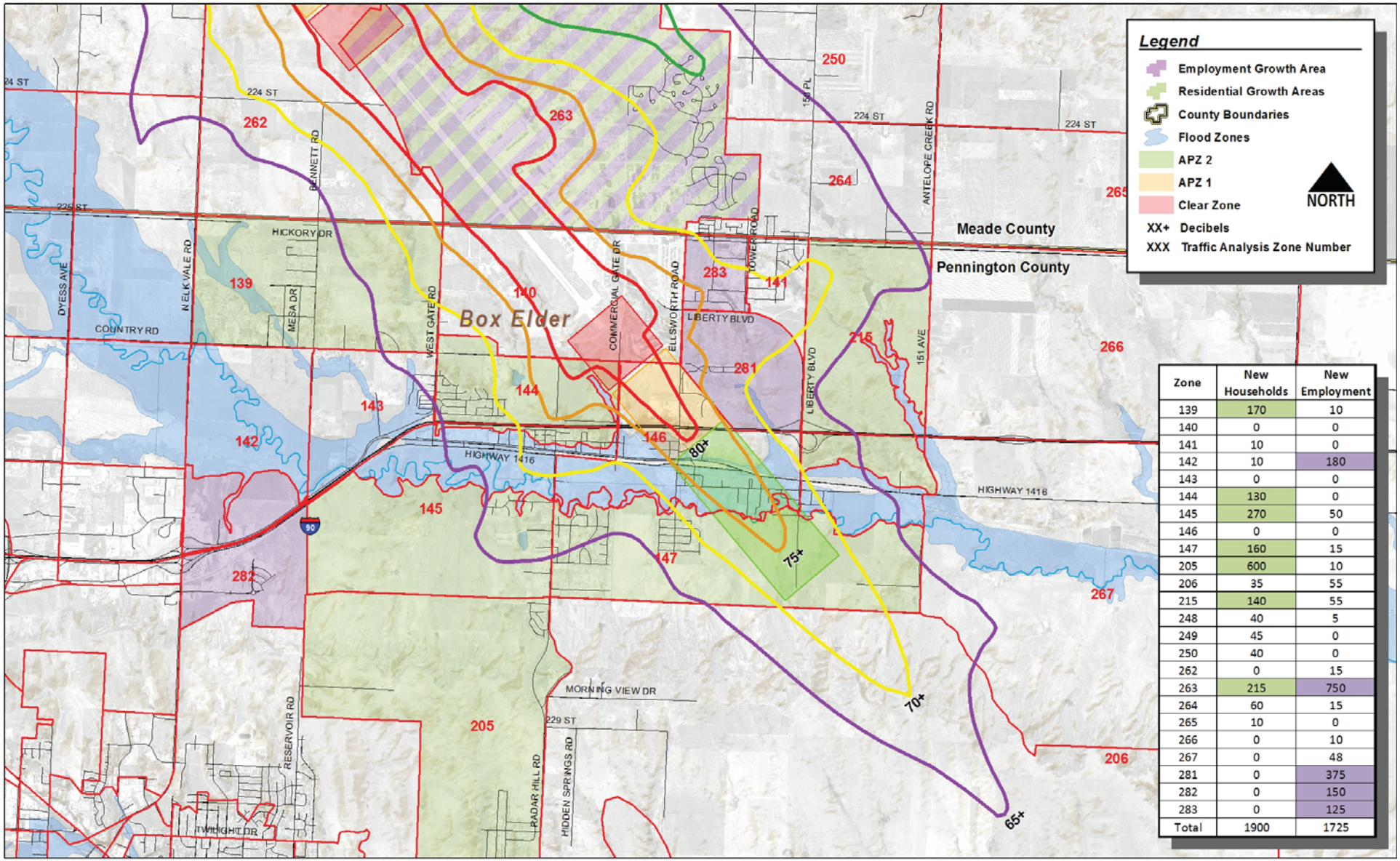
The City of Box Elder has experienced significant growth in the last 10 to 15 years. According to census data, the City has grown from about 3,500 residents in 2000 to nearly 8,000 residents in 2010, making it one of the fastest growing cities in the state. The City's growth has been catalyzed by annexation 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

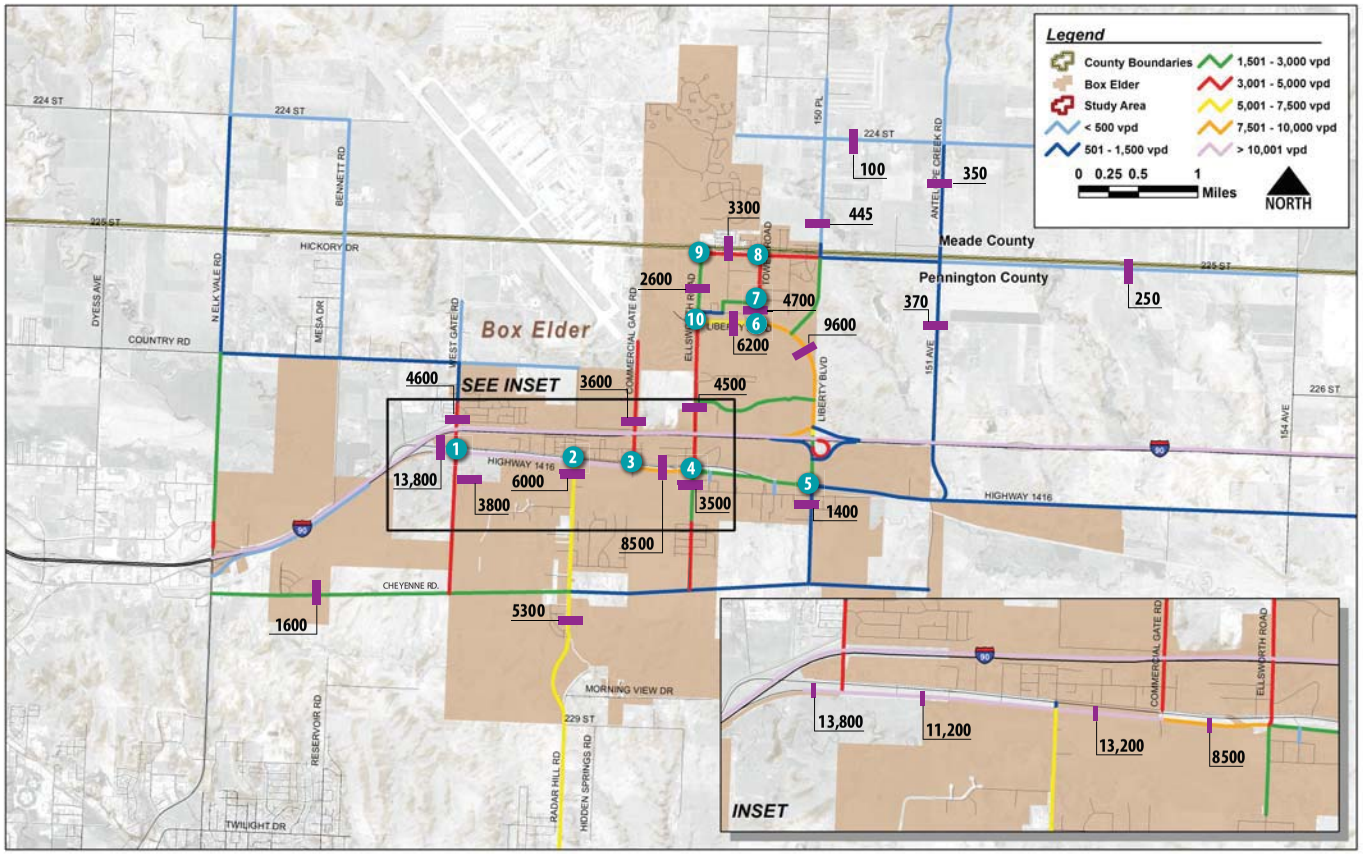
The Rapid City Area MPO travel demand model was used to develop long range, Year 2035 traffic projections for study area roadways. Model runs used the TAZ structure and the land use forecasts shown in **Figure 12** and the base year 2035 transportation network was modified slightly to reflect existing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

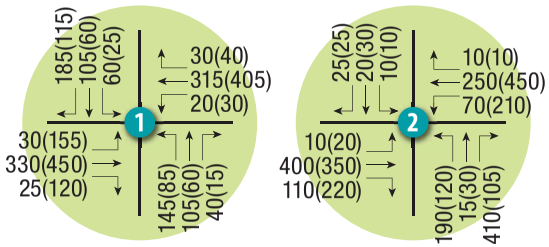
- Converting Highway 1416 from four lanes to a three lane roadway
- Adding roadway links between 225th and Liberty, along the 150th Place alignment
- Adding Cimarron Street between Ellsworth Road and Liberty Boulevard
- Adjusting modeled connections to better reflect how TAZ areas would access the adjacent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

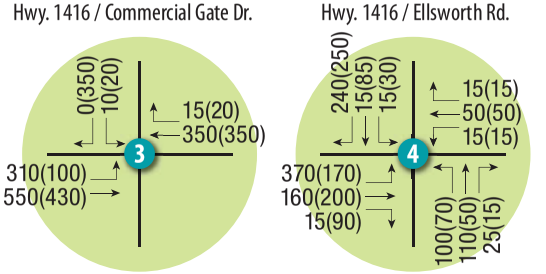
After these modifications to land use, TAZs, and the roadway network, daily traffic projections were developed for study area roadways. Transportation demand model results were adjusted using calibration factors developed from the relationship between existing traffic counts and results from the existing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

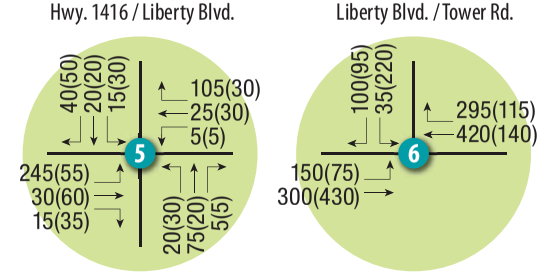
Figure 13 depicts daily traffic volume projections in 2035. I-90 and Highway 1416 are expected to carry more than 10,000 vph. Highway 1416 projections are about the same or even slightly less than existing traffic counts, while Liberty Boulevard projections are more than twice the existing traffic volume. 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



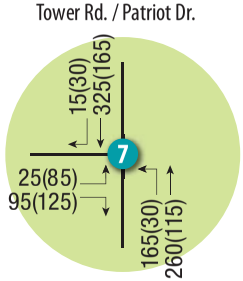


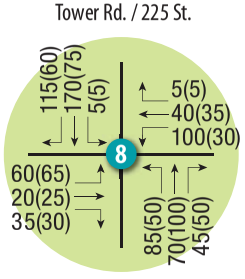


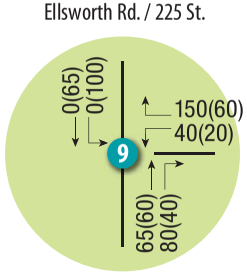


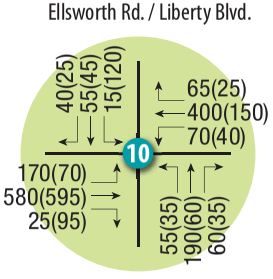
Legend

XXX(XXX)	AM(PM) Peak Hour Traffic Volumes
XXXX	Daily Traffic Count
	Count Location









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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.

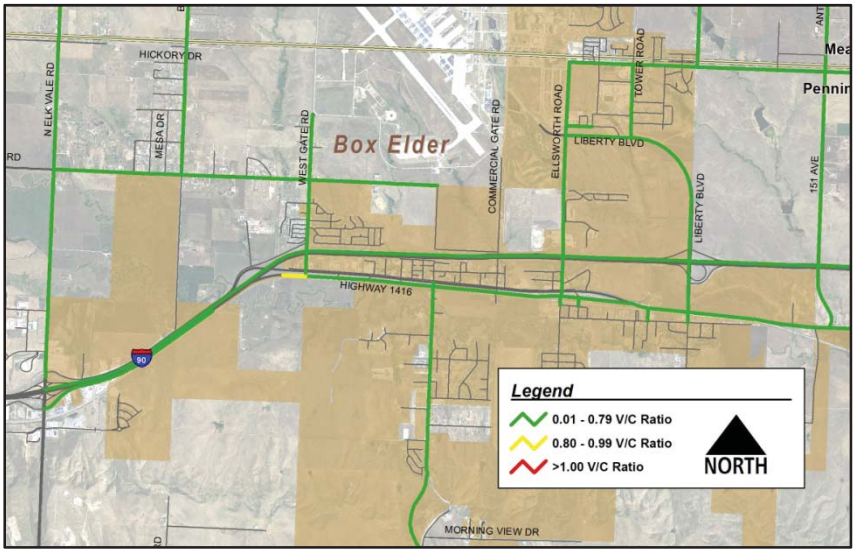


Figure 14. Long-Term Future (Year 2035) Volume to Capacity Ratios – Roadway Segments

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.

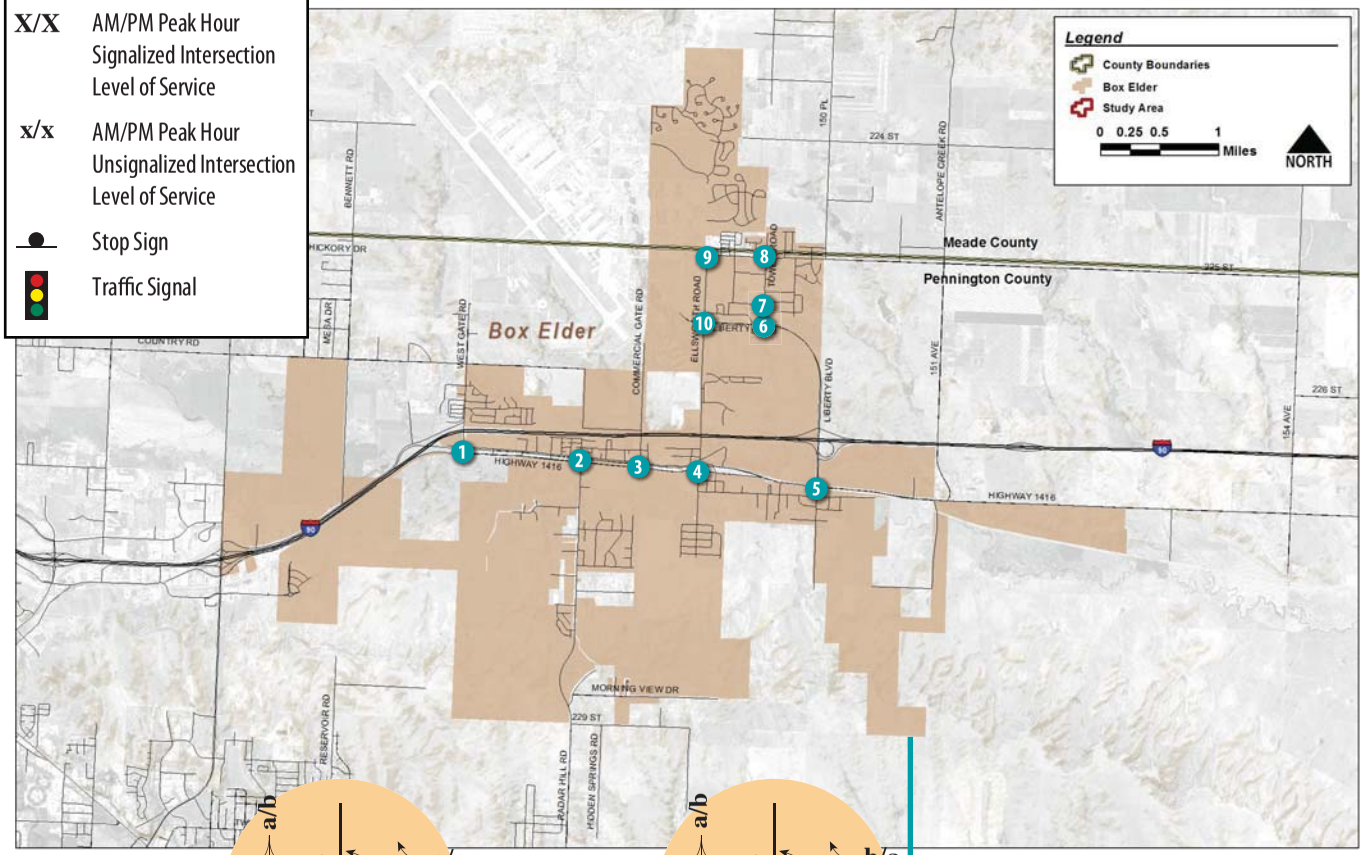
Ellsworth Road / 225th Street: This T-intersection has stop control on 225th. Turn movements at this intersection operate at LOS B during the peak hours.

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.

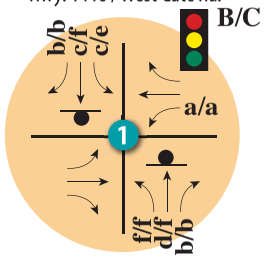
Figure 15
Future (Year 2035) Peak Hour Levels of Service

Legend

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

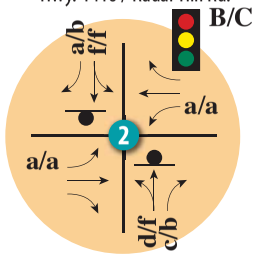


Hwy. 1416 / West Gate Rd.



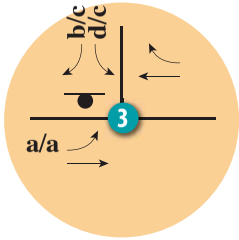
Possible traffic signal or roundabout needed

Hwy. 1416 / Radar Hill Rd.

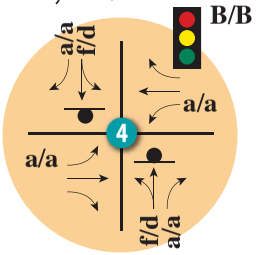


Possible traffic signal or roundabout needed

Hwy. 1416 / Commercial Gate Dr.

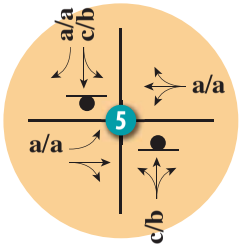


Hwy. 1416 / Ellsworth Rd.

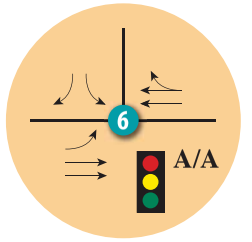


Possible traffic signal or roundabout needed

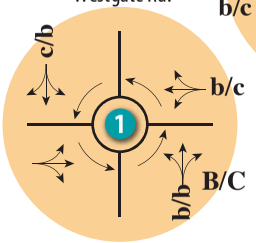
Hwy. 1416 / Liberty Blvd.

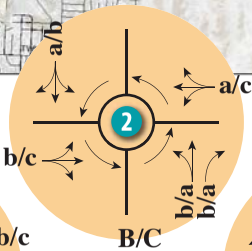


Liberty Blvd. / Tower Rd.



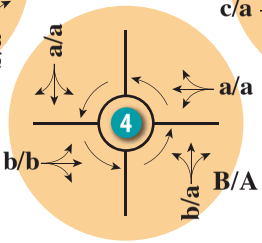
Westgate Rd.

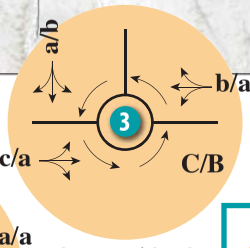




Radar Hill Rd.

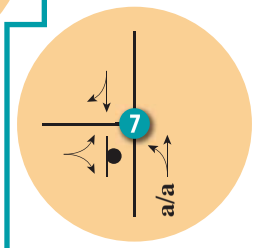
Ellsworth Rd.



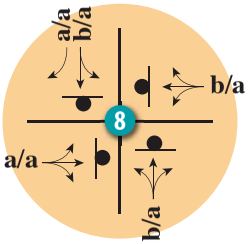


Commercial Gate Dr.

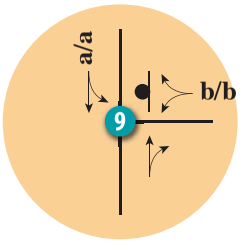
Tower Rd. / Patriot Dr.



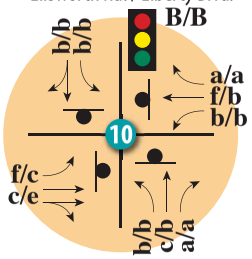
Tower Rd. / 225 St.



Ellsworth Rd. / 225 St.



Ellsworth Rd. / Liberty Blvd.



Possible traffic signal or roundabout needed

1416 Roundabout Analysis

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IV. LONG RANGE TRANSPORTATION PLAN

A. Major Street Plan

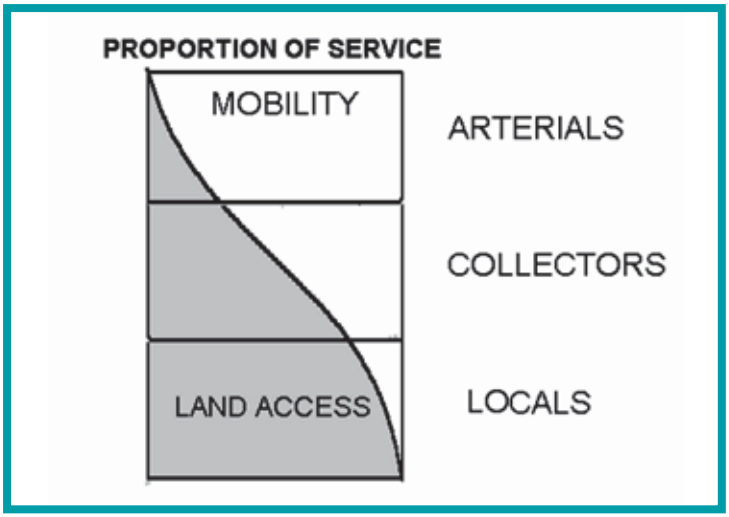
The centerpiece of the Box Elder Strategic Transportation Plan as it relates to the road network is the Major Street Plan. The Major Street Plan provides a framework for how the road network should be established as development occurs within the study area. The plan labels the classification of current 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.

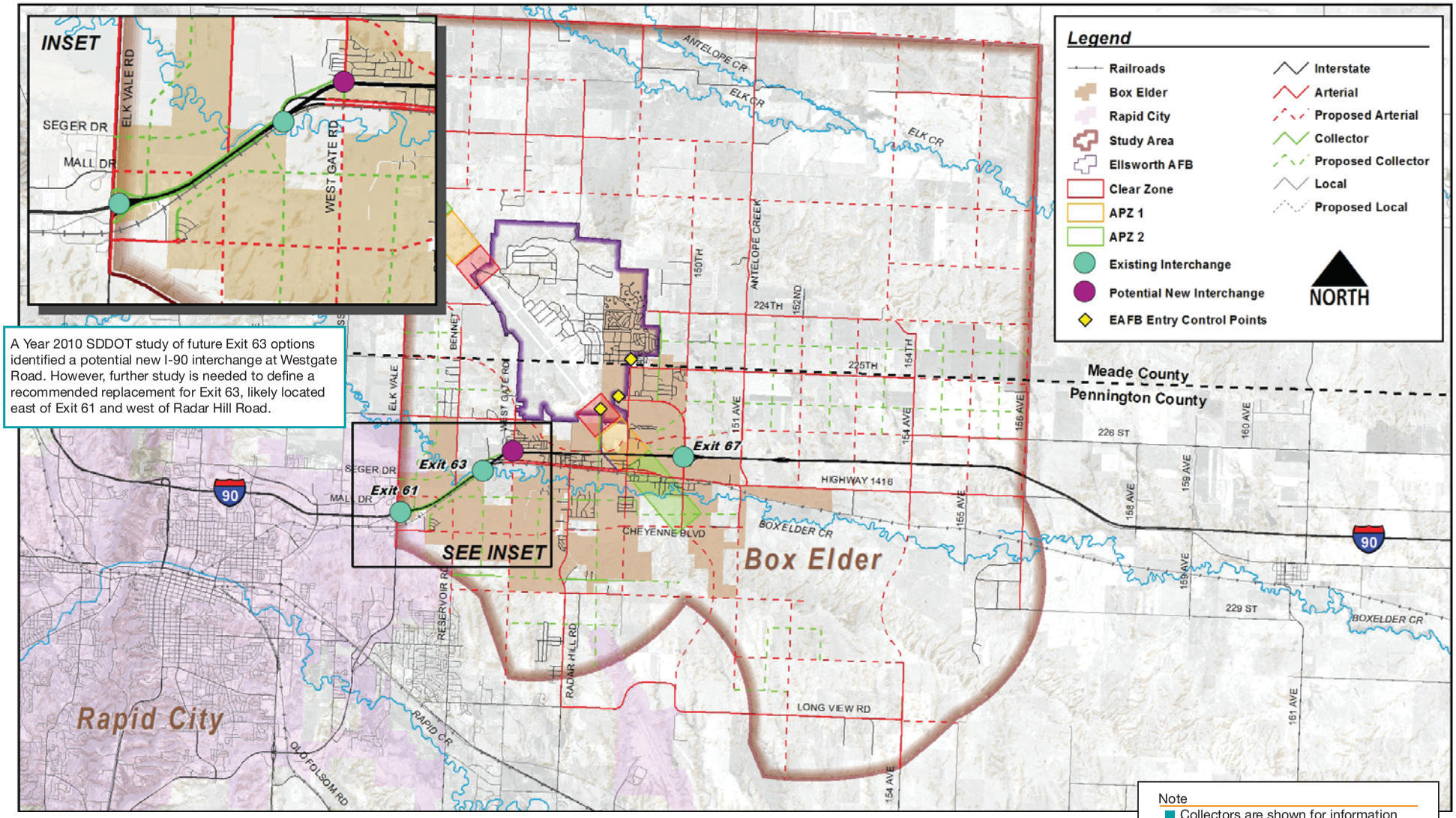
Collector Roads

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



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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