Technical Memo

Date:	Thursday, December 17, 2020
Project:	US14A / US85 Deadwood Box Corridor Study
To:	Study Advisory Team
From:	HDR
Subject:	Existing Conditions

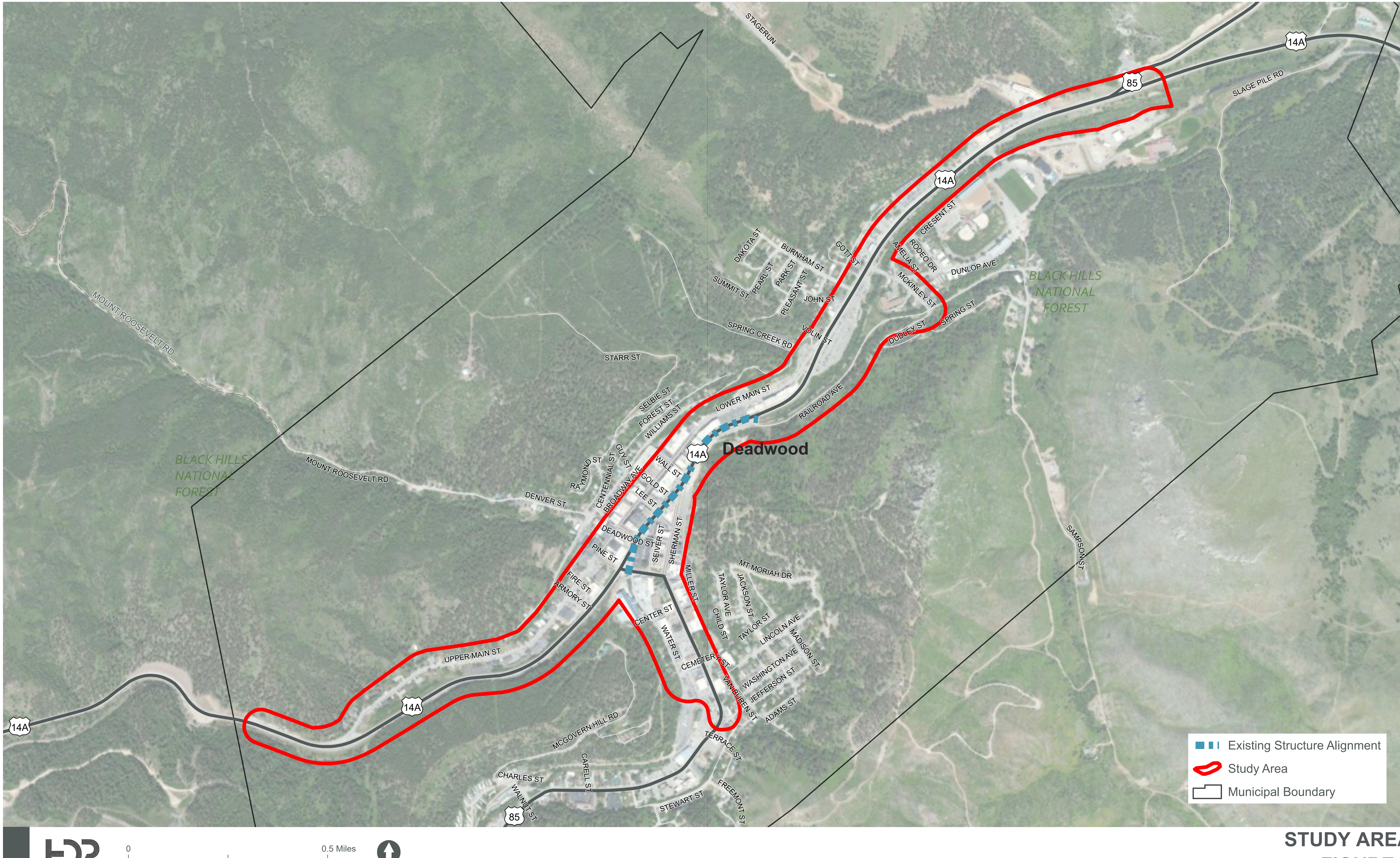
1.0 Introduction

The South Dakota Department of Transportation (SDDOT) in conjunction with the City of Deadwood is conducting a corridor planning study for a portion of the US Highway 14 Alternate (US14A) / US Highway 85 (US85) / Pioneer Way corridor in the City of Deadwood, South Dakota. This corridor study includes determining the type, size & location for replacement of the structure (Structure Number 41-161-156) over Whitewood Creek, which is a 1,768 foot-long structure that crosses US85 / Pine Street and carries the US14A / US85 / Pioneer Way corridor on a good portion of its deck and is referred to as the “Deadwood Box”.

1.1 Existing Conditions Memo Purpose and Study Area

An important piece of the study is determining the needs of the US14A / US85 / Pioneer Way corridor. The purpose of this memo is to identify those needs by taking inventory of the existing conditions including the regional roadway network, existing land use, accesses, daily volumes, roadway section, parking facilities, roadway geometrics, multimodal facilities, historical crash review, and existing traffic operations.

The study area is shown in Figure 1 and extends along US14A / Pioneer Way from Upper Main Street to the northern junction with US85. Main Street, Sherman Street from Cemetery Street to US14A, Pine Street, and several side streets are also included in the study area. The Deadwood Box begins at the southeast quadrant of the US14A / US85 / Pine Street intersection and traverses under the Deadwood Visitors Center parking area. The Deadwood Box then follows the alignment of US14A and outlets near Railroad Avenue. The Study Area encompasses the potential relocation of the Deadwood Box and roadway corridor, the possible construction detour routes, and the surrounding major intersections that may be indirectly impacted by the build concepts brought forward during the concept development process.



STUDY AREA
FIGURE 1

DEADWOOD BOX CULVERT

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1.2 Deadwood Background

The City of Deadwood was established in 1876 and named by early settlers who found numerous dead trees lining the canyon walls within the gulch[1]. It is settled in a narrow canyon in the Northern Black Hills and is currently the county seat of Lawrence County, South Dakota.

POPULATION TRENDS

During its heyday of the gold-rush, the city was home to a population of 25,000. According to the most recent 2010 US census, the current population of Deadwood is 1,270. Although Deadwood has undergone several boom and busts due to its mining history, the population has remained relatively stable the last 20 years. As shown in Figure 2, the population was slowly declining between years 2000 to 2008 and has leveled out in the last 10 years. The Homestake Mine located in nearby City of Lead, the largest and deepest gold mine in the US, may be the cause of the slow decline in population for the years following its closure in 2001. The Homestake Mine later had a revival in 2006 when it was converted into the Sanford Underground Research Facility, bringing employees and more economic activity to the Lead-Deadwood area (City of Deadwood, 2018)[2]. The data collection efforts of the 2020 census are still underway and are not included in the population estimate graph.

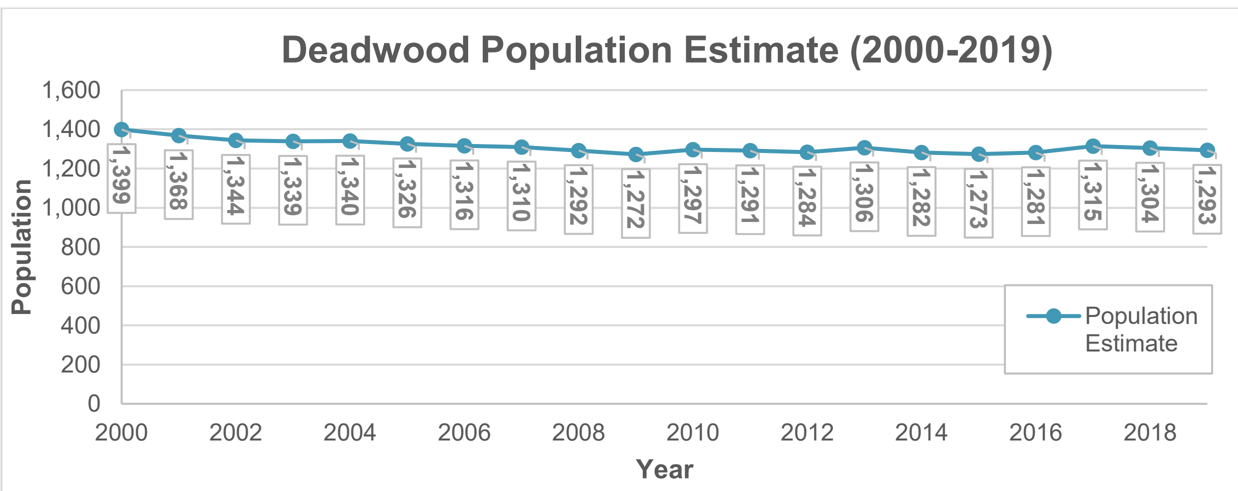

Figure 2. Deadwood 20-Year Population Trend

Sources: (US Census Bureau, 2016)[3] & (US Census Bureau, 2020)[4]

[1] City of Deadwood. (2013, July). *Deadwood: An Entire American City Named a National Historic Landmark!* Retrieved from City of Deadwood: https://www.cityofdeadwood.com/?SEC=269A8C80-9F36-4D72-A17D-DF18E23E10FF

[2] City of Deadwood. (2018). *Deadwood Comprehensive Plan.*

[3] US Census Bureau. (2016, December 2). City and Town Intercensal Datasets: 2000-2010. Retrieved from Census.gov: https://www.census.gov/data/datasets/time-series/demo/popest/intercensal-2000-2010-cities-and-towns.html

[4] US Census Bureau. (2020, May 21). *City and Town Population Totals: 2010-2019.* Retrieved from Census.gov: https://www.census.gov/data/datasets/time-series/demo/popest/2010s-total-cities-and-towns.html

IMPORTANCE OF HISTORIC PRESERVATION

In 1879, a fire that started at the Empire Bakery on Sherman Street and spread to the core of Deadwood burned 300 buildings, mostly wood-framed structures. When Deadwood rebuilt, they used more fire-resistant materials such as stone and brick. Due to the limited developable land, many of the buildings encroached upon the natural waterways of Whitewood and Deadwood Creeks. When a flood raged through town in 1883, the encroachment caused the floodwaters to spread and damage many buildings. Deadwood rebuilt again and by 1914, most of the historic neighborhoods and downtown core buildings still standing today were built. Deadwood was named a National Historic Landmark (NHL) in 1961 and the Historic Preservation Commission was established in 1973 to oversee the restoration of historic sites in Deadwood (City of Deadwood, 2013).

Fires have continued to shape the trajectory of the City with the most recent Syndicate Fire in 1987 burning three buildings on Main Street. This fire was the driving force behind legalizing gambling in Deadwood in 1989 to raise the revenue for revitalizing historic buildings. The latest boom in Deadwood was when gambling was legalized in 1989 and 80 casinos opened the first year. The additional development threatened the City's NHL status and the City was listed as one of the most endangered historic sites in 1990. The revenue from the casinos helped restore many of the historic buildings, and the NHL status was removed from the endangered list in 1992. Preserving historic buildings and character and preserving natural surroundings and scenic beauty were the top two items on a community wish list within the Deadwood Comprehensive Plan (City of Deadwood, 2018).

TOURIST AND COMMUTER TRAFFIC

Deadwood is a tourist destination known for its history, architecture, and opportunities for gaming, dining, entertainment and outdoor recreation (City of Deadwood, 2013). Deadwood attracts millions of visitors every year with gaming dominating Deadwood's economy. As of 2017, there were 892 people employed within Deadwood. Accommodation & Food Services (28%), Arts, Entertainment, & Recreation (22%), and Health Care & Social Assistance (8%) are the largest occupations of the employed workforce (DATA USA, 2017)[5]. According to the 2016 Deadwood-Lead Housing Study, the majority of the employed workforce in Deadwood are not residents and commute to Deadwood for their jobs (Community Partners Research, Inc., 2016)[6].

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[5] DATA USA. (2017). *Deadwood, SD*. Retrieved from DATA USA: https://datausa.io/profile/geo/deadwood-sd/#tmap_ind_num_emp

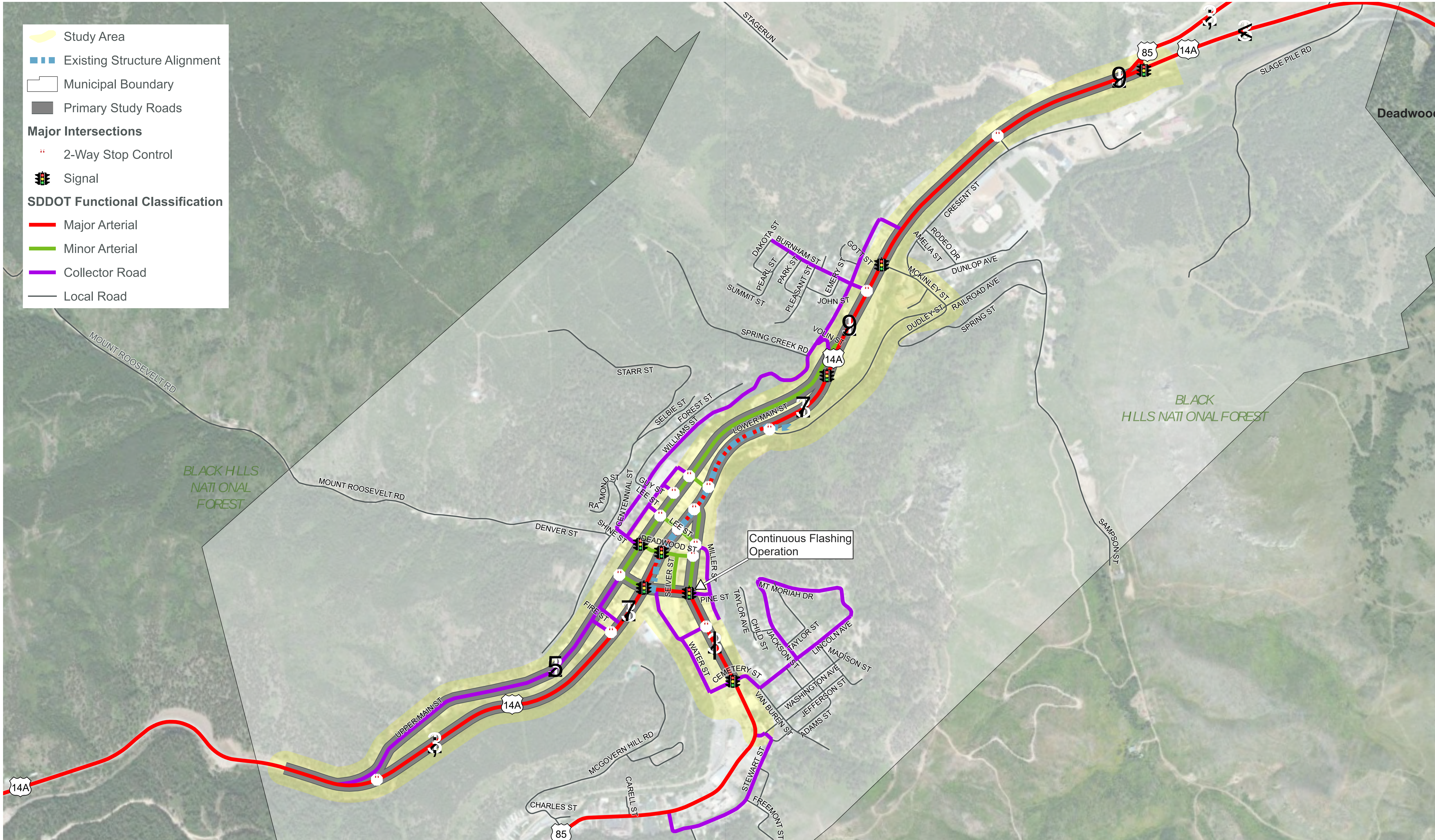
[6] Community Partners Research, Inc. (2016, April 21). *Deadwood-Lead Housing Study*. Retrieved from Deadwood-Lead Economic Development: https://www.deadwoodleadedc.com/news/deadwood-lead-housing-study

2.0 Study Area Characteristics

The study area includes the following roadway segments:

- US14A / Pioneer Way from Upper Main Street to the northern junction with US85,
- Main Street from the northern intersection of US14A / Pioneer Way to the southern intersection of US14A / Pioneer Way,
- US85 / Pine Street from Main Street to Sherman Street, and
- US85 / Sherman Street from Cemetery Street to US14A.

Figure 3 summarizes the study area boundary, the primary roadway segments, the major intersections, speed limits, and functional classifications.



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EXISTING INTERSECTION CONTROL AND ROADWAY FUNCTIONAL CLASSIFICATIONS

FIGURE 3

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2.1 Regional Roadway Network

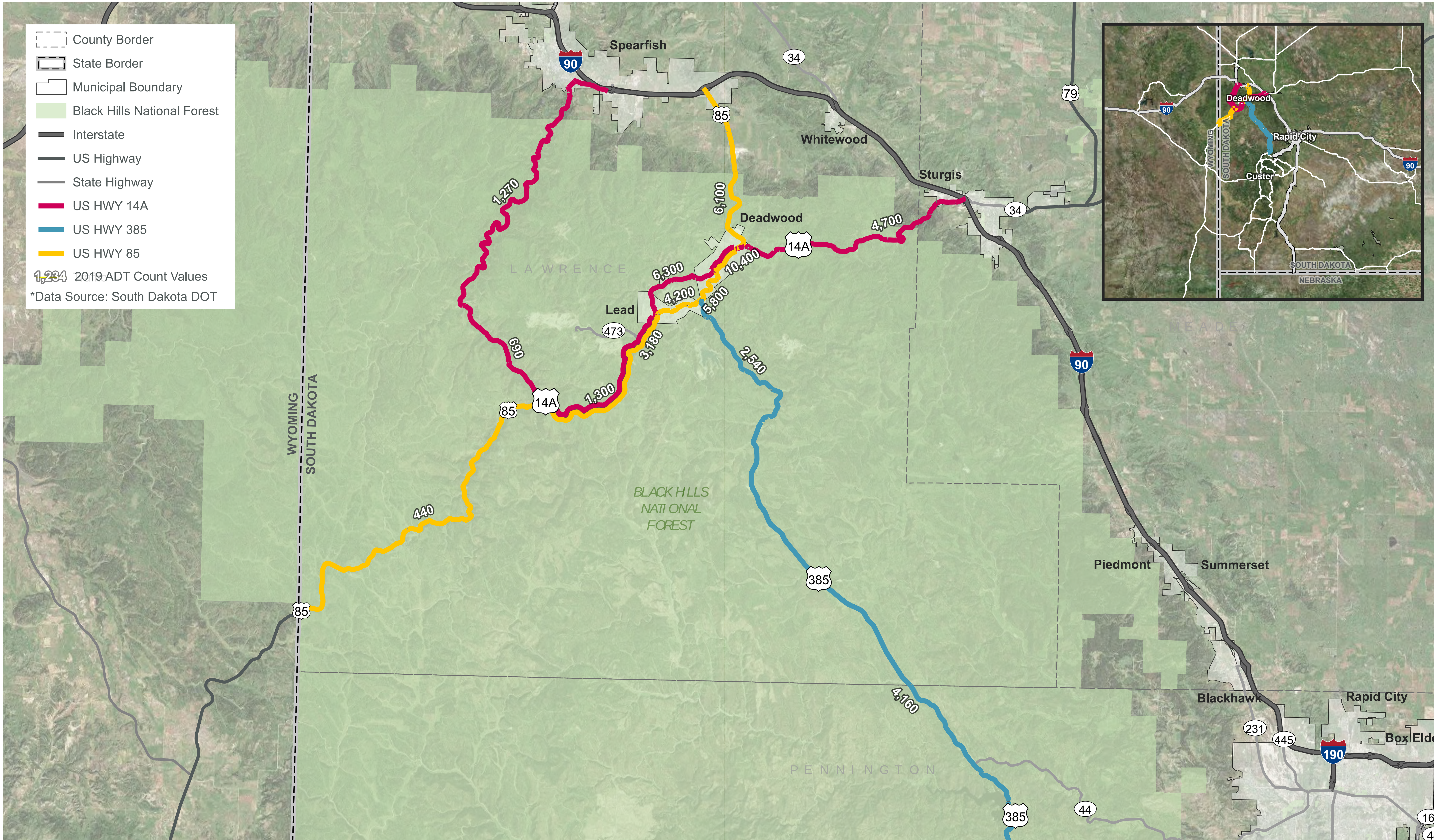
US14A is shown in red on Figure 4 and is the main artery between Sturgis/Interstate 90 (I-90) and the Cities of Lead / Deadwood. West of Deadwood, US14A serves as a truck bypass around the narrow and sometimes steep 2-lane highway that enters downtown Lead. US14A merges with US85 twice for a total length of approximately 1.2 miles through Deadwood and again for 7.6 miles between Lead and Cheyenne Crossing.

US85 is shown as the yellow line and connects the eastern part of Spearfish / I-90 to Lead / Deadwood and eastern Wyoming. US385, the blue line, is the main north-south route through the Black Hills Area. US385 intersects US85 between Deadwood and Lead and does not continue. US14A diverges with US85 to the north at Cheyenne Crossing and serves as mainly a recreational route through Spearfish canyon.

2.2 Existing Land Use and Challenges with Growth

As shown in Figure 5, commercial districts surround the main roadway corridors of Main Street, US14A, US85, and Sherman Street. Residential neighborhoods begin roughly one to two blocks from the main roadways and are built up into the hillsides and gulches of Deadwood.

Deadwood faces a challenge with future development due to very little developable land and surrounding steep and forested terrain. In addition, United States Forest Service and Bureau of Land Management managed lands surround the city limits. The physical and land ownership constraints restrict traditional outward growth and has led to an inward, upward and discontinuous outward growth patterns (City of Deadwood, 2018). According to results from a community survey sourced from the 2018 Deadwood Comprehensive Plan, residential and local commercial land uses tied for top needs for new development, followed by parking areas.



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REGIONAL ROADWAY NETWORK
FIGURE 4

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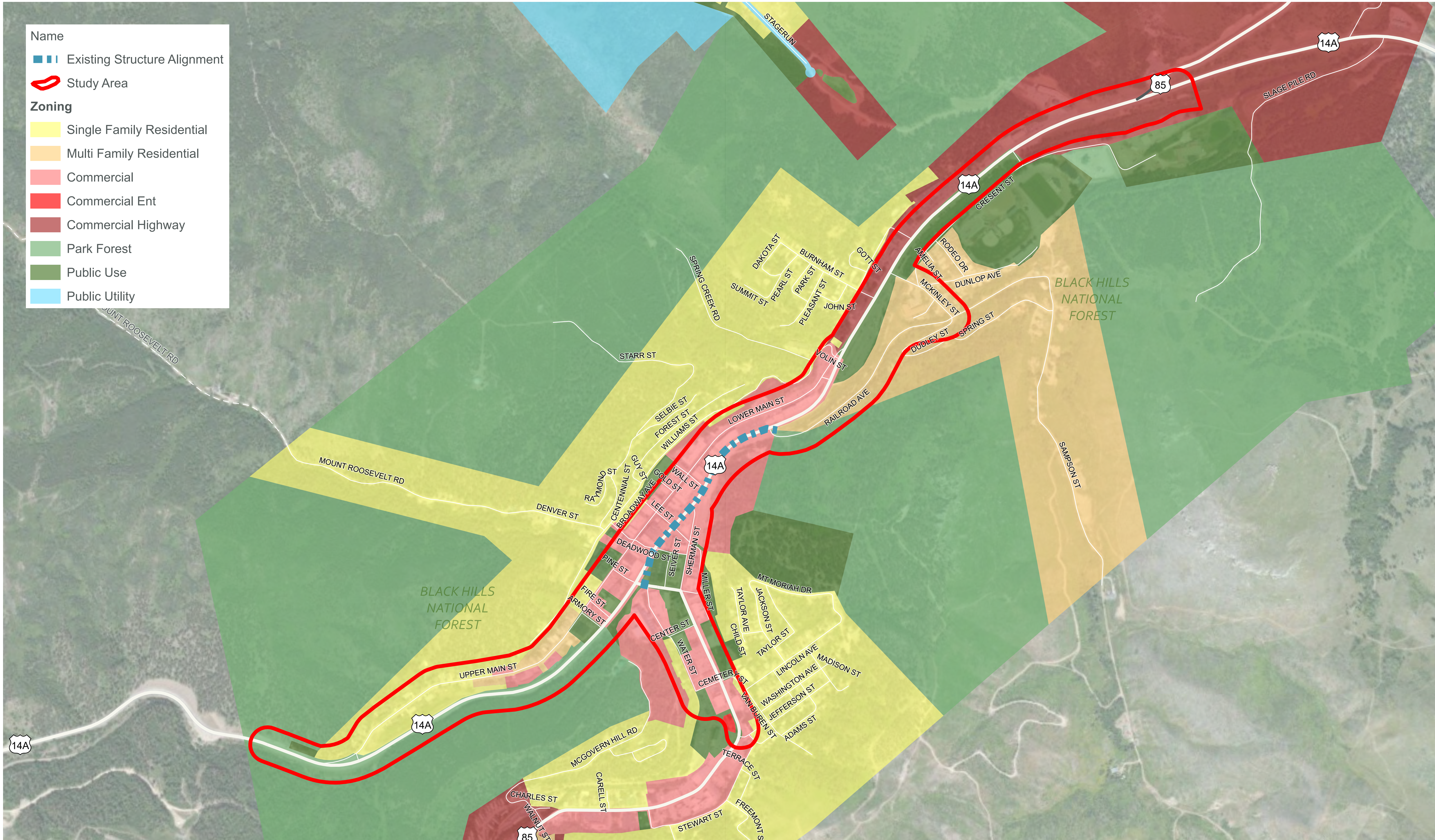
DEADWOOD BOX CULVERT



0 0.5 Miles

EXISTING LAND USE
FIGURE 5

DEADWOOD BOX CULVERT

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2.3 Access Inventory

Access is a necessary part of the roadway network, but it also introduces conflict and friction into the traffic stream. Access management can help identify opportunities to reduce or consolidate access points along a corridor in order to improve the flow of traffic and reduce the number of potential vehicular collisions. The National Cooperative Highway Research Program (NCHRP) Report 420 outlines research findings that demonstrate the impacts of access to crash potential and corridor travel speeds. The research indicates that accident rates (accidents per million vehicle miles) generally increased as access density increased. Signalized access density was one of the more influential factors. In urban and suburban areas, the research also indicated that the accident rate for access densities of more than 60 per mile was more than 2.5 times higher than the accident rate for access densities of fewer than 20 per mile (Gluck & Levinson, 1999)[7].

Within the study area limits, US14A / US85 corridors have an access classification designation of Urban Developed. According to the SDDOT Road Design Manual Access Management Chapter, urban developed access classifications are for arterial roadways with high access density where access and through movements have equal priority. The City of Deadwood does not have access spacing requirements, so the corridors managed by SDDOT were the main focus of the access inventory collection and analysis effort.

The following table summarizes the access spacing and density criteria applicable to US14A / Pioneer Way and US85. This criteria is used as a guide to establish locations for further analysis and opportunities to implement retrofit techniques to improve access as part of the future Deadwood Box project. Figure 6 illustrates how corner clearance is measured from a main intersection to an access.

Table 1. South Dakota Access Spacing and Density Criteria

Access Classification	Signal Spacing Distance (mile)	Corner Clearance		Minimum Unsignalized Access Spacing	Access Density
		Speed (mph)	Distance (feet)		
Urban Developed	1/4	20 25 30 35	150 175 200 225	100’	2 accesses/block face

Source: SDDOT Road Design Manual – Figure 17-1

[7] Gluck, J., & Levinson, H. (1999). *NCHRP Report 420 - Impacts of Access Management Techniques.* Washington, D.C.: TRB.

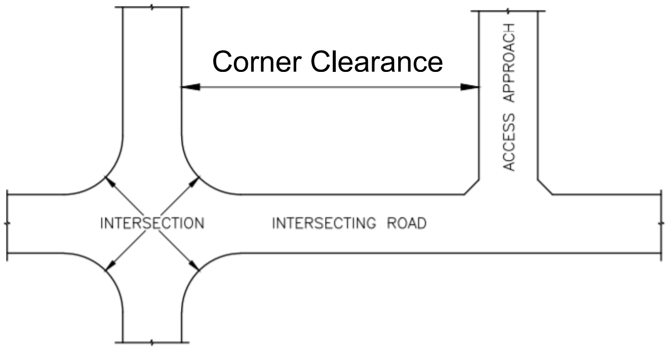


Figure 6. Corner Clearance Illustration

The proximity of four intersections within Deadwood's downtown core is shown in Figure 7. Figure 8 displays the all signalized intersections in the study area and whether the signalized intersections meet the spacing criteria listed in Table 1. Based on a signal spacing distance of one-quarter of a mile or 1320 feet, only one of the signalized intersections within the Study Area, the intersection of US14A and the northern junction with US85, meets the signal spacing distance criteria. The main reason for the closely spaced signalized intersections within the study area is due to limited space, the condensed nature of the Deadwood area, and the proximity of three parallel or somewhat parallel arterial corridors including Main Street (minor arterial), US14A / Pioneer Way (principal arterial), and Sherman Street (minor arterial). Historically, signals have been implemented in central business districts (CBD) to manage mobility and provide signalized pedestrian crossings. The signal density within Deadwood's downtown core isn't out of the norm for a downtown/CBD.

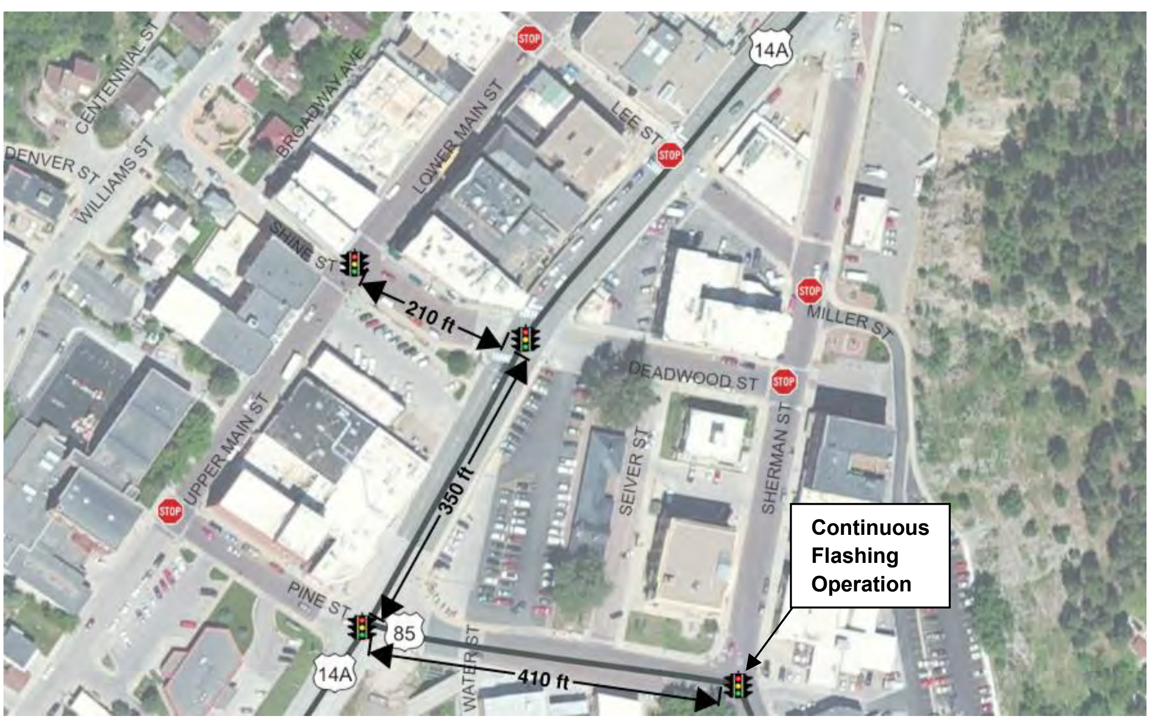
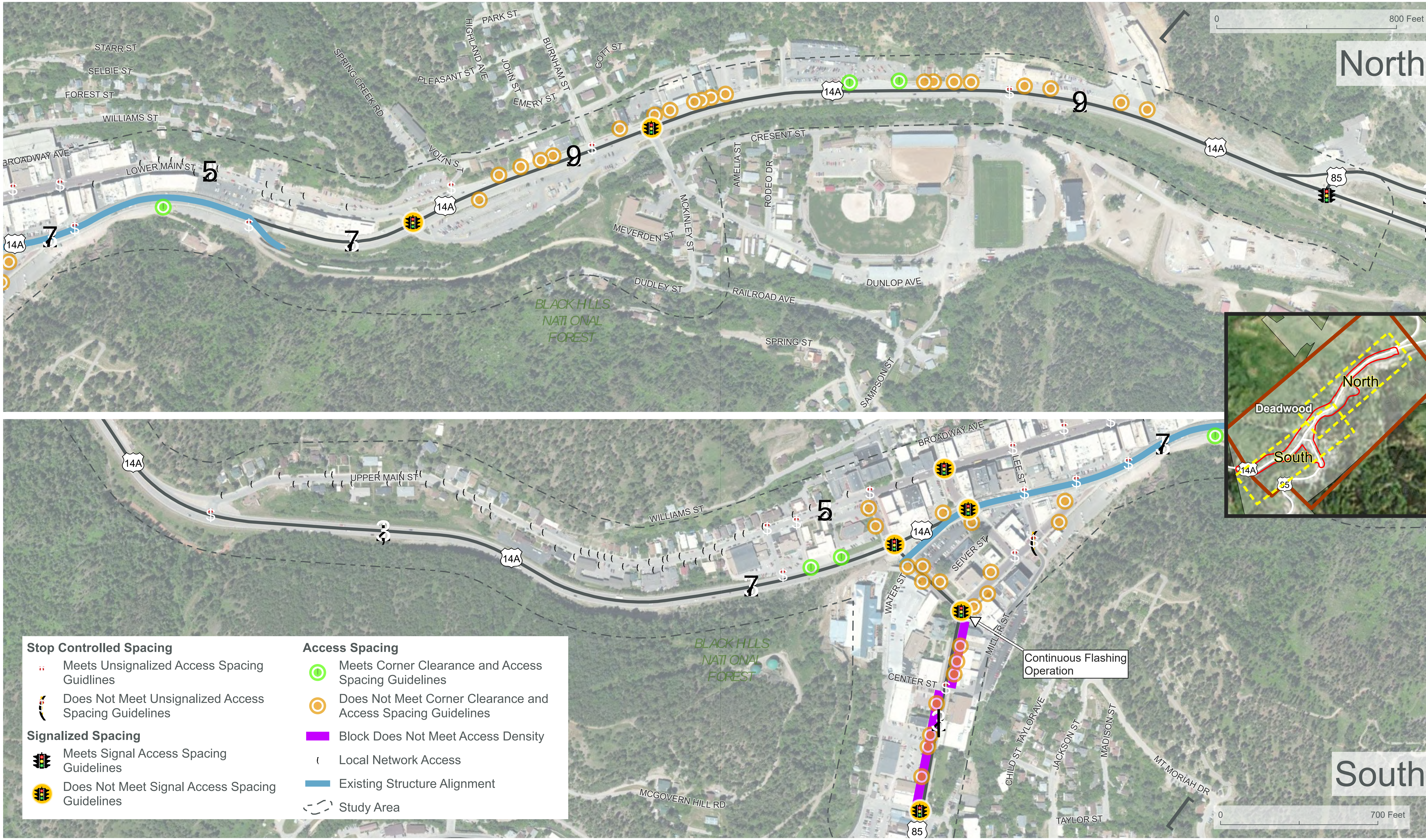


Figure 7. Spacing of Signals in Deadwood's Downtown Core

Figure 8 also identifies the stop controlled intersections and accesses within the study area and whether they meet corner clearance, minimum access spacing, and access density criteria listed in Table 1. Most all accesses along US85 / Sherman Street, US85 / Pine Street, and US14A / Pioneer Way (north of Lower Main Street) do not meet corner clearance and/or the minimum unsignalized access spacing. Due to limited space and close proximity of building faces to the edge of right of way, there is limited opportunity to consolidate accesses within the core of Deadwood. However, there is more opportunity for consolidation along US14A to the north of Lower Main Street, such as the private parking area at First Gold Hotel or a shared access between the Verizon and First Western Insurance Buildings. As new development occurs along US14A and US85, these access spacing guidelines should be taken into consideration.

Figure 9 breaks the corridors down into smaller segments and shows the access density in accesses per mile. The highest access density can be found along the residential portion of Upper Main Street, US85 / Sherman Street, US85 / Pine Street, and Lower Main Street. US14A / Pioneer Way, north of Lower Main Street, has a fairly high access density as well.



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ACCESS SPACING CLEARANCE AND GUIDELINES
FIGURE 8

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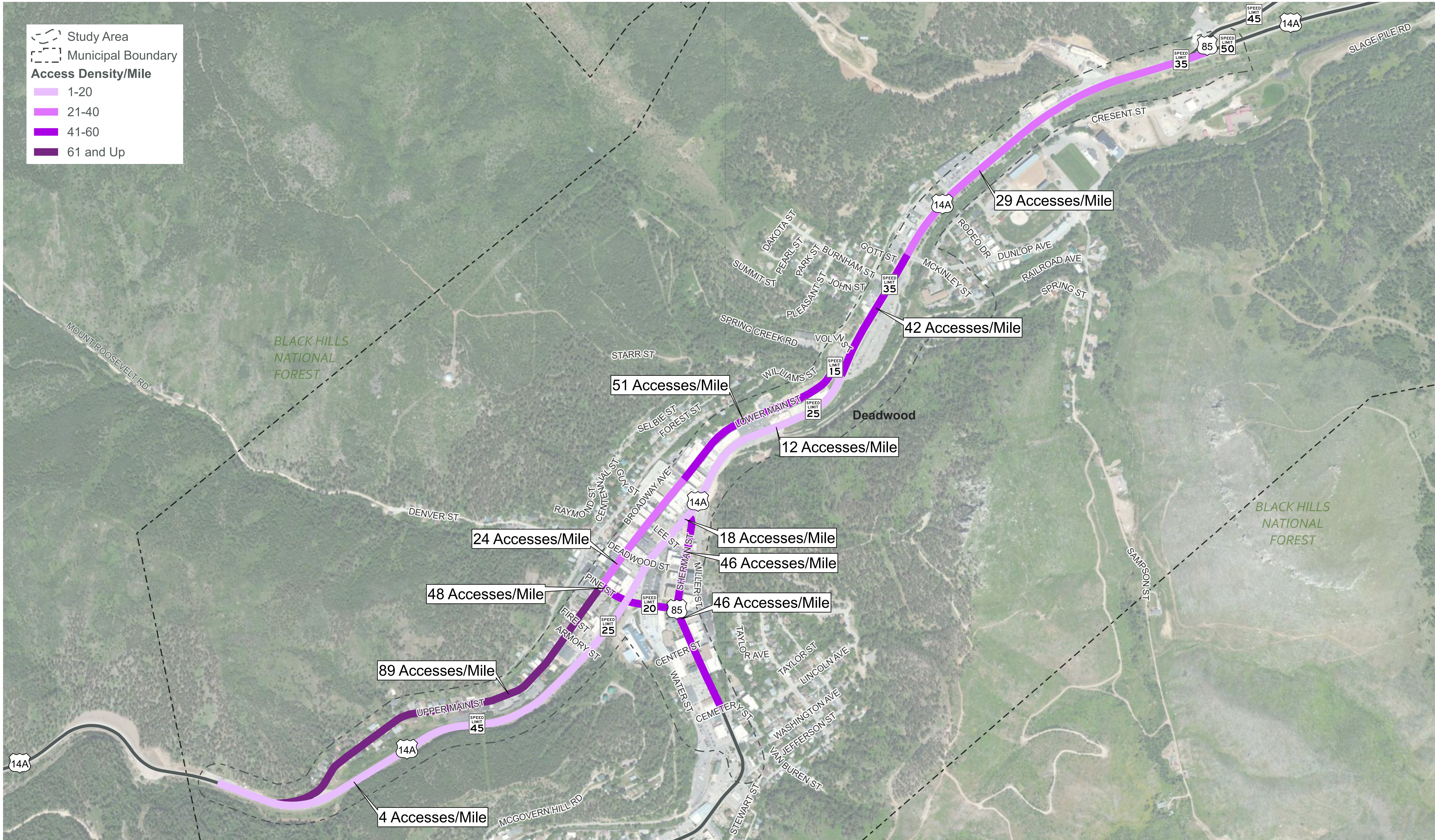
DEADWOOD BOX CULVERT



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ACCESS DENSITY
FIGURE 9

DEADWOOD BOX CULVERT

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A scatter plot graph, shown in Figure 10, compares the access density measured in accesses per mile to each segment's respective crash rate measured in crashes per million vehicle miles traveled (MVMT). Recognizing that there are outliners and several other factors that influence crash rates, this graph does support a correlation that more accesses may result in more crashes while taking into account segment length and exposure. The *Crash History Review Memo*, provides further detail on segment crash rates.

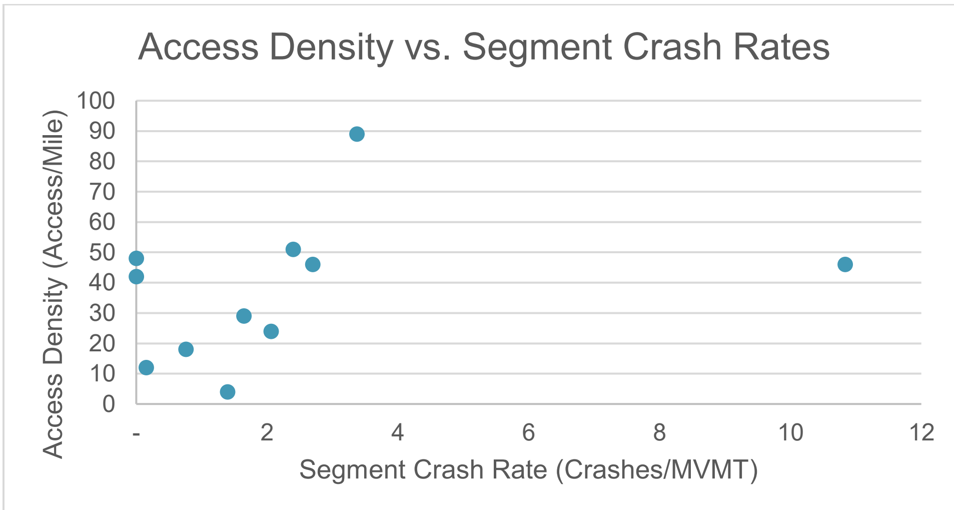


Figure 10. Scatter Plot of Access Density vs. Segment Crash Rates

2.4 Existing Daily Traffic Volumes

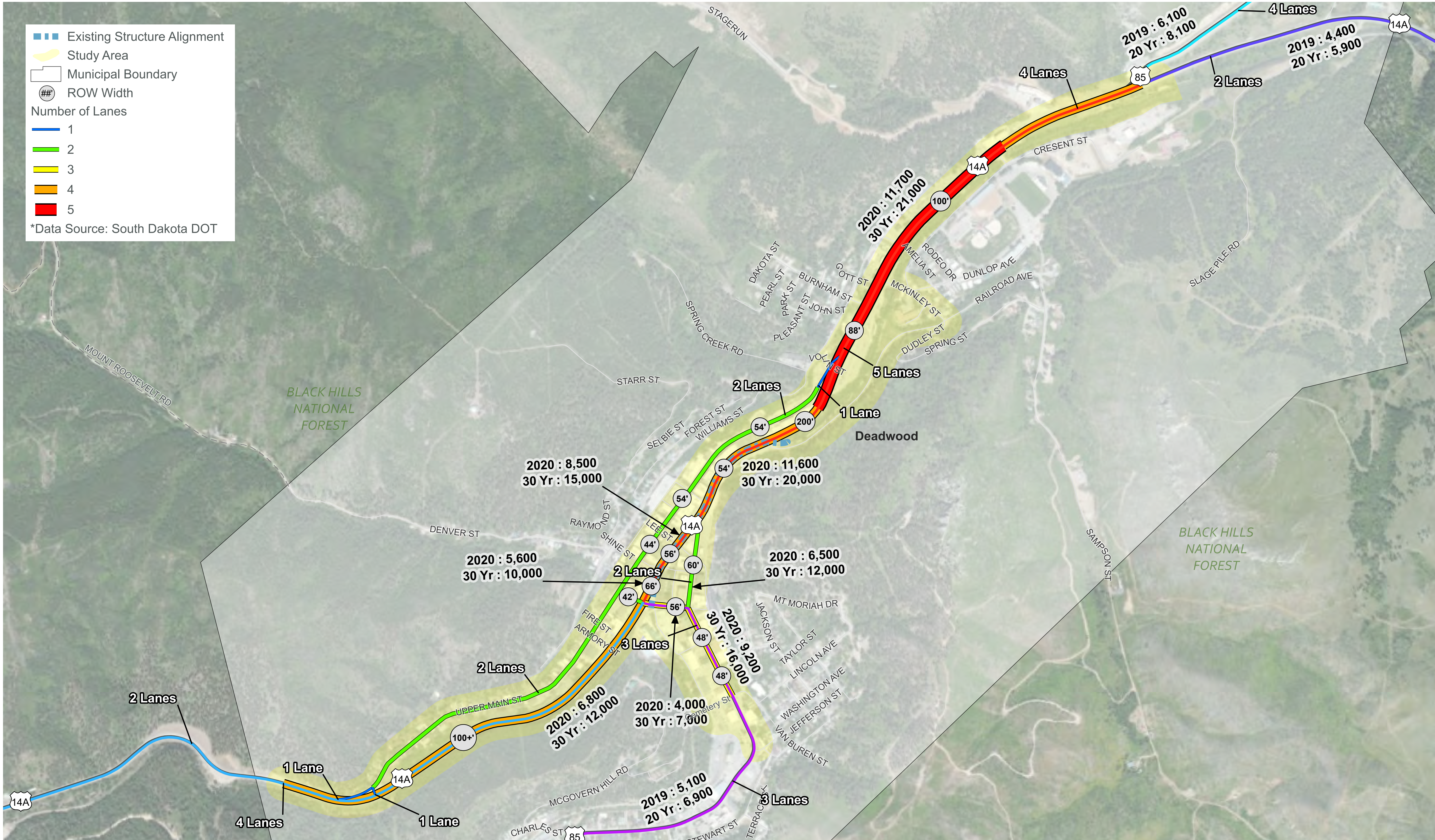
2020 average daily traffic (ADT) volumes are shown in Figure 11. The existing traffic volumes along US14A / Pioneer Way are 6,800 per day (vpd) to the south of the Deadwood Box, ranges from 5,600 to 11,600 vpd along the box alignment, and 11,700 vpd to the north of the Deadwood Box. The existing ADT along US85 / Sherman Street / Pine Street is estimated at 4,000 to 9,200 vpd. Estimated existing ADTs on US14A and US85 south/west of the Deadwood Box are close to equal.

2.5 Existing Roadway Sections and Right of Way Widths

The existing roadway sections range from 2 lane to 5 lane on the primary study corridors. The existing right of way widths range from 42 feet to 100 feet along the primary study corridors. Figure 11 visually summarizes the varying roadway typical sections and right of way widths throughout the Study Area.

2.6 Existing Roadway Surfacing

As shown on Figure 12, Deadwood has a mixture of brick pavers, asphalt, and concrete as roadway surfacing. Brick pavers are prevalent throughout Deadwood to enhance the historic feel of the City. Brick is used on Main Street from Pine Street to Wall Street, Sherman Street from US14A to Cemetery Street, and the total length of Pine Street and some side streets within the study area. The remainder of the study area is paved with concrete or bituminous pavement.



0 0.5 Miles

EXISTING ROADWAY LANES, ROW WIDTHS, AND DAILY VOLUMES
FIGURE 11

0 750 Feet

ROADWAY SURFACE
FIGURE 12

2.7 Existing Geometric Review

Horizontal curves, intersection sight distance, and intersection skews were reviewed as part of the existing geometric review. The main focus for this review were the major intersections and the horizontal alignment along the US14A and US85 corridors within the study area. Ideally, the design speed is 5 mph above the posted speed limit but can be the same as the posted speed limit. The posted speed limit was used as the design speed in the existing geometric review since it signifies the bare minimum geometric design criteria.

HORIZTONAL CURVES

The horizontal curve located along US14A to the south of the Gold Country Inn has a radius of 630 feet. The posted speed limit is 45 mph in this area. The minimum radius of a horizontal curve at 45 mph is 711 feet. The horizontal curve at this location has a radius less than the minimum radius required for a design speed of 45 mph. All other horizontal curves on US14A and US85 within the Study Area met or exceed the minimum radius based on their respective design speeds. This horizontal curve segment experienced three crashes between 2015 and 2019. Based on the segment length and exposure, the crash rate of this curve is similar to nearby horizontal curves that meet design speed criteria. The curve's segment crash rate also does not exceed the study-wide averaged critical crash rate.

Figure 13. Horizontal Curve Review

INTERSECTIONS

Departure sight triangles at intersections should be clear of obstructions (building, parking, trees, etc) and the intersection of the two streets optimally should be close to a right angle. Departure sight triangles with obstructions are shown in blue and orange within Figure 14 through Figure 18 below. Blue sight triangles are for right turns and orange sight triangles for left turns.

US14A & Deadwood Street

The intersection of Deadwood Street and US14A is located within the 25 mph speed limit zone and is signalized. The skew angle between Deadwood Street and US14A is 72 degrees. The sight triangle to the east of the southbound right-on-right turning maneuver is obstructed by the corner of the building within the northeast quadrant of the intersection. The sight triangle to the south of the westbound right-on-red turning maneuver is obstructed by parking within the southeast quadrant of the intersection. However, if a vehicle travels forward beyond the stop bar and into the crosswalk and before the lane of the conflicting traveled way, a vehicle has adequate sight distance to complete the maneuver. This intersection experienced the highest number of angle crashes of all study intersections, totaling five angle crashes. As described in the *Crash History Review Memo*, this intersection has an intersection crash rate less than the study-wide averaged critical crash rate. However, this intersection has the third highest Equivalent Property Damage Only (EPDO) rate of the study intersections. Meaning, of the crashes that do occur at this intersection, the crashes are more severe than the average similar type of intersection within the study area. This finding is consistent with the high number of angle crashes at this intersection.

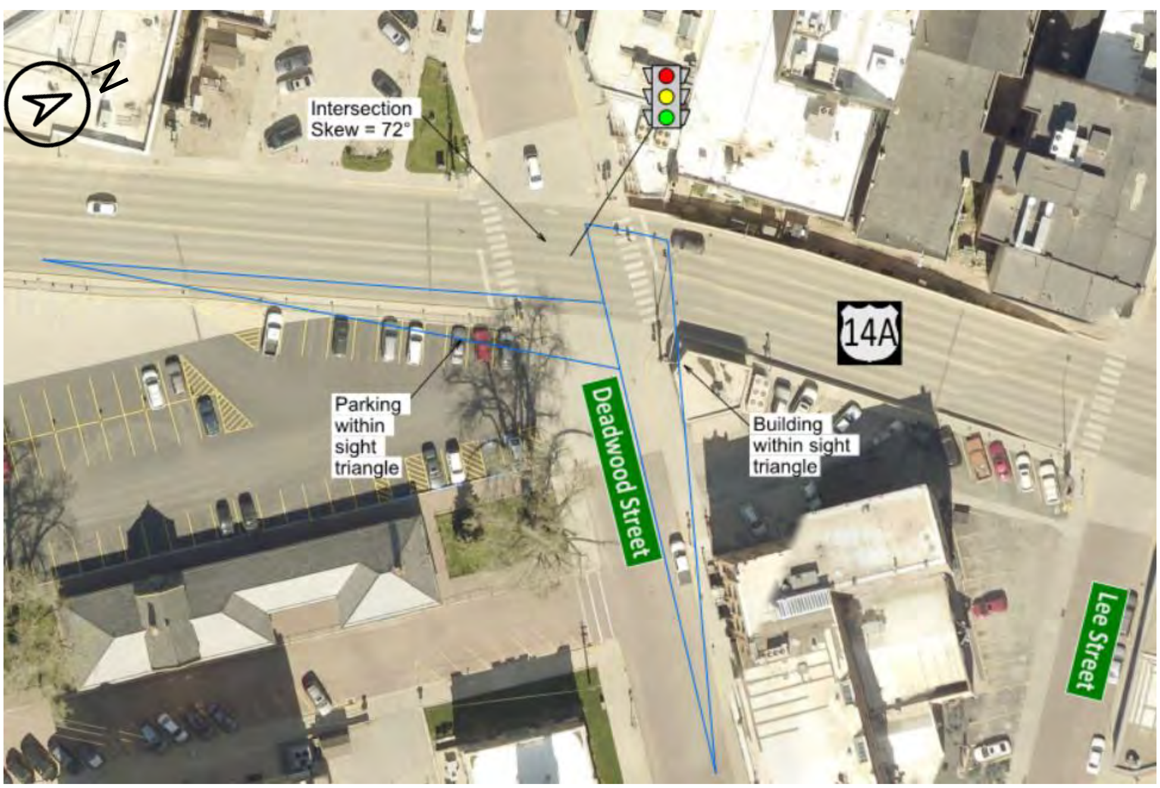


Figure 14. Intersection Geometrics at US14A and Deadwood Street

US14A & Lee Street

The intersection of Lee Street and US14A is located within the 25 mph speed limit zone and is unsignalized with two-way stop control from Lee Street. The west leg of Lee Street is a westbound one way street so the eastbound sight triangle from that leg is not applicable. The sight triangles are obstructed by parking within the southeast quadrant of the intersection and a building within the northeast quadrant of the intersection. If a vehicle travels forward beyond the stop bar and into the crosswalk and before the lane of the conflicting traveled way, a vehicle has adequate sight distance to complete the maneuvers previously listed. The crash history at this intersection did not indicate higher than average crash rates.

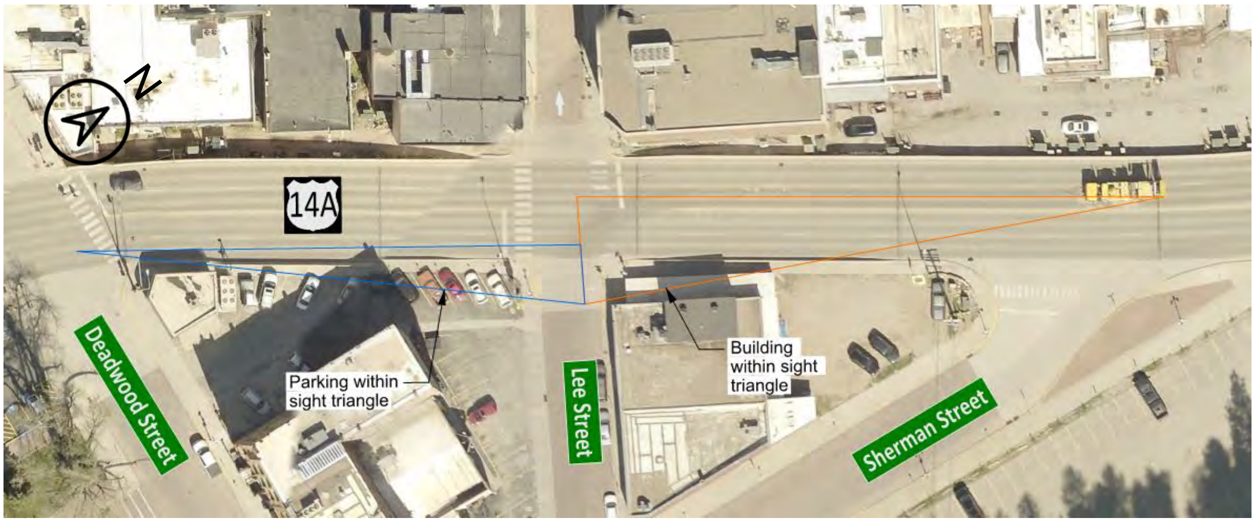


Figure 15. Intersection Geometrics at US14A and Lee Street

US14A & Sherman Street

The intersection of Sherman Street and US14A / Pioneer Way has a skew less than 60 degrees and the approach angles have an even greater amount of skew. The sight distance to the south is limited by a rock wall, utility cabinet, power pole, light poles, jersey barrier, bollards, and signs. As described in the *Crash History Review Memo*, this intersection experienced six crashes between 2015 and 2019 and is one of two study intersections with a crash rate that exceeds the critical crash rate. All six crashes were rear-ends and took place on the Sherman Street approach of the intersection. According to the traffic reports, the leading description of driver contribution to the crash was failure to yield and distraction. One of the potential reasons for these rear-end crashes is the skew of the intersection. The skew may give unfamiliar drivers the illusion of Sherman Street being the thru movement with US14A.

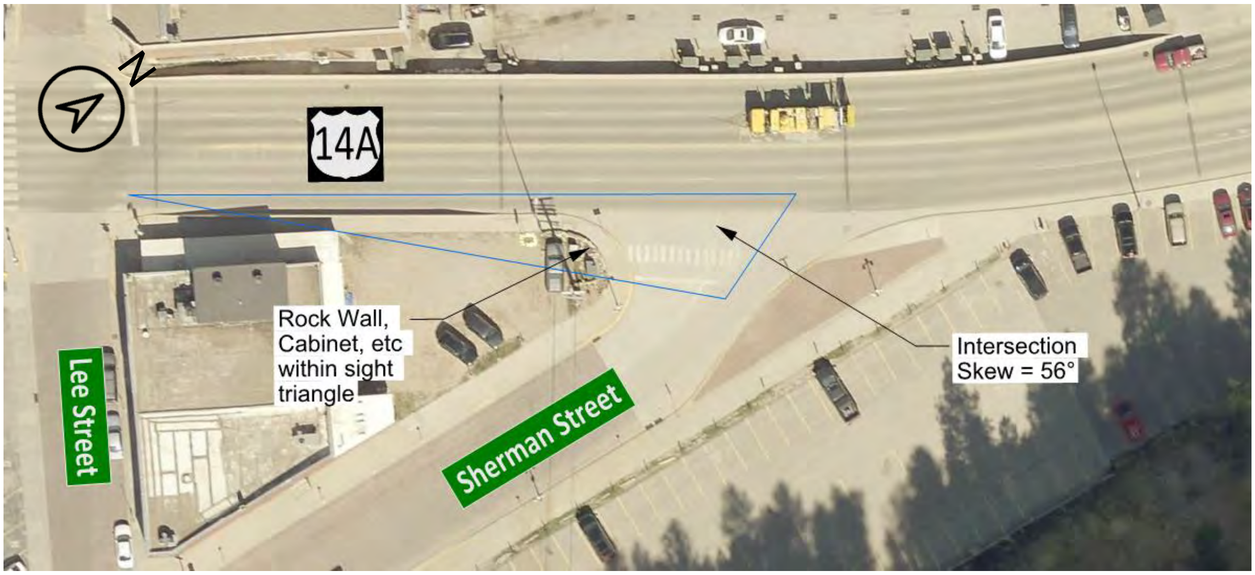


Figure 16. Intersection Geometrics at US14A and Sherman Street

US14A & Wall Street

The intersection of Wall Street and US14A is located within the 25 mph speed limit zone and is unsignalized with stop control from the Parking Area across from Wall Street. The west leg of Wall Street is a westbound one way street so the eastbound sight triangle from that leg is not applicable. The sight triangle to the north is obstructed by parking within the northeast quadrant of the intersection. If a vehicle travels forward into the crosswalk and before the lane of the conflicting traveled way, a vehicle has adequate sight distance to complete the maneuver. As described in the *Crash History Review Memo*, this intersection experienced eight crashes between 2015 and 2019 and is one of two study intersections with a crash rate that exceeds the study-wide averaged critical crash rate.

Figure 17. Intersection Geometrics at US14A and Wall Street

US14A & Lower Main Street

The intersection of Lower Main Street and US14A / Pioneer Way is atypical. Before US14A was built, Main Street was the thru movement with US 85 going through the downtown area. The construction of US14A required a retrofit situation with Lower Main Street, an intersection with a high amount of skew, and a slip ramp for southbound right turning traffic. The slip ramp maintains a direct inbound historic Main Street route/'gateway'. The approach angles for the eastbound left and right turns is less than optimal. However, the departure sight triangles for all turning maneuvers do not have obstructions within them. Volin Street intersects with the southbound right slip ramp and within the influence area of the intersection. The crash history at this intersection did not indicate higher than average crash rates.

Figure 18. Intersection Geometrics at US14A and Lower Main Street

2.8 Parking Facilities

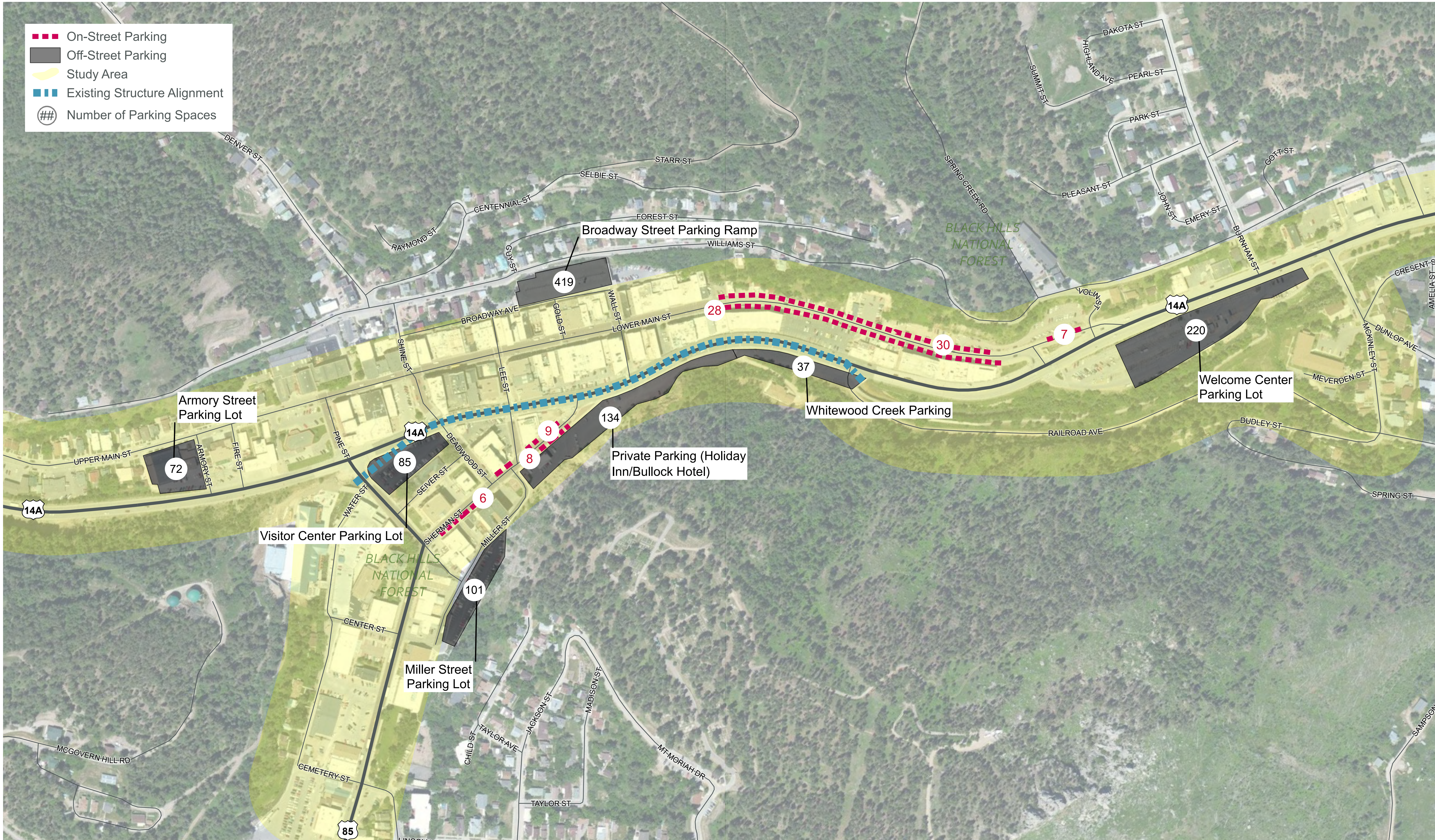
Parking, as with flat developable land, is a limited resource in Deadwood. The demand for parking near Main Street is extremely high, especially during special events that attract thousands of visitors. Parking is not a new issue in Deadwood. The City of Deadwood's 2018 Comprehensive Plan acknowledges, "Although much progress has been made [since the last comprehensive plan], many of the issues identified and discussed in the 2001 Comprehensive Plan remain relevant today, such as … greater parking needs." In a survey completed as part of the 2018 Comprehensive Plan, community respondents identified parking as the third most important type of development needed in Deadwood.

There are seven public municipal parking areas, one parking garage, and a limited number of on-street parking spaces in the vicinity of the Deadwood Box within the Study Area. The parking locations and the number of parking spaces at each of these locations are listed on Figure 19.

Parking areas that are privately managed were not included in the parking inventory. The exception to this was the Bullock Hotel / Holiday Inn parking area. This private parking area was cataloged due to the possibility of displacement during construction and/or it may be subject to permanent relocation after construction of the Deadwood Box replacement.

The parking areas have been retrofitted to fit as many parking spaces as they can between the steep cuts in the hillsides and the roadways. The majority of the parking areas are on the east side of US14A, while most of the attractions of Deadwood's historic Main Street area are on the west side of US14A. The location of these parking areas create a source of conflict between vehicles and pedestrians. Pedestrians need to cross US14A in order to get between the parking areas and the historic Main Street area.

This study will review the temporary and permanent impacts to these parking areas and on-street parking. The build concepts proposed as part of this study will be reviewed to determine the permanent impacts to the number of spaces and the continuity of the parking area and the historic Main Street area (reduction in the number of conflicts between pedestrian and vehicles). The constructability and maintenance of traffic (MOT) options will review the temporary impacts to parking.



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PARKING INVENTORY
FIGURE 19

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2.9 Multimodal Facilities

Transit, bicycle, and pedestrian facilities of Deadwood are an integral part of navigating the City due to the historical setting, recreational opportunities in the area, and proximity of parking areas to the CBD.

PEDESTRIAN AND BICYCLE FACILITIES

Pedestrian facilities through town include curbside sidewalks of varying widths, as shown in Figure 24. There are cross walks at signalized intersections and unsignalized intersections with pedestrian-actuated rapid flashing beacons at popular crossing locations. There are two main unsignalized crosswalks across US14A including one at Wall Street, as shown in Figure 20, and one at Lee Street. The City has received several complaints about these crosswalks over the years. The 2008 Deadwood Pedestrian Circulation and Enhancement Study cited that pedestrians were unlikely to use the buttons that actuate the rapid flashing beacons. In addition, the distance of the crosswalk, the speed at which traffic was traveling on US14A and the volume of traffic were intimidating to pedestrians that need to cross. The demographics of pedestrians is widely varied from families to older generations and proposed designs should accommodate a variety of walking speeds.

During special events when Main Street is closed, the intersection of US14A and Wall Street becomes an all-way stop due to the high pedestrian volumes. This often causes traffic to back-up into the nearby signalized intersections of Deadwood Street and Lower Main Street.

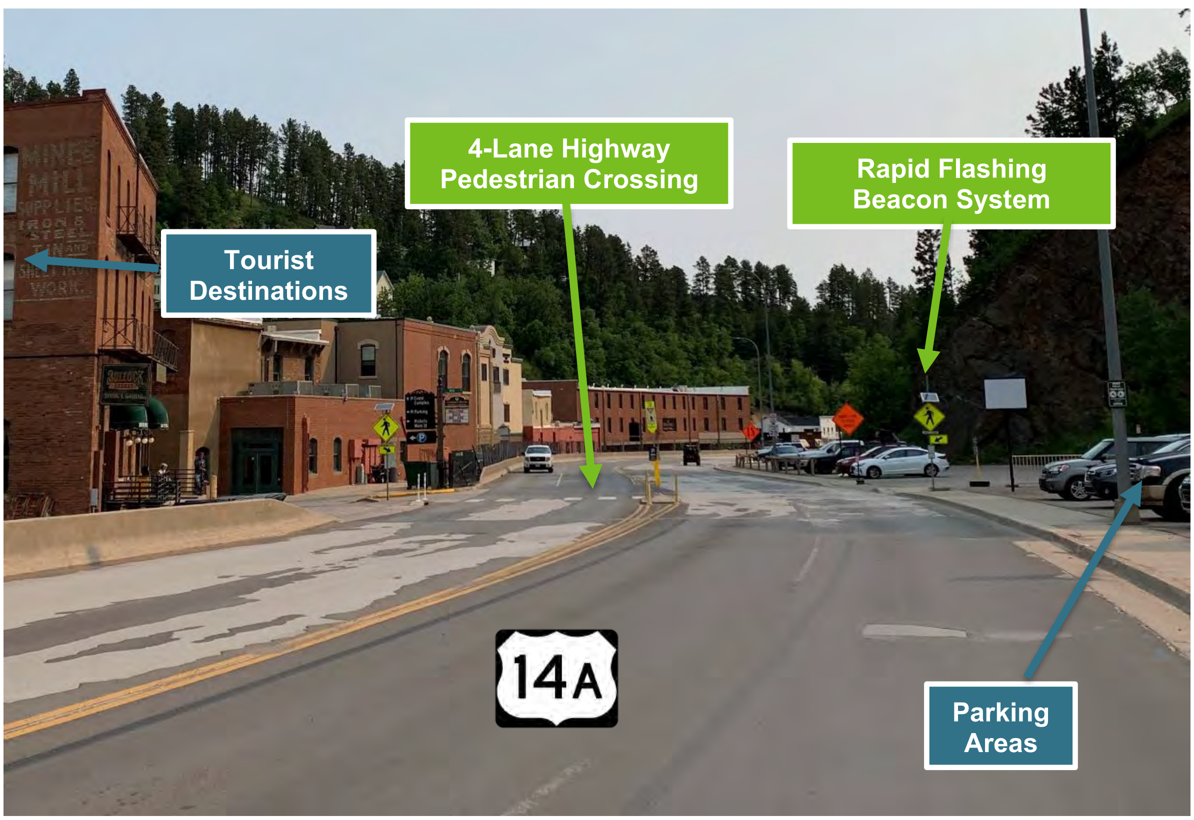


Figure 20. Crosswalk with Rapid Flashing Beacon across US14A at Wall Street

The multi-use paths and trails are shown in Figure 24 along with plans for future expansions of the trail systems. Currently, the trails are not connected with shared-use facilities that are wide enough to accommodate both pedestrian and bicycle traffic. Sidewalks 6 feet or less along both sides of Sherman Street and the east side of US14A serve as the network connections between the recreational trails. The sidewalks along Sherman Street are currently striped and signed as bicycle routes, even though they do not meet width requirements, and are heavily utilized by bicyclists making the connection between the Mickelson Trail and Whitewood Creek Trail. The 6 foot sidewalk along the east side of US14A has signage for bicyclists to dismount due to the narrow sidewalk, light poles, and frequent pedestrian usage.

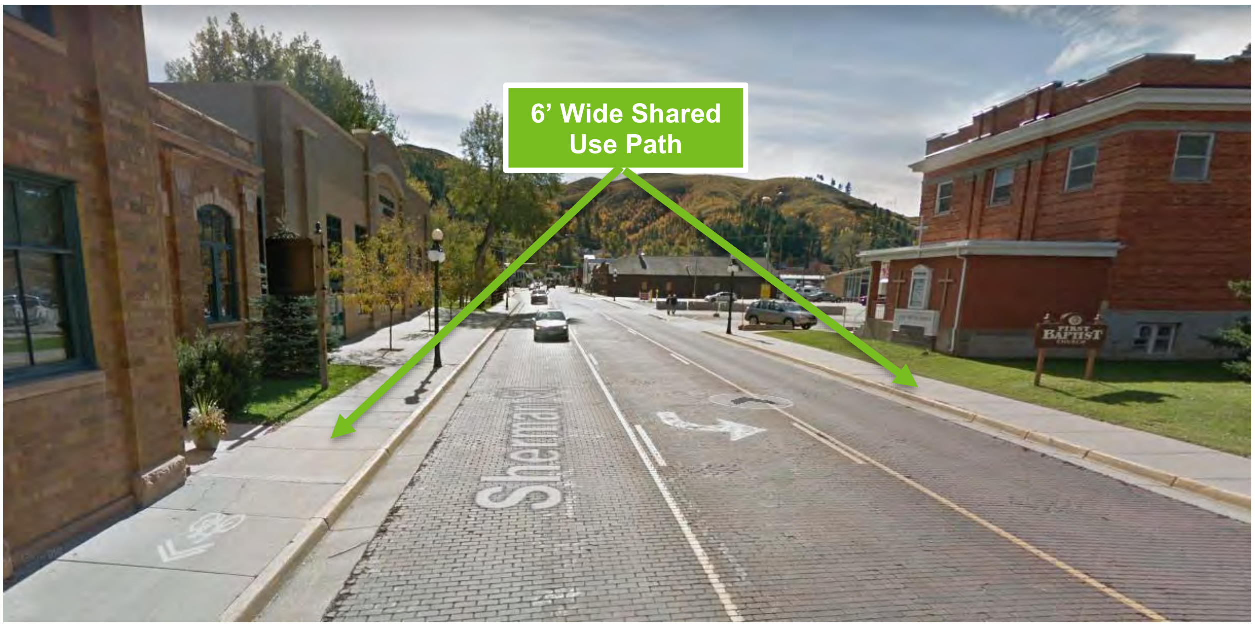


Figure 21. Shared Use Path Designation on Sherman Street’s Sidewalks (Facing South)

Figure 22. Shared Use Path Designation on US14A East Sidewalk (Facing North)

More information on the trail systems in Deadwood are as follows.

- The Mickelson Trail is a popular shared use recreational path that is over 109 miles long and spans the majority of the length of the Black Hills. The trail begins in Deadwood, ends in Edgemont, and has a total of 15 trailheads. The Mickelson Trail is accessible to bicyclists, hikers, and horseback riders. It is popular with bicyclists due to its gradual grades from its former years as a railroad.
- The Whitewood Creek Trail begins at Railroad Avenue and currently ends at the Days of 76 rodeo grounds. The City of Deadwood plans to extend this trail another mile to the east in the near future. The ultimate plan is to connect the Mickelson Trail to the Whitewood Creek Trail and continue to extend these trails to the City of Sturgis and/or Whitewood.
- The Homestake Mine Trail is an out and back hiking trail that is approximately 3.5 miles long. The trail begins along the Michelson Trail and connects Deadwood and Lead.

The current intersection of Main Street and Deadwood Street / Shine Street does not include pedestrian signal heads with countdown timers. Recent improvements to this intersection line up the previously offset streets of Deadwood Street and Shine Street. Although not a main study intersection, the City may want to have this signal reviewed for meeting warrants. Based on conversations with the City, there have been several close calls between pedestrians and vehicles. Although, zero pedestrian-vehicle crashes were reported to the state in the past 5-years. Pedestrians may tend to ignore the signal indications due to the absence of pedestrian signal heads and the lack of traffic on Shine Street. Vehicles heading eastbound on Shine Street see the green indication and may assume it is safe to proceed. Inadequate sight distance due to building corners block the view to see some of the pedestrian movements.

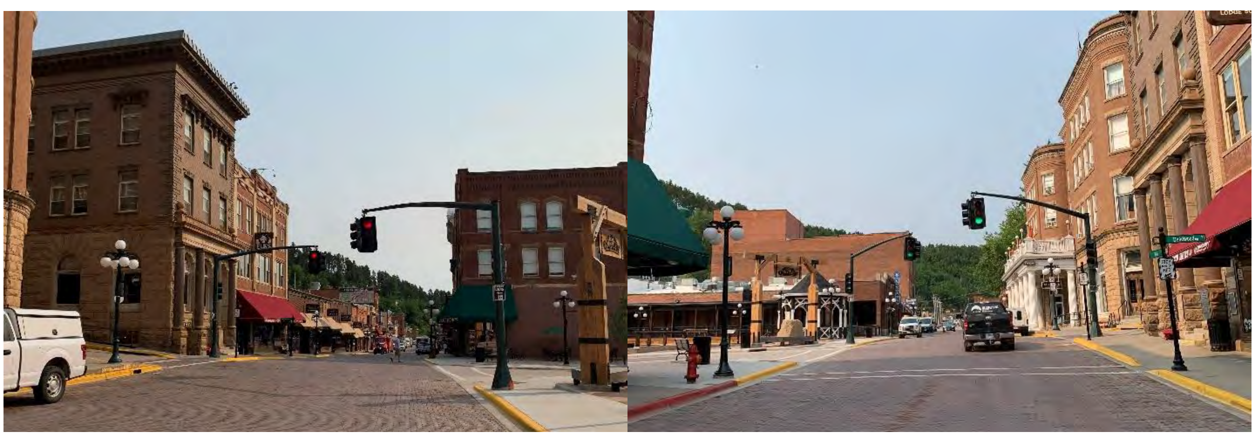


Figure 23. Signalized Intersection at Main Street and Deadwood Street/Shine Street Looking North (Left Photograph), Looking South (Right Photograph)

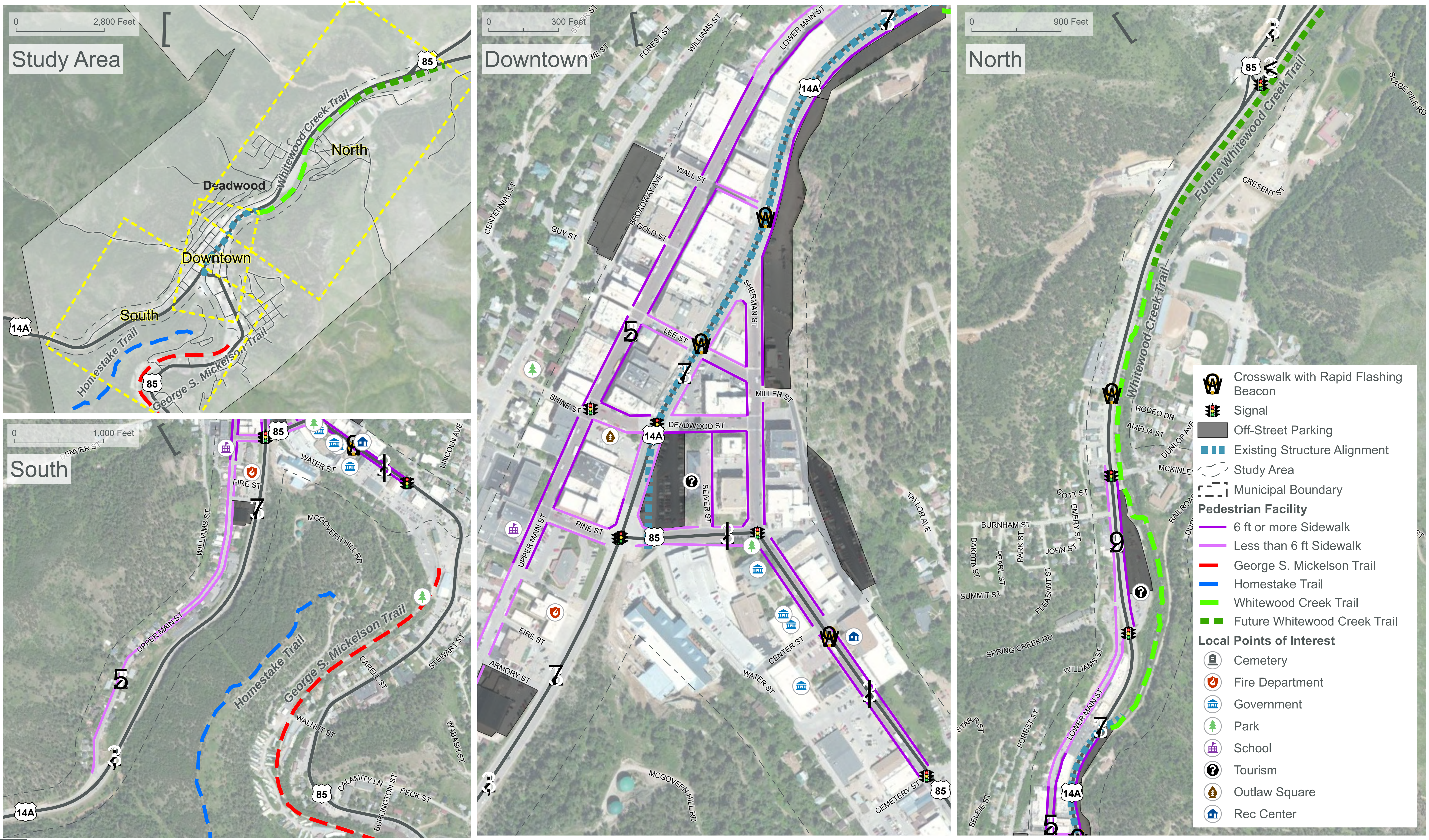
PEDESTRIAN ENHANCEMENT AND CIRCULATION STUDY SUGGESTED SOLUTION

The 2008 Pedestrian Enhancement and Circulation Study proposed a solution that could alleviate the pedestrian-vehicle conflicts by moving the roadway to the east along the hillside and the parking to the west along the backside of the historic buildings. These solutions can be found in Figure 25. Although, the north solution shown may no longer be feasible due to the new Welcome Center building footprint.

TRANSIT SYSTEM

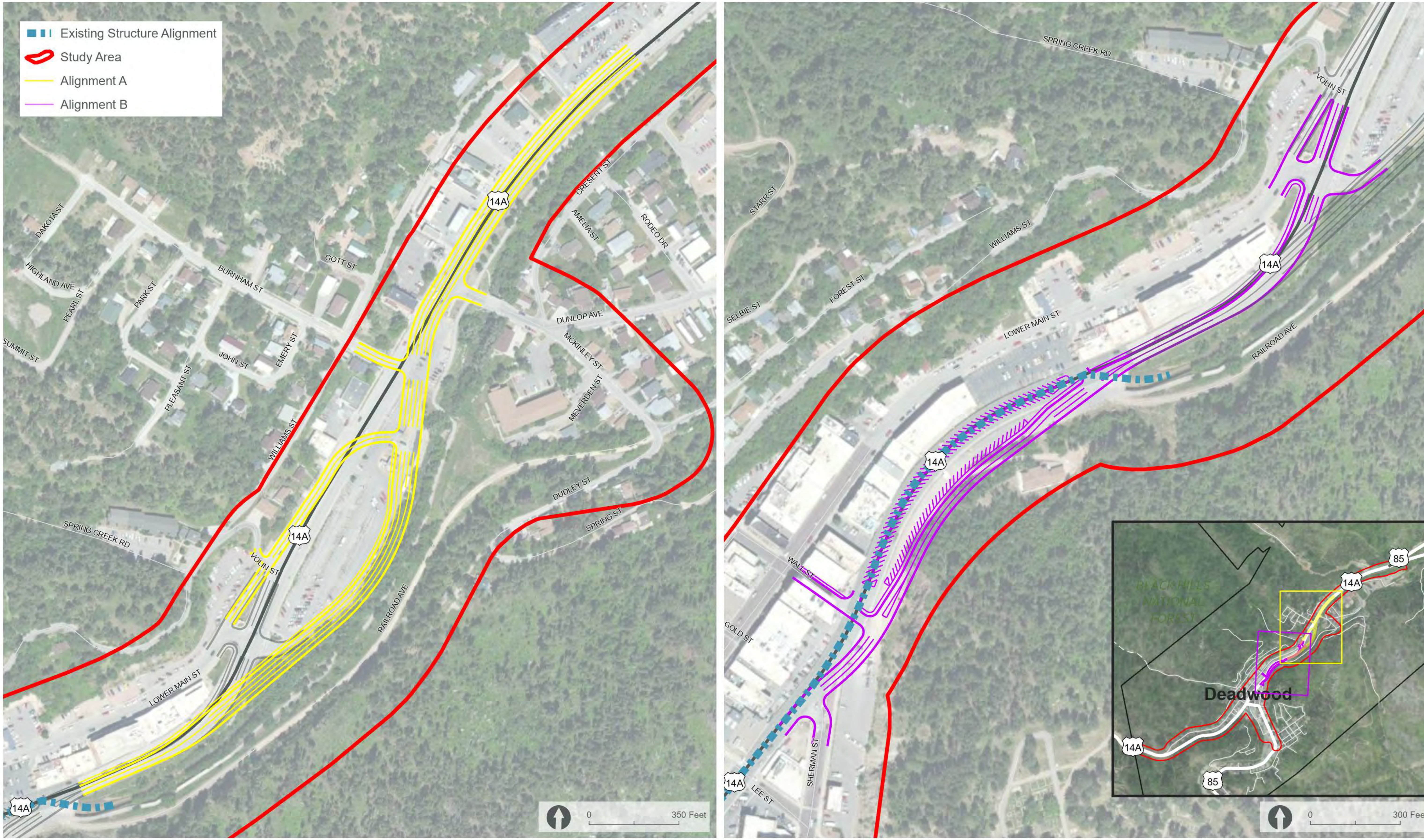
The City of Deadwood has a Trolley System with stops at all hotels, motels, and other key points throughout Deadwood. The trolley stops are shown on Figure 26 in relation to the parking areas and major destinations around town. According to the Deadwood Pedestrian Circulation Study, all trolley stops are within a 3-minute walk of the parking areas. The trolley operates year round, has a total of 5 trolleys, and 34 stops. Summer weekday operation hours are from 8 am to Midnight, and Summer weekend hours are from 8 am to 3 am. The fare is $1.00 per ride, $5.00 for an all-day pass, and free for residents over the age of 60. The trolley averages 250,000 passengers yearly.

The City of Deadwood also has an application for smartphones and an interactive GIS website dedicated to tracking the location of the trolleys. The URL of the Trolley Tracker can be found here: https://bit.ly/2GwQjaN.



MULTI-MODAL (PEDESTRIAN & BICYCLE)

FIGURE 24



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PEDESTRIAN ENHANCEMENT AND CIRCULATION STUDY POTENTIAL SOLUTIONS

FIGURE 25

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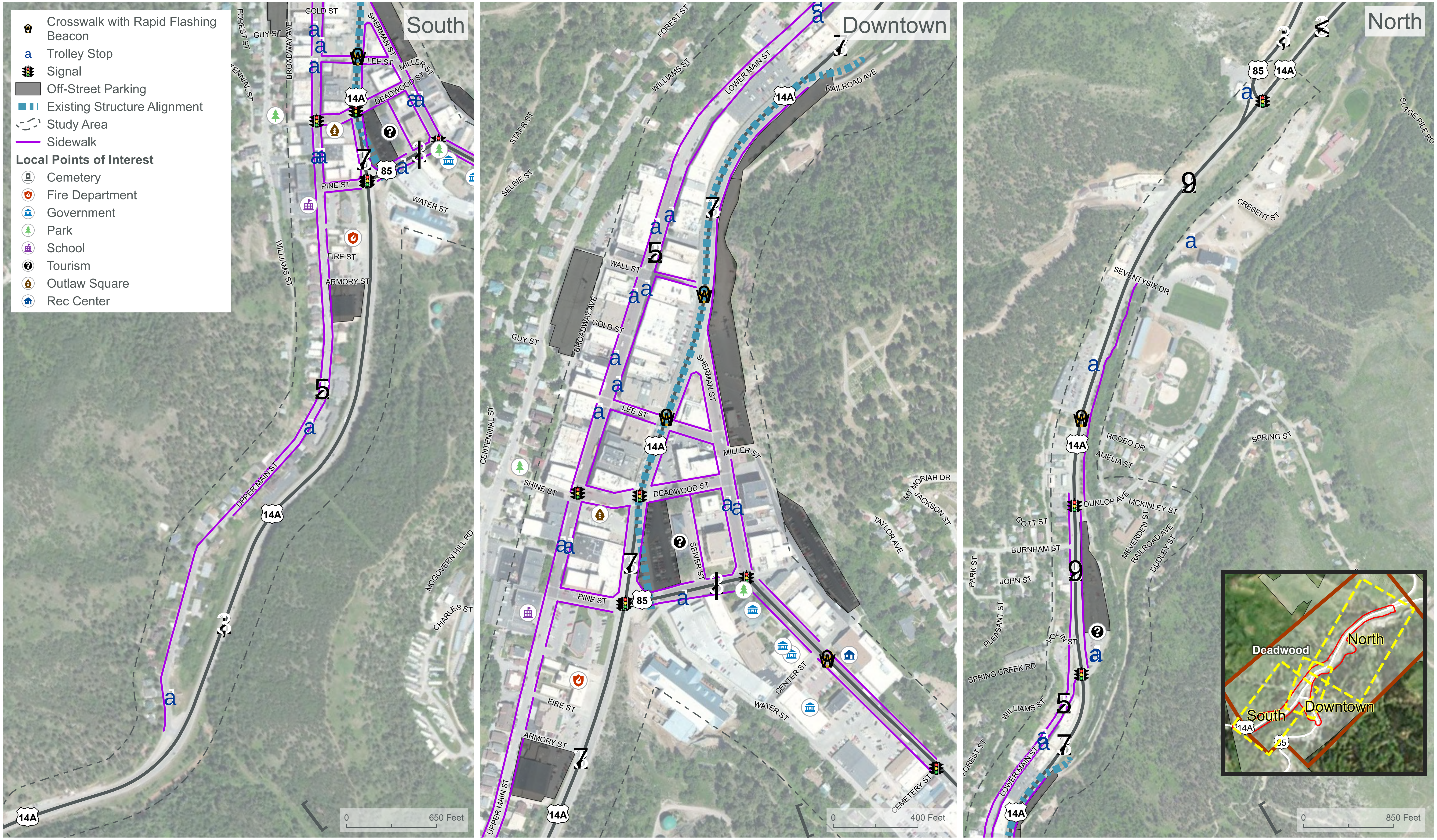

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MULTI-MODAL (TRANSIT)
FIGURE 26

DEADWOOD BOX CULVERT

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3.0 Preliminary Environmental Data

3.1 Current Environmental Data

As presented in Figure 27, known environmental constraints exist within the study area. Several sources were evaluated to determine existing environmental data within the study area including:

- SD Department of Environmental and Natural Resource (SDDENR) known regulated material releases and above and underground storage tanks (SDDENR, 2020)[8],
- SD Game Fish and Parks (SDGFP) Land and Water Conservation Fund (LWCF) properties (SDGFP, 2020)[9],
- historical property data collected for the SDDOT Major Bridge Investment Study (FHU and Benesch, 2016)[10],
- Federal Emergency Management Agency (FEMA) floodplain mapping (FEMA, 2020)[11],
- National Hydrography Dataset (NHD) (U.S. Geological Survey, 2020)[12] and National Wetland Inventory (NWI) (U.S. Fish and Wildlife Service, 2020)[13] wetland datasets,
- U.S. Fish and Wildlife Service (USFWS) Information for Planning and Consultation (IPaC) official species list for Lawrence County, South Dakota (U.S. Fish and Wildlife Service, 2020)[14], and
- aerial photography.

REGULATED MATERIALS

Several known releases of regulated materials, as well as the presence of underground storage tanks, are known with the study area. Existing data indicates that sites include former gas stations, a kerosene plant, the Historic Homestake Mine Slime Plant, and a former rail yard. A

[8] SDDENR. (2020). *Map Server Website*. Retrieved from https://arcgis.sd.gov/arcgis/rest/services/DENR/NR42_SpillReports_Public/MapServer ; https://arcgis.sd.gov/arcgis/rest/services/DENR/NR40_TankFacilities_Public/MapServer; https://apps.sd.gov/NR42InteractiveMap.

[9] SDGFP. (2020, July 8). Email from SDGFP to SDDOT.

[10] FHU and Benesch. (2016). Report for the South Dakota Department of Transportation Major Bridge Investment Study.

[11] FEMA. (2020). FEMA Flood Mapping. *National Flood Hazard Layer*. Retrieved from https://hazards.fema.gov/gis/nfhl/rest/services/public/NFHL/MapServer/

[12] U.S. Geological Survey. (2020). *https://www.usgs.gov/core-science-systems/ngp/national-hydrography/access-national-hydrography-products*.

[13] U.S. Fish and Wildlife Service. (2020). *USFWS Wetlands Mapper*. Retrieved from https://www.fws.gov/wetlands/arcgis/rest/services/Wetlands/MapServer.

[14] U.S. Fish and Wildlife Service. (2020). *USFWS Information for Planning and Consultation*. Retrieved from https://ecos.fws.gov/ipac.

site reconnaissance of known sites and search for undocumented sites may further indicate potential risk in encountering hazardous materials during construction.

SECTION 4(F) AND 6(F) PROPERTIES

Section 4(f) applies to projects undertaken by U.S. DOT, state DOT, and local transportation projects with federal funding, and requires consideration of park, recreation, refuges and historical sites during transportation project development. Section 4(f) requires FHWA to determine that there are no feasible and prudent alternatives that avoid a 4(f) property before approving a project that uses that property, unless FHWA makes a finding that the project has a de minimis impact on the Section 4(f) property.

Section 6(f) of the LWCF prohibits the conversion of property acquired or developed with these grants uses other than public outdoor recreation without the approval of the Department of the Interior's (DOI) National Park Service (NPS). In South Dakota, DOI has delegated most review, consultation and assessment of Section 6(f) impacts and conversions to the SDGFP. When acquisition or conversion of a 6(f) property is necessary for a project, approval from DOI is required to assure that replacement lands of at least equal fair market value and of reasonably equivalent usefulness and location are provided as a condition of such conversions.

No refuges are documented in the area. Current mapping indicates that there are several parks or recreation areas near or within the study area. These include:

- Powerhouse Park
- Gordon Park
- Methodist Park
- Whitewood Creek Trail
- Keene Park

Additionally, based on information gathered from the SDGFP, Gordon Park and the Rodeo Grounds were improved with LWCF moneys and are considered Section 6(f) properties. See Figure 27 for locations of these areas.

HISTORICAL PROPERTIES

Section 106 of the National Historic Preservation Act requires federally funded projects to identify cultural resources and evaluate impacts resulting from proposed projects, and may require the SDDOT to consult with the South Dakota State Historic Preservation Office (SHPO). Cultural resource data was gathered as part of the SDDOT Major Bridge Study and has been reviewed for this memo. Based on this data, several historic structures exist within and near the study area; and the preliminary data indicates that many of these structures are eligible for listing on the National Register of Historic Places (NRHP). See Figure 27 for locations of these structures and National Historic Landmark Boundary. NRHP-listed and eligible structures and historic districts are protected both under Section 106, and Section 4(f).

The City of Deadwood is also a designated Historical Landmark and preserving, restoring, or enhancing the historical characteristics of the City is necessary to maintain that designation.

Additional data will be gathered through a record search with the SD Archaeological Research Center (SDARC) and the City of Deadwood Historic Preservation Commission.

FLOODPLAIN

A floodplain is defined by the Federal Emergency Management Agency (FEMA) as the area adjacent to a watercourse, including the floodway, inundated by a particular flood event. FEMA floodplain and floodways exist within the study area. See Figure 27 for locations of the floodways and 100-year floodplain in the study area.

WETLANDS AND WATERWAYS

Impacts to wetlands and other waters of the U.S. may be regulated by the US Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act. Other waters of the U.S. include rivers, streams, intermittent streams, lakes, ponds, and impoundments. Several ephemeral to perennial streams exist within the study area. Additionally, three NWI wetlands are designated within the study area. See Figure 27 for locations of these areas. A aquatic resource delineation is in progress and will identify presence or absence of wetlands and other waters within the study area.

THREATENED AND ENDANGERED SPECIES

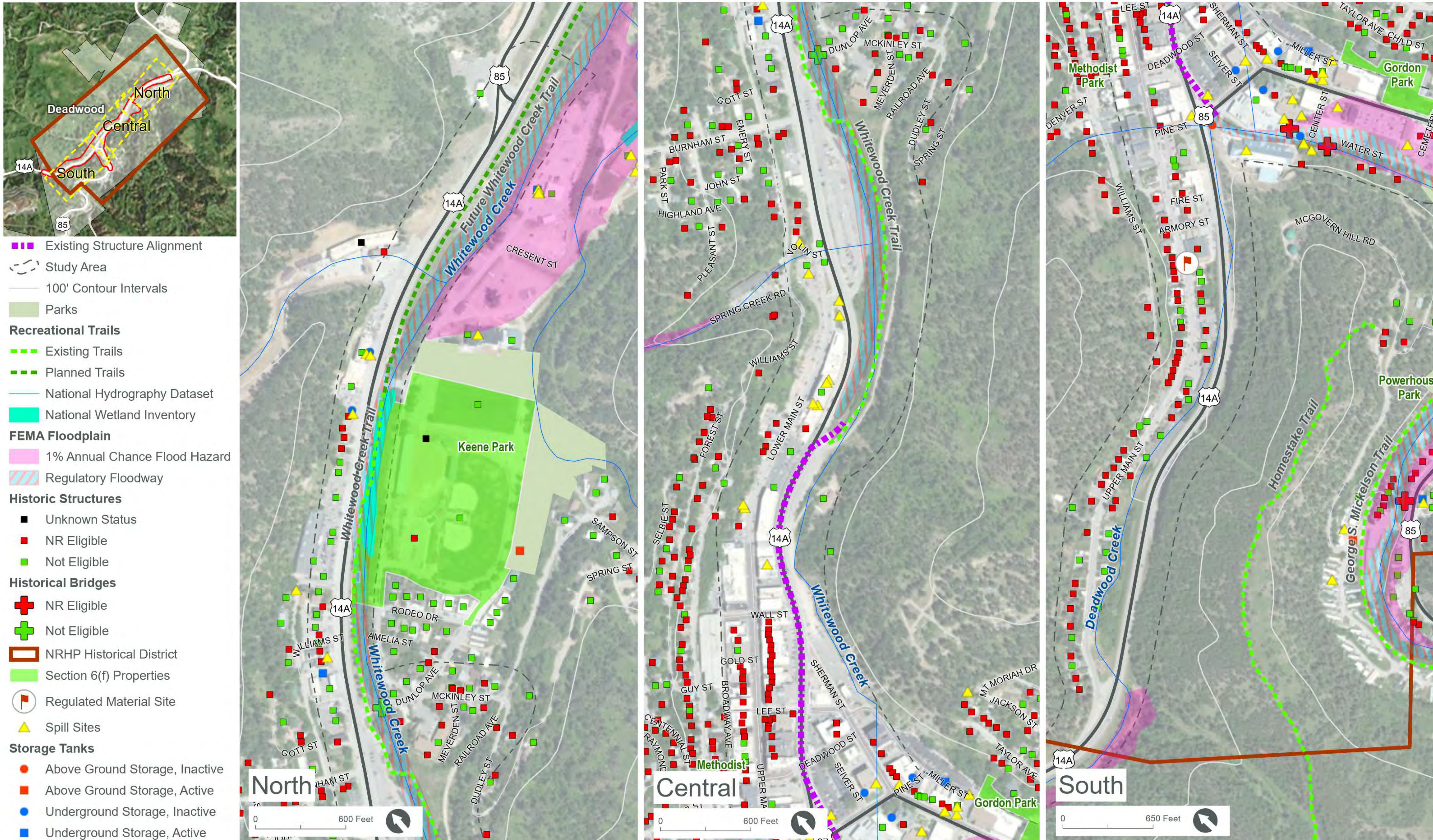
An official species list was requested from the USFWS IPaC online database. Based on this information, three species may be found within Lawrence County:

- Northern Long eared bat (*Myotis septentrionalis*)
- Red Knot (*Calidris canutus rufa*)
- Whooping Crane (*Grus americana*)

No designated critical habitat is found within the study area.

3.2 Additional Data Collection

Field studies, record searches, and agency coordination are currently being conducted to collect information for the resources mentioned in the above sections. The existing data, along with new data gathered for the Project will be used to guide the environmental study.



ENVIRONMENTAL CONSTRAINTS

FIGURE 27

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4.0 Existing Levels of Service

An existing conditions analysis was conducted using Synchro 10 and HCS7 software to evaluate intersection and segment operations, respectively. Based on this analysis, it was determined that all study intersections and segments operate at acceptable levels today; however, the intersection of US85 / Pine Street & Sherman Street and US14A & US85/Pine Street operates at LOS C in future conditions and therefore should be monitored as detour routes and alternatives are developed to avoid operations that deteriorate below the SDDOT threshold. All study roadway segments have available capacity to accommodate detour traffic and/or potential changes to traffic circulation.

5.0 Summary of Crash History Review

A total of 118 crashes were reported along corridors within the study area between the years of 2015 and 2019. Of those 118 crashes, 61 were identified as intersection crashes and 57 were identified as segment crashes. Refer to the *Crash History Review Memo* for the further details.

5.1 Intersection Crash Review

There were a total of 61 intersection crashes within the study area during the five-year period of 2015 to 2019. Figure 28 provides a summary of intersection crashes by crash type.

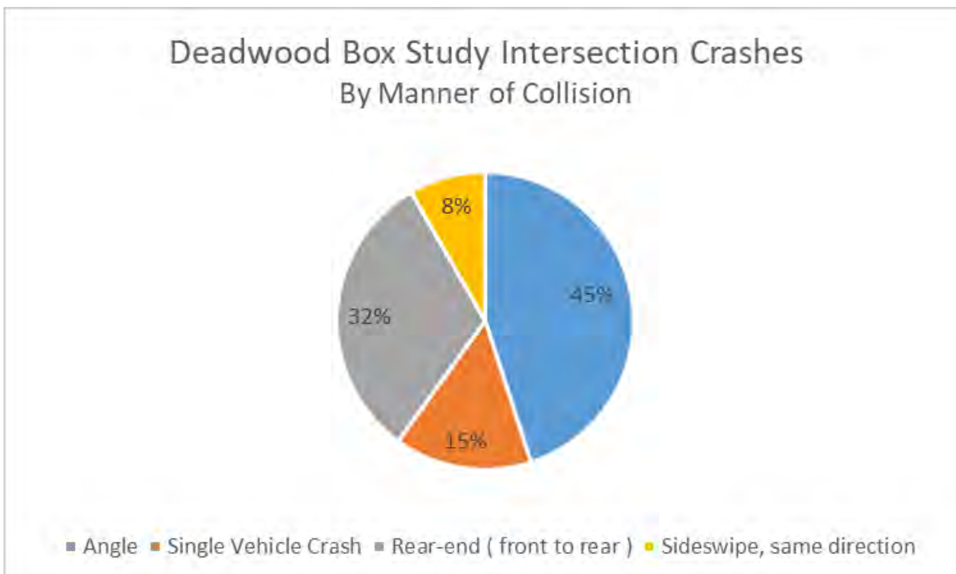

Figure 28. Deadwood Box Study Intersection Crashes by Manner of Collision (2015 – 2019)

Angle collisions were the most prevalent type of crash reported, making up 45% of all intersection crashes. The intersection that experienced the highest number of angle crashes was Intersection 5 (US14A & Deadwood St), totaling five angle crashes. Intersection 7 (US 14A & Sherman St) experienced the highest number of rear-end collisions, with 6 (32%) crashes taking place there of the 19 total intersection rear-end crashes. There were 4 (44%) single-vehicle crashes that took place at Intersection 14 (US 14A & US85), out of the total 9 single-vehicle crashes reported at intersections.

A summary of the intersection crash review findings is provided in Table 1. For intersections where crash rates exceed the critical crash rate, the cell and text is highlighted in red. These two intersections include:

- Intersection 7 (US 14A & Sherman St)
- Intersection 8 (US 14A & Wall St)

EPDO weighted rates are provided and ranked to identify intersections with the highest weighted crash rates based on severity. These include:

- Intersection 5 (US 14A & Deadwood St)
- Intersection 8 (US 14A & Wall St)
- Intersection 13 (US14A & Dunlop Ave)

Table 1. Study Intersection Crash Rates

Intersection No.	Intersection	Control Type	Total # of Crashes	Intersection Crash Rate (Crashes/MEV)	Study-Wide Averaged Critical Crash Rate (Crashes/MEV)	Intersection EPDO Weighted Rate (PDO Crashes/MEV)	Study-Wide Averaged EPDO Weighted Rate (PDO Crashes/MEV)
1/2	US14A & Upper Main St	TWSC	2	0.15	0.41	0.31	0.31
3	US14A & Armory St	TWSC	2	0.19	0.43	0.37	0.31
4	US14A & US85/Pine St	Signal	6	0.34	0.57	0.46	0.50
5	US14A & Deadwood St	Signal	6	0.38	0.59	0.76	0.50
6	US14A & Lee St	TWSC	3	0.19	0.38	0.32	0.31
7	US14A & Sherman St	TWSC	6	0.38	0.38	0.64	0.31
8	US14A & Wall St	TWSC	8	0.51	0.38	0.89	0.31
9	US14A & Railroad Ave	TWSC	-	-	0.36	-	0.31
10/11	US14A & Lower Main St	Signal	8	0.38	0.55	0.66	0.50
12	US14A & Burnham Ave	TWSC	3	0.16	0.36	0.27	0.31
13	US14A & Dunlap Ave	Signal	7	0.38	0.56	0.81	0.50
14	US14A & US85	Signal	6	0.32	0.56	0.54	0.50
15	US85/Sherman St & Cemetery St/Water St	Signal	1	0.11	0.69	0.11	0.50
16	US85/Pine St & Sherman St	Signal	-	-	0.66	-	0.50
17	Upper Main St & Pine St	TWSC	-	-	0.61	-	0.31
18	Railroad Ave & Dunlap Ave	TWSC	-	-	1.45	-	0.31
19	Upper Main St & Deadwood St & Shine St	Signal	3	0.66	0.87	0.66	0.50

Only five (8%) of intersection crashes occurred during dark – lighted roadway conditions. Fifty-five (90%) occurred during daylight. Each of the five nighttime crashes was experienced at a different intersection, so nighttime visibility is not identified as a safety concern based on the data.

Eleven (18%) of the 61 total intersection crashes were attributed to winter conditions. The highest concentration of these winter weather-related crashes occurred at Intersection 14 (US14A & US85), totaling three crashes.

The intersections with the highest crash rates (Intersection 5, 7, 8, 10/11, and 13) are discussed in further detail within the *Crash History Review Memo*.

5.2 Roadway Segment Crash Review

There were a total of 57 reported segment crashes in the study area over the five-year period. A breakdown of each intersection crash history by manner of collision is provided in Figure 29.

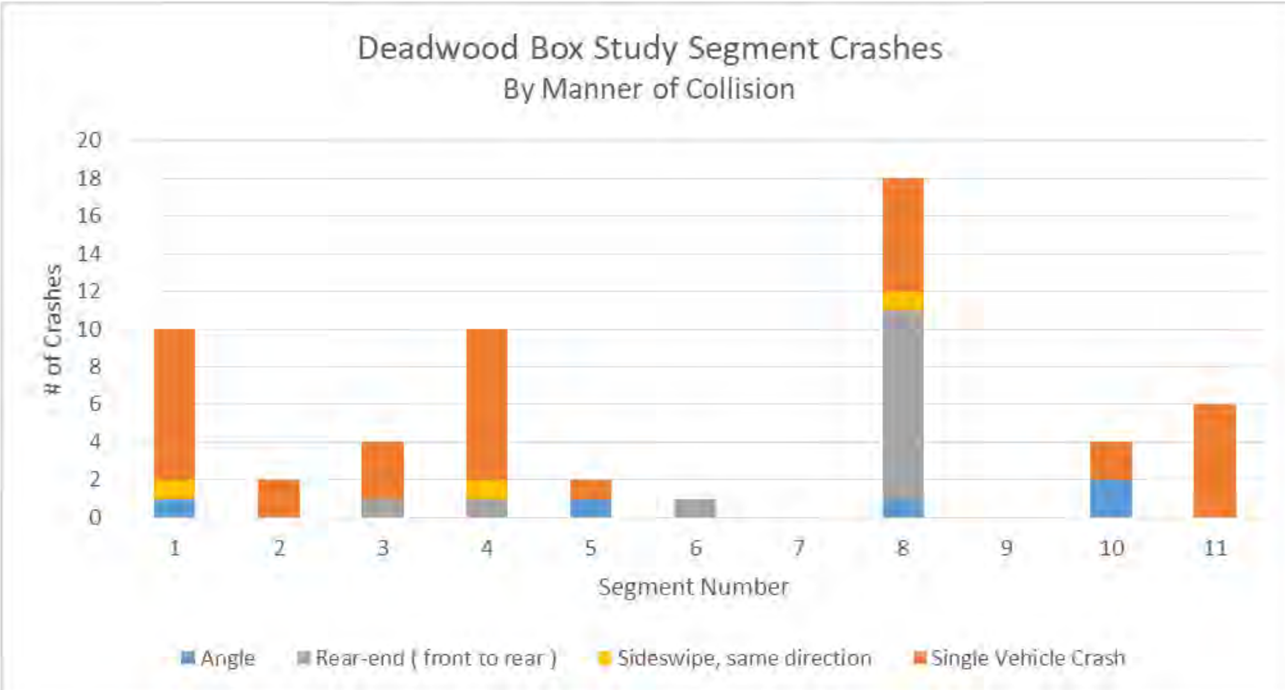

Figure 29. Deadwood Box Study Segment Crashes by Manner of Collision (2015 – 2019)

Segment 8 (US14A between Dunlop Avenue and US 85) experienced the most crashes at 18 total crashes. Ten (56%) of those 18 crashes were rear-end collisions, the most of any other segment. Segment 8 also experienced the most severe crash, an incapacitating crash that resulted in a single vehicle running off the road to hit a fixed object.

There were five reported wild animal collisions unique to the segment crashes. Of the five reported wild animal collisions, three took place on Segment 4 (US14A between Upper Main St and Pine St) and two took place along Segment 8.

Each segment was evaluated for crashes based on lighting conditions. The majority of segment crashes occurred during daylight conditions. Segment 1 (Upper Main St between US 14A (south) and Pine St) was the only segment where five (50%) of its 10 total crashes occurred during nighttime conditions.

Similar to intersection crashes, crash rates, critical crash rates and weighted EPDO crash rates were calculated for the study area segments. Segment crash rates are measured in million vehicle miles traveled (MVMT). These findings are provided in Table 2.

Table 2. Study Segment Crash Rates

Segment No.	Mainline	From	To	Length (miles)	ADT	Total # of Crashes	Segment Crash Rate (Crashes/MVMT)	Study-Wide Averaged Critical Crash Rate (Crashes/MVMT)	Segment EPDO Weighted Rate (PDO Crashes/MVMT)	Statewide EPDO Weighted Rate (PDO Crashes/MVMT)
S-1	Main St	Upper Main St	Pine St	0.65	2,500	10	3.38	6.90	6.08	1.71
S-2	Main St	Pine St	Wall St	0.21	2,500	2	2.06	8.80	6.19	1.71
S-3	Main St	Wall St	Lower Main St	0.37	2,500	4	2.40	7.72	2.40	1.71
S-4	US 14A	Upper Main St	Pine St	0.67	5,900	10	1.40	1.62	2.51	1.46
S-5	US 14A	Pine St	Sherman St	0.17	8,600	2	0.76	2.13	2.28	1.46
S-6	US 14A	Sherman St	Lower Main St	0.34	10,400	1	0.15	1.66	0.46	1.46
S-7	US 14A	Lower Main St	Dunlop Ave	0.22	10,200	-	-	1.87	-	1.46
S-8	US 14A	Dunlop Ave	US 85	0.59	10,200	18	1.65	1.48	3.66	1.46
S-9	US 85/Pine St	Main St	Sherman St	0.13	4,700	-	-	2.95	-	1.46
S-10	US 85/Sherman	Cemetery St	Pine St	0.17	4,700	4	2.70	2.60	4.05	1.46
S-11	Sherman St	Pine St	US 14A	0.15	2,000	6	10.84	10.35	10.84	1.71

Three segments were identified as having a crash rate exceeding the critical crash rate, these include:

- Segment S-8 (US 14A between Dunlop Ave and US 85)
- Segment S-10 (US 85/Sherman St from Cemetery St to Pine St)
- Segment S-11 (Sherman St from US85/Pine St to US 14A)

Segment S-11 was also identified to have the highest EPDO weighted crashes rate at 10.84 crashes/MVMT, followed by Segments 1 and Segment 2 with 6.08 crashes/MVMT and 6.19 crashes/MVMT respectively. Segment 1 and Segment 2 high EPDO crash rates correlate with the high access densities along those two segments as identified earlier in this memo.

The segments with the highest crash rates (Segment 8, 10, and 11) are discussed in further detail within the *Crash History Review Memo*.

6.0 Summary of Existing Transportation Issues

6.1 Parking Needs

Parking is very limited in the City of Deadwood. There is a need for parking areas adjacent to the historical Main Street area, especially during special events. This study will review the temporary and permanent impacts to these parking areas and on-street parking. The build concepts proposed as part of this study will be reviewed to determine the permanent impacts to the number of spaces and the continuity of the parking area and the historic Main Street area. The continuity of the parking area and historic Main Street area would provide a reduction in the number of conflicts between pedestrian and vehicles. The constructability and maintenance of traffic (MOT) options will review the temporary impacts to parking.

6.2 Pedestrian and Bicycle Needs

US14A presents several challenges to providing bicycle and pedestrian connectivity in the downtown core area due to the distance of the crosswalk, the speed at which traffic was traveling on US14A, and the volume of traffic. The majority of the parking areas are on the east side of US14A, while most of the attractions of Deadwood's historic Main Street area are on the west side of US14A. The location of these parking areas create a source of conflict between vehicles and pedestrians. Pedestrians need to cross US14A in order to get between the parking areas and the historic Main Street area.

There is a need for a 10 foot wide shared use sidewalk between the Mickelson Trailhead and the Whitewood Creek Trailhead. With the future plans for expansion of the Whitewood Creek Trail, the lack of a shared use path along Sherman Street and US14A is a missing link for the potential northern expansion of the Michelson Trail system to Sturgis or Whitewood.

6.3 Access Density

High access density is prevalent throughout the main study area corridors and there may be an opportunity to consolidate accesses along US14A to the north of Lower Main Street. Only one of the signalized intersections within the study area meet the minimum SDDOT signal spacing criteria, but this is the norm for CBDs. This study will recommend retrofit techniques to improve access in consideration of desired access and mobility within the study area.

6.4 Geometric Review

The horizontal curve on US14A to the south of Gold Country Inn has a radius less than the minimum radius for the design speed of the roadway segment. There are several intersections with inadequate intersection sight distance or a high amount of skew including US14A and Deadwood Street, US14A and Lee Street, US14A and Wall Street, US14A and Sherman Street, and US14A and Lower Main Street. This horizontal curve and intersections should be reviewed during the build concept phase to determine if correcting these geometrics are feasible.

6.5 Crash History Review

Intersections and segments that demonstrate a higher than average crash rate should be considered during the build concept development.