BELGRADE to BOZEMAN corridor
FRONTAGE ROAD study

Existing and Projected Conditions

Technical Memorandum

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1.0. INTRODUCTION

This report identifies existing and projected conditions, as well as social, economic, and environmental factors for the Belgrade to Bozeman Frontage Road corridor in Gallatin County. The analyses performed include a planning-level examination of the corridor by applying technical and environmental considerations to determine known issues, constraints, and/or areas of concern.

The information contained in this report is based on existing and historic traffic data, field measurements and observations, roadway as-built plans, aerial imagery, geographic information system (GIS) data, and publically available environmental information and demographics.

1.1. STUDY CORRIDOR

The study corridor for the *Belgrade to Bozeman Frontage Road Corridor Study* consists of approximately 10 miles of roadway. The corridor includes 1.4 miles of Main Street from Jackrabbit Lane to Airway Boulevard, 5.9 miles of Primary 205 (Frontage Road) from Airway Boulevard to Springhill Road, and 2.7 miles of Primary 118 (7th Avenue North) from Springhill Road to the west bound ramps of Interstate 90 (I-90). Additionally, the East Valley Center Spur Road is included as part of the study corridor. **Figure 1** presents the location of the corridor.

The south side of the corridor from Jackrabbit Lane to the railroad bridge on P-118 is generally constrained by the Montana Rail Link railroad. The character of the area ranges from urban within the cities of Belgrade and Bozeman to rural between the two cities. Adjacent land uses include commercial, residential, agricultural, industrial, and recreational.

The study corridor is divided into multiple highway segments. Between Jackrabbit Lane and Airway Boulevard, the roadway is designated as N-205 and is classified as a principal arterial on the Non-interstate National Highway System (NHS). The highway is designated as P-205 between Airway Boulevard and Springhill Road and as P-118 between Springhill Road and I-90. These two segments are classified as minor arterials on the primary highway system. The East Valley Center Spur Road is a local roadway. **Table 1** summarizes the designations of the study corridor.

Table 1: Study Corridor Segments

MDT DEPARTMENT ROUTE ID	DESCRIPTION	BEGIN RP	END RP	HIGHWAY SYSTEM	FUNCTIONAL CLASSIFICATION
N-205	Jackrabbit Lane to Airway Boulevard	19.7	21.1	NHS	Principal Arterial
P-205	Airway Boulevard to Springhill Road	21.1	27.0	Primary	Minor Arterial
P-118	Springhill Road to I-90 Exit 306 WB ramps	4.0	1.3	Primary	Minor Arterial
L-16-2074N	East Valley Center Spur Road	N/A	N/A	Local	Local

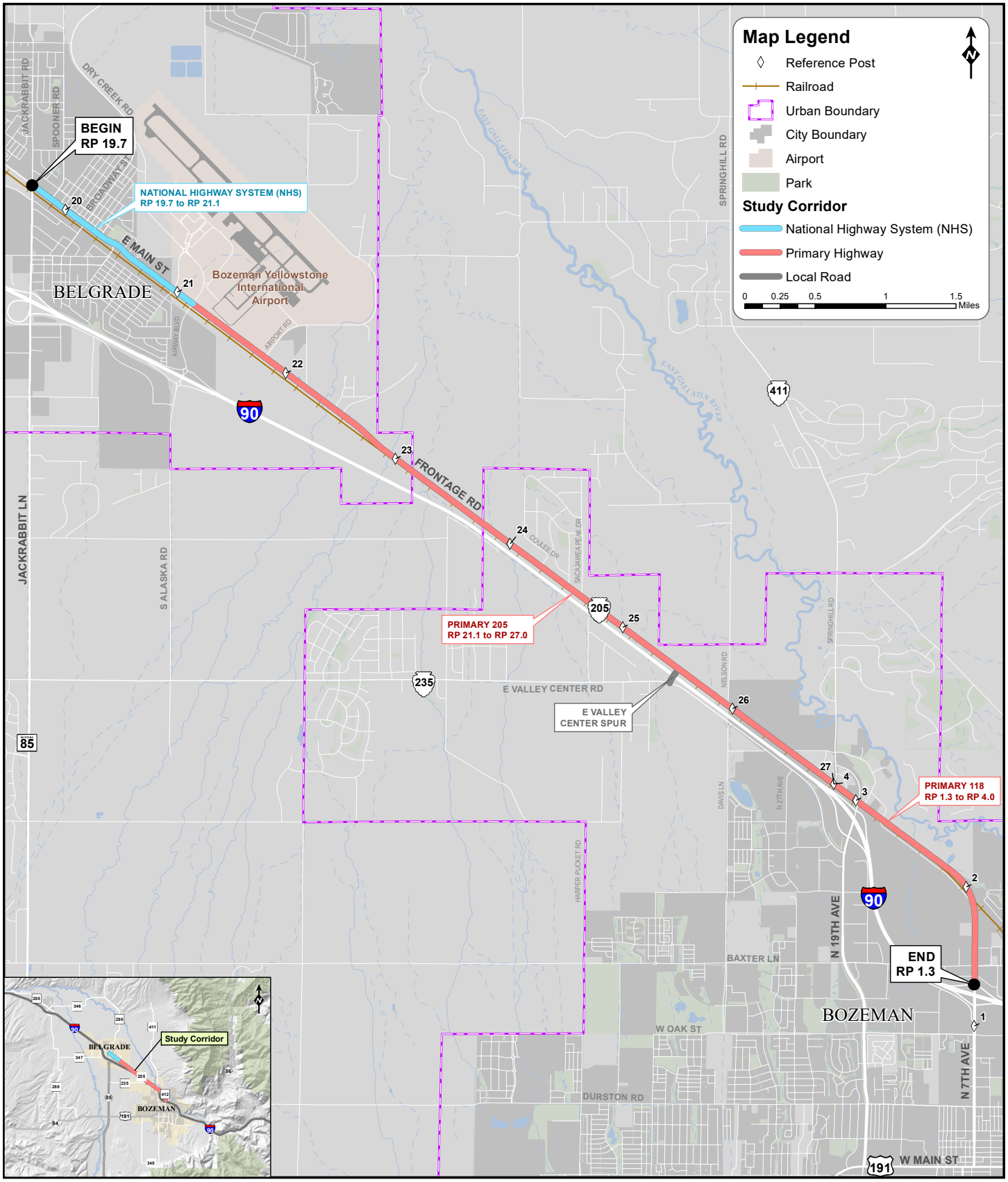

Figure 1: Study Corridor

1.2. Past, Current and Planned Projects

The roadway was originally constructed as early as 1922. Since then, numerous projects have been constructed. A search of the Montana Department of Transportation (MDT) online summary of road and bridge construction projects was reviewed to identify notable projects along the study corridor. A list of recent projects, along with the letting year and a brief description, are shown in **Table 2**. The list is not an all-inclusive list of projects; rather, it is a list of recent major projects completed along the corridor. The list does not include maintenance projects performed by MDT such as guardrail repair, pothole repair, striping, or other similar projects.

Table 2: Recent Projects along the Study Corridor

PROJECT NAME	UPN	LETTING YEAR	DESCRIPTION
2 Miles East of Belgrade	2444	1996	Curve flattening for 0.5 miles of the Frontage Road approximately 2 miles east of Belgrade.
Safety Improvement – West of Bozeman	4433	2004	Turn bays at the intersections with Nelson Road and with Valley Center Spur Road.
Main & Jackrabbit Lane – Belgrade	4471	2006	Realignment and signal installation at Main Street and Jackrabbit Lane.
Gallatin Field Road – East	6518	2009	Pavement preservation (from RP 20.9-26.8).
East Belgrade Interchange – North	5897	2013	New I-90 Interchange and associated connections.
2002 Signal – Junction S-411	5373	2002	Signal at intersection with Springhill and Frontage Road.
SF 139 – Butte Advance Signal Flasher	8120	2015	Upgrade advance warning flashers to standardize for uniformity at intersection with Springhill and Frontage Road.
Sidewalks II - Belgrade	8655	2015	CTEP Project: Sidewalk installation at the following locations: West side of Spooner Road (from Mayfair Drive north 580 feet); West side of Broadway Street (from 205 S. Broadway to Main Street); North side of Madison Avenue (from Broadway Street west 820 feet); East side of Jackrabbit Lane (between the Lee & Dads approach and Missoula Avenue); East side of Jackrabbit Lane (between 300 Jackrabbit Lane and Northern Pacific Avenue); and South side of Yellowstone Avenue (between Oregon and Montana Streets).
Valley Center / P-205 Intersection Study	8796	2015	Study Corridor / Traffic (P-205).
Bozeman Signal Upgrades	8036010	2015	Controllers and communication upgrades to promote traffic flow improvements via increased signal connectivity and synchronization. Traffic signal hardware was updated as well. Work on North 7th Avenue was from RP 1.22 to RP 1.5.
N. 7th Ave Signals (Bozeman)	8036012	2016	Signal synchronization to promote traffic flow improvements via increased signal connectivity and synchronization. Traffic signal hardware was updated with 8036010. Work on North 7th Avenue was from RP 0.126 to RP 1.212 and from RP 1.213 to RP 1.43 (overlapped the previous project in the row above).

There are two projects currently under development along the study corridor. One is to flatten slopes and provide turn lanes between RP 23.0 and RP 24.6; the other is to install traffic signals at the intersections of the East Valley Center Spur Road with the Frontage Road and with East Valley Center Road. Construction dates have not yet been identified for either project. A summary of the planned projects are shown in **Table 3**.

Table 3: Planned Projects along the Study Corridor

PROJECT NAME	UPN	LETTING YEAR	DESCRIPTION
SF 129 – Slope Flattening (Belgrade)	8031	2018	This project will completely reconstruct the roadway between RP 23.0 and RP 24.6. Wider shoulders, flatter slopes, and turn lanes will be constructed. The turn lanes will include left turn lanes at four approaches, a two-way left-turn lane and four right turn slip lanes. Shoulder rumble strips will be provided. Centerline rumble strips will be provided on the two lane section.
Valley Spur Intersection Improvements	9190	Unknown – Currently in design	Installation of traffic signals at both ends of Valley Spur Road (at the Frontage Road and East Valley Center Road intersections) just west of Bozeman. Geometric improvements to the intersections are anticipated, including a westbound right turn lane on Valley Center Road. Signal timing will be complex due to proximity of an at-grade railroad crossing. MDT is interested in an accelerated project development schedule for this project.
Griffin Drive Intersection Improvements	9312	2019	The intersection will be reconstructed to include dual westbound left-turn lanes. The northbound and southbound legs will be realigned to include left-turn lanes. Upgrades will be made to the traffic signal.

1.3. Local Planning

Local planning documents were reviewed for relevance to transportation along the study corridor. Improvement options identified as part of this study should be reviewed for continuity with existing local plans. In addition, a review for updated planning documents should take place during any project development process. The following provides a summary of relevant local planning documents.

1.3.1. Bozeman Transportation Master Plan

The *Bozeman Transportation Master Plan (TMP)*[1] was adopted by the Bozeman City Commission in 2017. The TMP serves as a guide for development of and investment in the community's transportation systems in a comprehensive manner. The TMP provides for guiding transportation infrastructure investments based on system needs and associated decision-making principles. The comprehensive plan identifies community goals and improvements to the transportation infrastructure and services within the city of Bozeman and that portion within Gallatin County that is likely to include future urban area expansion. The following is a summary of recommended improvements along the study corridor as identified in the TMP.

TSM-18: N. 7th Avenue and Griffin Drive

Modify the intersection of North 7th Avenue and Griffin Drive to add additional designated turning lanes on all approaches, and to provide revised traffic signalization.

Shared Use Path (SP-34): Frontage Road (I-90 WB on- & off-ramp to Study Area Boundary)

Shared use path contained in the *PROST Plan*; has robust public support. Locate to the north of existing Frontage Road and east of North 7th Avenue. Only includes portion of path between Bozeman (I-90) and TMP study area boundary (~5 miles in length). Approximately 4 miles remaining from TMP study area boundary to downtown Belgrade.

Bike Lane (BL-16): N. 7th Ave (Red Wing Dr to W. Oak St)
I-90 overpass was designed for bike lanes, but never had them marked or signed. This project completes the bike lanes, adds dotted lane line extensions across the I-90 ramps, and signs/marks bike lane on North 7th Avenue north of the interchange.

1.3.2. Greater Bozeman Area Long Range Transportation Plan (2007 Update)

The *Greater Bozeman Area Long Range Transportation Plan (2007 Update)*[2] is intended to offer guidance for the decision-makers in the Greater Bozeman Area by responding to existing and future transportation system concerns through a menu of large and small improvements to the transportation network. The plan provides a blueprint for guiding transportation infrastructure investments based on system needs and associated decision-making principles. The following provides a summary of recommended improvement options along the study corridor as identified in the 2007 LRTP.

Facility Recommendations

MSN-17: Frontage Road (N. 7th Avenue to Belgrade)
The Frontage Road between North 7th Avenue to Belgrade should be upgraded to a three-lane rural arterial roadway. This includes one travel lane in each direction and a two-way center turn lane where appropriate. This project is necessitated by the future development patterns in the region and will serve as a link between the Belgrade and Bozeman areas. Roadway shoulders should be included to facilitate bicycle travel. *This improvement has not been completed. A committed project will partially complete this recommendation between RP 23.0 and RP 24.6 and is referred to as the "SF 129 Slope Flattening" project. A construction date has not yet been identified.*

MSN-20: East Belgrade Interchange [Completed]
This project consists of constructing a new I-90 interchange to serve the airport and Belgrade areas. A northern interchange connection is to be made to connect with the Frontage Road. A southern connection to the interchange should be made to connect to Alaska Road. The interchange connections should be constructed to two-lane rural arterial standards complete with one travel lane in each direction. This project is necessitated by the future development in the region and the need for more adequate connection to the airport. Non-motorized facilities should be developed in association with this project as this interchange will serve important cross connectivity north and south of Interstate 90. *This improvement was completed in 2015.*

TSM-15: Nelson Road / Frontage Road
It is recommended that a left-turn lane be added to Nelson Road at the intersection with the Frontage Road as necessitated by the growing traffic demand. The intersection is a three-legged intersection with stop control on Nelson Road. The Frontage Road is a minor arterial roadway and Nelson Road is classified as a collector. A traffic signal, roundabout, or other traffic control device should be added to this intersection when warrants are met. *A traffic study is planned for this intersection to determine if signal warrants are met.*

TSM-16: Sacajawea Peak / Frontage Road
It is recommended that left-turn lanes be added to the intersection of Sacajawea Peak and Frontage Road as necessitated by the growing traffic demand. The intersection is a three-legged intersection with stop control on Sacajawea Peak. The Frontage Road is a minor arterial roadway and Sacajawea Peak is classified as a local. A traffic signal, roundabout, or other traffic control device should be added to this intersection when warrants are met. *This improvement has not been completed. A committed project will partially complete this recommendation between RP 23.0 and RP 24.6 and is referred to as the "SF 129 Slope Flattening" project. A construction date has not yet been identified.*

TSM-17: Gallatin Field / Frontage Road [Completed]
It is recommended that a traffic signal, roundabout, or other adequate traffic control device be installed at the intersection of Gallatin Field and Frontage Road when warrants are met. This is a three-legged intersection with stop control on Gallatin Field. There currently are designated left-turn lanes on each approach leg of this intersection. *This improvement was completed in 2015.*

Non-motorized Recommendations

Frontage Road (N. 7th Avenue at Flora Lane to Belgrade)
The LRTP recommended expanded shoulders on each side of the Frontage Road with a minimum width of 4-feet, in conjunction with future roadway improvements.

1.3.3. Bozeman Parks, Recreation, Open Space and Trails (PROST) Plan

The *Bozeman Parks, Recreation, Open Space and Trail (PROST) Plan*[3], while focusing primarily on Parks and the general operations of them, includes a chapter dedicated to trails and pathways. The PROST Plan represents the city of Bozeman's desire to proactively plan for these amenities and to achieve excellence in meeting both current and future needs. The Plan designates five classes of trail with multiple sub groups. These trail types address various transportation and recreation needs and range from paved paths 12-feet in width to narrow semi-separated equestrian trails.

Relevant to the study corridor, the Plan identifies a separated shared-use path running the length of the Frontage Road within the city of Bozeman's planning limits. The plan also identifies numerous trail connections to the north to residential neighborhoods, the East Gallatin River, and the Cherry River Fishing Access Site (FAS).

1.3.4. Belgrade Area Transportation Plan (June 2002)

The *Belgrade Area Transportation Plan*[4] identified a variety of improvements that were classified as "Major" and "Transportation System Management (TSM)" projects. Within the corridor, the following projects were identified:

Major Project ID-4: Airport Interchange [Completed]
Construct an Interstate 90 interchange in the area generally between Alaska Road and Love Lane. The connector road between the proposed interchange and Main Street is anticipated to pass under the railroad and intersect with Main Street at grade. This improvement would provide better intermodal access to Gallatin Field from Interstate 90 and would give Belgrade/Bozeman commuter traffic the option of accessing the Interstate without impacting old Highway 10 east of the study area, Jackrabbit Lane and a number of intersections within the Belgrade area. *This improvement was completed in 2015.*

Major Project ID-6: Reconstruct Main: Jackrabbit to Airport Access [Partially Completed]
Reconstruct this segment of Main Street in phases to a three-lane roadway complete with curb, gutter and sidewalks, dedicated left-turn bays at major intersections, and control of access to improve safety. The recommended first phase of improvements would extend generally from Broadway east to Oregon. The second phase would extend from Jackrabbit east to Broadway. The final phase would extend generally from the east end of phase one east to the Gallatin Field access road. This phasing scheme could certainly change as needed to respond to the effects of other transportation improvements, or other community needs. *This improvement has been partially completed directly east of Jackrabbit Lane to Quaw Boulevard.*

Major Project ID-10: Signalize Broadway and Main
Install a traffic signal and appropriate geometric improvements when Manual on Uniform Traffic Control Devices warrants are met. Existing buildings and high percentages of left turns indicate

elimination of on-street parking on Main Street will be necessary to provide adequate turn bays. The length of parking removal on each leg will be determined at the time of geometric design of storage lane lengths. Given the proximity of the at-grade railroad crossing on Broadway south of Main, this signal must be interconnected with the railroad signal to prevent queued vehicles being stranded on the tracks.

Major Project ID-16: Pedestrian / Bicycle Path: Belgrade to Bozeman
Build a ten-foot wide path with an all-weather surface on the south side of old Highway 10 between Belgrade and Bozeman within either the railroad or the Interstate rights-of-way. Americans with Disabilities Act guidelines for pedestrian access should be followed.

TSM Project ID-a: Connect Arizona to Main [Completed]
Construct a short length of Arizona Street from its current terminus at Northern Pacific to Main Street, with a right-angle, at-grade crossing of the railroad. Appropriate traffic control devices should be installed at the same time the connection is constructed. *This improvement has been completed.*

TSM Project ID-d: Reconstruct Oregon and Main Intersection
Reconstruct the Oregon approach from Main Street south to Northern Pacific Avenue, with provisions for separate left and right turn lanes for northbound vehicles on Oregon Street. Rollover curb and gutter should be used to define the outside limits of the travel lanes while still allowing truck access to the property at the southeast corner of the intersection.

1.3.5. North Park Properties Concept Land Use Plan Master Plan (formerly Mandeville Industrial Park)

The 275-acre North Park property, formerly known as the Mandeville Farm, is roughly divided into an 80-acre tract owned by the City of Bozeman and the remainder held by the Montana Department of Natural Resources and Conservation (DNRC). A Master Plan was completed in 2012 that identified a development plan for the property[5]. The preferred development alternative utilizes a combination of roadways, paths and rail siding locations to provide access to the site. The Master Plan proposes linking roadways to North 7th Avenue at Red Wind Drive and Flora Lane. There are three additional connections to the Frontage Road proposed in the plan. The plan also proposes an overpass at Mandeville Lane to connect to East Baxter Lane east of I-90 to provide indirect access into the site and provide a community-wide east-west access road to North 19th Avenue and a direct east-west route for the community across I-90.

1.3.6. Gallatin Field Airport 2007 Master Plan Update

The Bozeman Yellowstone International Airport (formerly Gallatin Field Airport) completed a comprehensive Master Plan Update[6] which outlines growth over the planning horizon and annual projects. This effort was completed to identify future development needs and potential timelines for implementation. The Master Plan Update noted that airfield capacity calculations indicated the need to start planning for an additional runway, expanded parking, and improved access to accommodate future growth. Growth at the airport was also included in the Bozeman TMP travel demand model. Transportation infrastructure associated with the airport and growth has been substantially improved with the completion of the East Belgrade Interchange.

1.3.7. Streamline Transit Coordination Plans

Coordination Plans are prepared every year for Streamline Transit that evaluate ridership characteristics, needs and funding. Presently, transit service is provided by Streamline between Belgrade and Bozeman via the “greenline” route. That route does not utilize the Frontage Road, but rather uses Jackrabbit Lane and Huffine Lane for transit service. There are currently no Streamline routes along the study corridor.

1.3.8. 2016 Montana Rail Grade Separation Study

MDT commissioned an update to the *2003 Montana Rail Grade Separation Study* to address changed conditions and assess highway-rail crossing needs across the state. The purpose of the *2016 Montana Rail Grade Separation Study*[7] was to use a data-driven evaluation process to identify a list of at-grade and grade-separated railroad crossings where potential feasible improvements may be considered. Between Belgrade and Bozeman, two at-grade railroad crossings were studied for improvements, at Jackrabbit Lane and Broadway, respectively. After a screening process, Jackrabbit Lane was evaluated holistically with Broadway. A recommendation for new grade separation at Jackrabbit Lane was made in the form of an underpass with the following description: *A new grade separation of Jackrabbit Lane would improve traffic mobility in the area. While the Broadway Street at-grade crossing appears unable to be closed due to local business and residential traffic access, improvements to the intersection with Main Street north of the tracks could improve safety for the Broadway Street at-grade crossing*.

2.0. TRANSPORTATION SYSTEM

The study corridor serves as a key route connecting Belgrade and Bozeman and supports both local and regional travel demand. The following sections discuss the transportation-specific aspects of the study corridor. Information obtained from publically available sources, field observations, data collection efforts, GIS data, and as-built drawings were used to evaluate the transportation system.

2.1. PHYSICAL FEATURES AND CHARACTERISTICS

The roadway was constructed at various times, beginning in 1922. The study corridor consists of two travel lanes, one in each direction. The south side of the roadway is generally constrained by a railroad mainline owned by BNSF Railway and leased by Montana Rail Link (MRL). West of Airway Boulevard, the corridor is more urban in nature with a mix of commercial, industrial, and residential development on both the north and south sides of the corridor. Between Airway Boulevard and Springhill Road, the surrounding land use is primarily agricultural with occasional residential areas. East of Springhill Road, the corridor transitions back to an urban character.

2.1.1. Posted Speeds

The posted speed limits within the study area vary from 25 mph within the Belgrade urban area to 50 mph along the rural portions of the corridor. The posted speed limits are shown in **Table 4** and in **Figure 2**.

Table 4: Posted Speed Limits

LOCATION	ROUTE	BEGIN RP	END RP	POSTED SPEED
Jackrabbit Lane to Birch Lane	N-205	19.7	20.5	25 mph
Birch Lane to Madison Avenue	N-205	20.5	20.7	35 mph
Madison Avenue to Airway Boulevard	N-205	20.7	21.1	45 mph
Airway Boulevard to Springhill Road	P-205	21.1	27.0	50 mph
Springhill Road to Railroad Overpass	P-118	4.0	1.8	50 mph
RR Overpass to I-90 WB Ramps	P-118	1.8	1.3	45 mph

A speed study was conducted by MDT in September 2014. The speed study evaluated vehicle speeds between Airport Road and the railroad viaduct on North 7th Avenue. The results of the speed study showed that the existing speed limit of 60 mph was consistent with the 85th percentile of measured speeds.

Comments were received from the City of Belgrade, Gallatin County, and the City of Bozeman regarding the speed study. The agencies recommended speed limits be set to 60 mph, 55 mph, and 50 mph, respectively. At the October 2015 Transportation Commission meeting, it was agreed to extend the 45 mph zone to the east of Airway Boulevard and to post a speed limit of 50 mph from east of Airway Boulevard to south of the railroad viaduct.

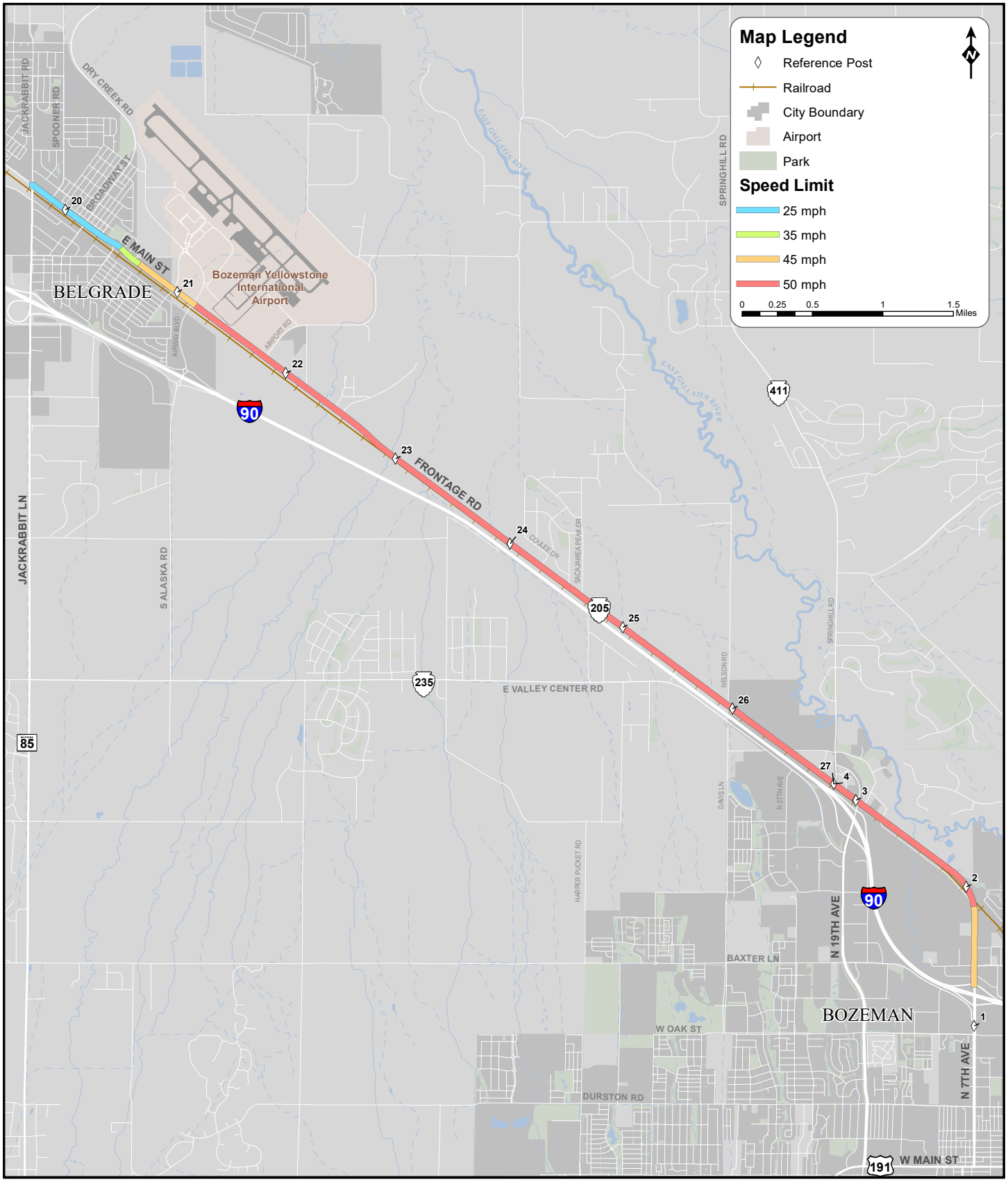

Figure 2: Posted Speed Limits

2.1.2. Roadway Surfacing

The MDT Road Log contains information for roadway surface width, lane width, shoulder width, surfacing thickness, and base thickness. The roadway surface width varies along the study corridor. The majority of the corridor has a paved surface width of 24 feet, which includes one travel lane in each direction and little or no shoulders. Through Belgrade, the roadway has shoulders/on-street parking and includes a center two-way left-turn lane (TWLTL) between Jackrabbit Lane and North Quaw Boulevard. The segment of the corridor reconstructed as part of the East Belgrade Interchange project is also wider with shoulders and turn-lanes at major intersections. Shoulders are also present as the corridor transitions into Bozeman near the Cherry River FAS.

MDT tracks and measures pavement condition on an annual basis. MDT's Pavement Management System (PvMS) is used to analyze the collected data to determine the condition of the pavement. Items of primary interest include the presence and degree of cracking and rutting, as well as overall ride quality. By understanding the condition of the pavement, MDT can identify the most appropriate treatments and resources needed to extend pavement life. Several pavement condition indices are monitored through MDT's PvMS. The performance measures and corresponding indices are such that the numerical value of 100 is assigned to a new pavement with no flaws, and zero is assigned to a highly degraded pavement. The following performance measures are routinely used to track pavement conditions:

- **Ride Index:** This is determined by using an internationally applied roughness index (IRI) in inches per mile and converting the number to a 0 to 100 scale.
- **Rut Index (RI):** This is calculated by converting rut depth to a 0 to 100 scale. Rut measurements are taken approximately every foot and averaged into one-tenth-mile reported depths.
- **Alligator Crack Index (ACI):** This is measured by combining all load-associated cracking and converting the index to a 0 to 100 scale.
- **Miscellaneous Cracking Index (MCI):** This is calculated by combining all non-load-associated cracking and converting the index to a 0 to 100 scale.
- **Overall Performance Index (OPI):** This is determined by combining and placing various weighting factors on the IRI, RI, ACI, and MCI figures and converting the index to a 0 to 100 scale. The OPI is calculated to provide a single index describing the current general health of a particular route or system.

The most important performance measure is the OPI, as this index includes all the aforementioned indices. An OPI of 80 to 100 is considered "good", 60 to 79.9 is "fair", and 0 to 59.9 is "poor". As shown in **Table 5**, the various pavement condition performance measures generally indicate fair or poor performance. The OPI indicates that the pavement is in poor condition. Note that some locations along the study corridor have been recently reconstructed and are not reflected in the table.

Table 5: Pavement Condition

CORRIDOR ROUTE		BEGIN RP	END RP	IRI	RI	ACI	MCI	OPI
C000250	**Jackrabbit Lane to Airway Boulevard**	19.7	21.1	66.5	59.0	86.6	98.6	53.7
C000205	**Airway Boulevard to Springhill Road**	21.1	26.8	73.2	54.0	99.1	98.5	59.9
C001207	**Springhill Road to I-90**	1.2	3.2	70.8	54.3	83.8	98.4	52.1

Source: MDT Pavement Management System, 2016, https://app.mt.gov/cgi-bin/pvms/pavement.cgi

2.1.3. Access and Right-of-Way

Access

There are numerous public and private access points along the study corridor. Access points were identified through a review of available GIS data accessed in October 2016, and aerial photography from 2015. Based on this review, there are approximately 111 access points along the corridor. Of the 111 total access points, 36 are public roadways, 71 are private approaches, and 4 are farm field approaches.

The angle of approaches are also of importance. The angle of approach is the angle at which the approaching road intersects the major road. Desirably, roadways should intersect at or as close to 90° as practical. Intersection skews greater than 30° from perpendicular are undesirable, as the driver's line of sight for one of the sight triangles becomes restricted. Accordingly, the approach angle should be between 60° and 120°. There were six access points that intersect the corridor at a skewed angle. Four of the six skewed approaches are public roadways.

Table 6 provides a summary of access points grouped in incremental segments along the study corridor. The table shows the number and density of approaches for the various roadway segments. Locations with a high density of approaches may indicate an area where a center left-turn lane may be desirable. The density of approaches per quarter mile is also shown in **Figure 3**.

Table 6: Access Points

SEGMENT	BEGIN RP	END RP	LENGTH (mi)	ACCESS POINTS			DENSITY (per mile)	SKEWED (<60° ANGLE)
				PUBLIC	PRIVATE	FARM		
Jackrabbit Lane to Quaw Boulevard	19.7	20.0	0.33	4	5	0	27.3	1 (public)
Quaw Boulevard to Davis Street	20.0	20.3	0.29	5	7	0	41.4	0
Davis Street to Airway Boulevard	20.3	21.1	0.83	7	11	0	21.7	2 (public)
Airway Boulevard to Airport Road	21.1	21.8	0.66	1	0	0	1.5	0
Airport Road to East of Dollar Drive	21.8	23.1	1.25	3	9	2	11.2	1 (public)
East of Dollar Drive	23.1	24.0	0.90	0	2	0	2.2	0
East of Dollar Drive to Nelson Road	24.0	25.9	1.93	5	13	1	9.8	2 (private)
Nelson Road to Springhill Road	25.9	27.0	0.93	2	4	1	7.5	0
Springhill Road to Cherry River Fishing Access	4.0	2.2	1.10	4	6	0	9.1	0
Cherry River Fishing Access to South End of Railroad Viaduct	2.2	1.8	0.22	0	0	0	0.0	0
South End of Railroad Viaduct to I-90 WB Ramps	1.8	1.3	0.47	5	14	0	40.4	0
		TOTAL	**8.91**	**36**	**71**	**4**	**12.5**	**6**

Right-of-Way

The majority of the Frontage Road is within railroad right-of-way through an easement granted by BNSF Railway (MRL leased) for that purpose. Exceptions exist in Belgrade and Bozeman proper, where right-of-way is generally owned by MDT. Additional investigation regarding railroad easements will be necessary depending on the location of potential improvement options within the corridor. MRL has stated that no additional easements shall be granted south of the existing roadway easement. MRL is open to granting additional roadway easements up to the northerly extent of their existing right-of-way. Aside from the Frontage Road itself, there appears to be private encroachments on the railroad right-of-way and MDT easements. Some of these encroachments may be affected by potential improvement options within the corridor.

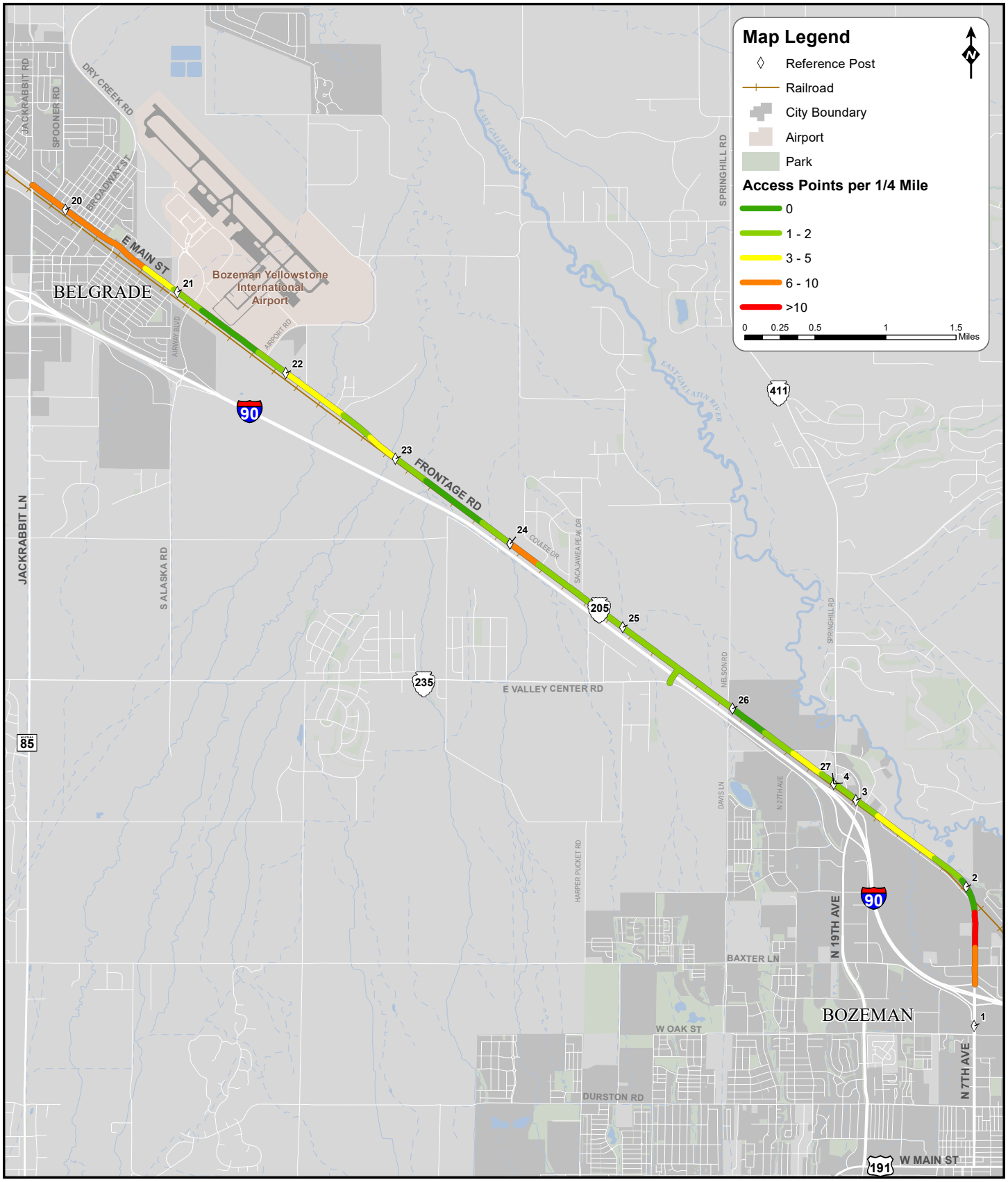

Figure 3: Access Density

2.1.4. Utilities

Northwestern Energy distributes natural gas and operates electric power generation, transmission, and distribution in the study corridor. Century Link, Charter Communications and Montana Opticom provide fiber optic communication services including telephone and internet. Charter Communications is the sole cable television provider. The City of Bozeman and City of Belgrade have buried water and sewer infrastructure in place on both ends of the corridor.

The Yellowstone Pipeline Company has a 10-inch pipe conveying crude oil and enters the study corridor from the north at approximately RP 25.5. The pipeline travels along the corridor until approximately RP 2.8 where it crosses the highway. The crude oil pipeline crosses again at RP 1.8.

A natural gas pipeline (size unknown) crosses the study corridor at approximately RP 26.7 and at RP 1.8. Due to legal protections regarding the terms of use and data sharing agreements, up-to-date mapping of these pipelines is not available. If improvements are proposed in these general areas, additional research and coordination with the owners will need to occur to identify if the pipelines currently exist at these locations and what, if any, potential conflicts exist with the pipelines.

2.1.5. Winter Operations

The study corridor is considered a Level I and Level I-A winter maintenance area according to the *MDT Maintenance Operations and Procedures Manual*[8]. A Level I winter maintenance area includes roadways within or adjacent to a 3-mile radius to towns or cities with an average daily traffic (ADT) greater than 5000 vpd. Level I routes are eligible to receive up to 24 hours-per-day coverage during a winter storm event. A Level I-A winter maintenance area includes roads outside of the 3-mile radius buffer which carry more than 3000 vpd. Level I-A routes are eligible for 19 hours-per-day coverage, typically between 5:00 AM and 12:00 AM, during a winter storm event. Coverage is at the discretion of MDT's Bozeman Area Maintenance Chief. The primary objective is to keep one lane in each direction open to traffic. Snow packed and/or icy surfaces are acceptable but they may be treated with abrasives or abrasive/chemical combination.

2.1.6. Railroads

A BNSF owned (MRL leased) railroad parallels the southern side of the Frontage Road. The track is referred to as the MRL (2nd Subdivision). The track averages 21 daily trains, and the 90th percentile is 26 daily trains. There are a total of five public and three private at-grade crossings adjacent to the study corridor. Daily rail traffic effects vehicle traffic operations at and near these at-grade crossings.

Based on data collected on July 29th, 2016 as part of this planning study, it was observed that 23 trains crossed at the Jackrabbit Lane crossing. Of these trains, 7 were traveling westbound and the remaining 16 were traveling eastbound. It took an average of 107 seconds for the trains to clear the Jackrabbit Lane crossing. **Table 7** outlines general rail data at the crossing locations in and adjacent to the study area.

The existing distance from roadway center line to railroad centerline is approximately 115 feet between Sundown Creek Road east of Belgrade and the Railroad Viaduct along North 7th Avenue north of Bozeman. Areas of the corridor closer to and within the cities of Belgrade and Bozeman have a greater distance between the roadway and railroad. MRL has given direction that the horizontal distance from the southernmost edge of roadway to the railway is not to be reduced with the planned slope flattening project (UPN 8031). Any improvement option(s) identified for those portions paralleling close to the tracks must not move the southern edge of the roadway shoulder any closer to the tracks.

Table 7: At-grade Railroad Crossing Data

US DOT CROSSING #	LOCATION	APPROACH TYPE	RAILROAD MP	MAXIMUM SPEED (MPH)	ROADWAY AADT (YEAR)
060 090P	Jackrabbit Lane (Belgrade)	Public	150.39	60	15,060 (2012)
060 085T	Broadway Street (Belgrade)	Public	149.98	60	6,570 (2012)
060 082X	Oregon Street (Belgrade)	Public	149.71	60	2,730 (2012)
060 079P	Unknown Road	Private	147.71	60	Unknown
060 078H	Sundown Creek Road	Private	147.33	60	Unknown
060 077B	Sundown Meadow Road	Private	147.12	60	Unknown
060 076U	Valley Center Road	Public	144.67	60	4,600 (2012)
060 075M	Red Wing Drive (Bozeman)	Public	142.97	60	170 (2012)

Source: Montana Department of Transportation, 2016

2.1.7. Passing Zones

Passing opportunities are provided along the corridor in areas where roadway geometrics allow. No passing zones are established in areas where there is insufficient passing sight distance or near public approaches. The following information summarizes the guidelines for no-passing zones as contained in the MDT *Traffic Engineering* Manual[9]:

- For determining a no-passing zone, the distance along a driver's line-of-sight is measured from a 3.5-foot height of eye to a 3.5-foot height of object.
- For 2-lane rural highways on the NHS, the no-passing zone design speed will be 70 mph. For a rural 2-lane primary highway, the design speed is 60 mph.
- The minimum passing sight distance required for a no-passing zone 1,200 feet and 1,000 feet for 70 and 60 mph design speeds, respectively.
- The minimum length for a no-passing zone is 500 feet.
- If the length between successive no-passing zones in the same direction of travel is less than 1,000 feet, then the gap between the no-passing zones should be closed.
- A no-passing zone should be marked in advance of intersections at a minimum distance of 500 feet.

Figure 4 shows the passing zones along the corridor as documented through on-site field review, aerial imagery, and *Google Street View* imagery. A total of 14 passing zones, seven eastbound and seven westbound, exist along the study corridor. Eight of the 14 passing zones are less than 1,000 feet in length.

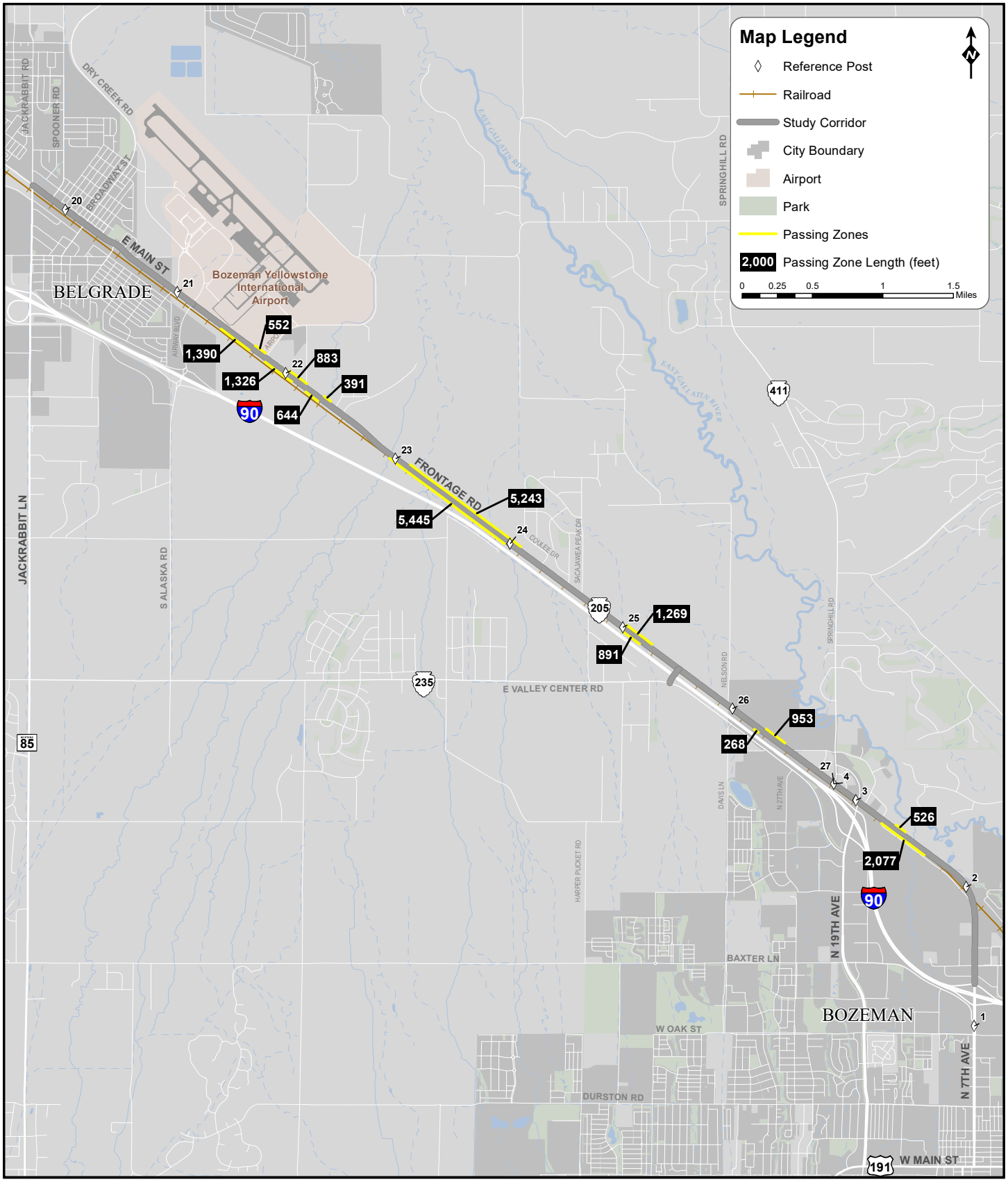

Figure 4: Passing Zones

2.1.8. Drainage Conditions

Due to the varied nature of the corridor (urban and rural), drainage conditions along the study corridor vary from curb and gutter with storm sewer to simple drainage ditches. Within Belgrade, curb and gutter is used to direct and control storm water. It was noted during the field review that many areas within Belgrade have poor drainage as evidenced by standing water in multiple locations.

In addition to storm water control, many other hydraulic structures are in place along the study corridor. **Table 8** tabulates location, construction date, and other details relevant to hydraulic structures along the study corridor.

Table 8: Hydraulic Structures

LOCATION	PROJECT NUMBER	CONSTRUCTION DATE	DETAILS
Jackrabbit Lane and Main Street	CN 4471 SFCU-STPS 291-1(5)1	2006	Project included new curb and gutter, storm drain with drainage sumps and new reinforced concrete pipe arch (RCPA) on the Mammoth Ditch crossing both Jackrabbit Lane and Main Street.
Airway Boulevard	UPN 5897001 IM-MT STPU 90-6(112)300	2015	This project eliminated some irrigation and minor drainage culverts crossing the Frontage Road and added a significant amount of curb and gutter and a storm drain system with detention/retention ponds to address storm runoff.
Spain Ferris Ditch (RP 22.3)	Unknown	Unknown	The Spain Ferris Ditch crosses the Frontage Road via a Reinforced Box Culvert (RBC) and includes two laterals east and west of the main crossing that are conveyed across the Frontage Road via culverts.
Hyalite Creek (RP 22.3)	STPHS 205-1(16)23	1997	Hyalite Creek crosses the Frontage Road via RBC with an overflow RCPA.
Baxter Creek (RP 23.2)	UPN 8031000 HSIP 205-1(45)23	Not yet constructed	Project in early stages of design. The project is primarily the replacement of the Baxter Creek culvert.
RP 25-27	UPN 4433 STPHS 205-1(26)26	2004	Miscellaneous irrigation and drainage culverts. Replaced culvert crossing on Spring Creek (RP 25.8).
Springhill Road to I-90 WB ramps	N/A	N/A	Miscellaneous irrigation and drainage culvert crossings. Close proximity to the City of Bozeman Waste Water Treatment Plant and may include several underground utilities.

2.1.9. Bridges

MDT's Highway Bridge Program (HBP) emphasizes asset management and preservation. This emphasis promotes a "right treatment at the right time" philosophy in prioritizing and selecting projects on MDTs bridge system. MDT has defined the bridge program objectives and performance measures. The objectives and measures are intended to identify the right treatments for Montana's bridge assets, as well as promoting cost-effective bridge preservation, appropriate safety-related work, and economic growth.

MDT uses a Structure Condition Performance Measure and a Deck Performance Condition Measure. These measures categorize bridge conditions as good, fair, or poor, based on the condition rating given to the bridge deck (riding surface), superstructure (generally beams underneath the riding surface), and substructure (support structure extending into the ground). Additionally, the Structure Condition Performance Measure assigns a poor rating to a bridge that is structurally deficient.

A bridge is considered structurally deficient if load-carrying elements have deteriorated enough to be considered in "poor condition" or the adequacy of the waterway opening provided by the bridge is insufficient, causing intolerable traffic interruptions. When a bridge is classified as structurally deficient, it does not mean that it is unsafe. A structurally deficient bridge typically requires increased maintenance and repair to remain in service and eventual rehabilitation or replacement to address overall deficiencies.

The deck condition performance measure uses the National Bridge Inventory (NBI) deck rating to give an indication of the deck condition and a planning level indication of needed preservation treatment. The deck condition ranking is a general indicator of the condition of any individual deck. The rankings are useful for planning purposes on a system wide basis.

There are two bridges along the study corridor. **Table 9** shows the bridge locations and condition ratings. The bridge at RP 26.6 has a structure condition of "poor" which means it is a candidate for repair or replacement. The bridge located at RP 2.1 over the railroad tracks has a structure condition of "good" which indicates it is a candidate for continued preservation. Both of the bridges have bridge deck ratings of "fair-1", which means they are candidates for healer/sealer treatments.

Table 9 also lists the width of each bridge within the study area. According to the MDT *Bridge Design Standards*, the bridge at RP 26.6 has a total bridge width narrower than the recommended standard for new bridges. The bridge at RP 2.1 has a width that meets standards for new bridges. Bridges to remain in place that do not meet the recommended width may be considered for additional signing or widening depending on further engineering analysis[10].

Table 9: Bridge Locations and Condition

LOCATION	FEATURE CROSSED	YEAR BUILT	WIDTH (ft)	LENGTH (ft)	STRUCTURE CONDITION	DECK CONDITION
RP 26.6 (P-205)	Unknown Creek	1950	29.5	42.6	POOR	FAIR-1
RP 2.1 (P-118)	Railroad Track	1993	42.3	391.0	GOOD	FAIR-1

Source: MDT Bridge Management System, 2016

2.1.10. Other Transportation Modes

Other transportation modes include any mode that does not use an automobile. These can include, but are not limited to, bicycles, walking, transit services, and other non-motorized forms of transportation. The following discusses these other transportation modes relative to the study corridor.

Non-motorized

Sidewalks are in place on both sides of the study corridor from Jackrabbit Lane to Kennedy Street in Belgrade. From Kennedy Street to the east of the Central Valley Fire Station, the north side of Main Street is striped as a buffered pedestrian area. There is sidewalk on the north side of Main Street from east of the Central Valley Fire Station to approximately Oregon Street. Multiple gaps in the sidewalk network exist within Belgrade south of Kennedy Street.

With the construction of the East Belgrade Interchange, sidewalks were constructed from Gallatin Field Road to east of Airway Boulevard. Between Redwing Road and the end of the study corridor, sidewalks are in place at spot locations on both sides of North 7th Avenue. There is approximately 310 feet of separated shared-use path constructed south of the Gallatin Veterinary Hospital and north of the Frontage Road east of the intersection with Campbell Road.

Local planning documents conflict on long-term non-motorized infrastructure recommendations for the Frontage Road (see **Section 1.3**). The following summarizes the relevant local plans, and their corresponding recommendations.

- **Greater Bozeman Area LRTP (2007 Update):** Recommends expanded shoulders on each side of the Frontage Road with a minimum width of 4-feet, in conjunction with future roadway improvements.
- **Bozeman PROST Plan:** Identifies a separated shared-use path running the length of the Frontage Road within the City planning limits, and numerous trail connections to the north connecting to residential neighborhoods, the East Gallatin River, and the Cherry River FAS.
- **Belgrade Transportation Plan:** Recommends a ten-foot wide path with an all-weather surface on the south side of old Highway 10 between Belgrade and Bozeman within either the railroad or the Interstate rights-of-way.
- **Draft Bozeman TMP:** Draft recommendations include a separated shared use path on the north side of the Frontage Road within the City planning limits.

The Union Pacific Railroad – BNSF Railway has guidelines for projects within railroad right-of-way. MRL, as a lessee, is required to seek BNSF concurrence as the underlying landowner on any easement for roadway purposes granted to MDT, and MRL seeks to avoid roadway designs which do not conform to BNSF's standards. The guidelines are intended to limit potential impacts on existing and future railroad operations. Compliance with the guidelines is required to expedite review and approval of design and construction projects. Any development of trails within or near the railroad would likely require coordination with the railroad. The following guidelines exist for trails parallel to tracks[11]:

- The Railroad does not allow trails parallel to the track on railroad right-of-way and does not permit the use of railroad access roads for trail use.
- Railroad structures cannot be used to serve trail traffic or support a structure serving trail traffic.
- Fences or barriers such as vegetation, ditches, and/or berms shall separate trails that are outside the railroad right-of-way and running parallel to the track to stop trespassers from entering the railroad right-of-way.

Transit

Public transit services are not present along this study corridor. The closest public transit is Streamline's Greenline route which services Jackrabbit Lane in Belgrade. Streamline is the only public bus service in the Livingston, Belgrade, Four Corners, and Bozeman areas.

2.2. Traffic Operations

An evaluation of traffic operations for the study corridor was completed using available data provided by MDT, as well as field-collected data. Turning-movement counts were conducted by MDT at nine major intersections within the study area over a 24-hour period. Mainline traffic volume data for existing and historic conditions were available at multiple locations within the study area. Visual observations were made for driver behavior, vehicle queuing, and general traffic characteristics. The following sections provide details about the existing and projected traffic characteristics for the study corridor. Detailed data are available in the appendix.

2.2.1. Traffic Volumes

Traffic volumes along the study corridor are collected annually as part of MDT's traffic data collection program. A total of 10 data collection sites are located along the study corridor. The data collected at each site is used to determine an average daily traffic (AADT) volume. AADT represents the average number of vehicles that pass a given point on a typical day of the year. Existing AADT volume on the study corridor ranged from a low of 5,250 vehicles per day (vpd) west of Broadway Street in Belgrade, to a high of 12,520 vpd south of Griffin Drive in Bozeman.

Projected Conditions

Historic and projected future conditions were evaluated to help identify an appropriate growth rate for the study corridor. The selection of an appropriate growth rate for the area is important for forecasting future traffic conditions and to help identify corridor needs. This section presents two methodologies for determining projected traffic conditions. The first approach utilizes available historic traffic data to define how conditions have changed in the past. The second approach uses a travel demand model to project how changes to area land use might affect traffic conditions in the future. The following sections discuss these methodologies in more detail.

Historic Traffic and Growth Rates

The historic traffic growth method utilized the AADT data available from MDT. AADT data for the past 20 years (1996 through 2015) were used to determine an average annual growth rate (AAGR) for the count sites along the study corridor.

Historic growth rates for the study corridor are used to help project future traffic conditions. Past growth is typically used as an indicator for future growth. Traffic volumes can vary greatly over short periods of time. As such, an analysis of multiple years of historic data is needed to more accurately project future conditions.

Traffic has shown moderate growth over the past 20 years. Between 1996 and 2015, traffic was shown to increase at an average annual rate of 1.0 percent along the study corridor. However, volumes are generally shown to decrease between 2014 and 2015 due to the opening of the East Belgrade Interchange. During this one year period, volumes dropped by just over 20 percent on average along the study corridor. Prior to the East Belgrade Interchange opening, traffic volumes grew at an average annual rate of 1.2 percent between 1995 and 2014. **Table 10** shows the change in traffic volumes since the East Belgrade Interchange was constructed. It is expected that traffic volumes will start to increase again after the initial reduction in volumes due the change in travel patterns from the new interchange.

Table 10: AADT Change between 2014 and 2015

LOCATION	2014 AADT	2015 AADT	% DIFFERENCE
East of Jackrabbit Lane	9,460	8,348	-11.8%
West of Broadway Street	7,210	5,250	-27.2%
East of Broadway Street	9,980	8,670	-13.1%
East of Madison Avenue	11,510	9,550	-17.0%
West of Valley Center Spur Road	11,360	7,478	-34.2%
West of Springhill Road	10,100	5,760	-43.0%
East of Springhill Road	8,370	5,300	-36.7%
North of Red Wing Drive	8,160	6,090	-25.4%
North of Griffin Drive	9,540	9,930	4.1%
South of Griffin Drive	14,410	12,520	-13.1%
		Average for Corridor	**-21.2%**

Travel Demand Model

A travel demand model was developed for Gallatin County as part of the *Bozeman TMP*. The model uses the transportation network and land use assignments to determine the number of trips for roadway segments. The model was initially developed and calibrate to existing conditions. To project future conditions, future land use assignments were completed using a combination of socioeconomic data and vetted through a workshop with staff from the City of Bozeman, Gallatin County, and MDT.

Future traffic volumes are estimated by projecting land use changes and applying those changes to the existing conditions model. In addition to land use changes, changes to the road network can be applied. Future projections were made out to the year 2040. The model projected an AAGR of 1.3 percent for the study corridor.

Projected Growth Summary

Over the past 20 years, the study corridor has experienced an AAGR of approximately 1.0 percent. The historic growth is influenced by the recent construction of the East Belgrade Interchange. As such, the travel demand model was used as a tool to help predict future conditions. The model suggests an AAGR of 1.3 percent for the study corridor.

Factoring in historic growth along with the results of the travel demand model, it was determined that an AAGR of 1.3 percent would be appropriate for the study corridor. As such, a 1.3 percent average annual growth rate was applied to existing traffic volumes for the projected operational analysis contained in this report. Projected AADT for the study corridor are shown in **Table 11**.

Table 11: Existing and Projected Traffic Volumes

SITE	LOCATION	2015 AADT	2040 AADT[i]
16-3-014	East of Jackrabbit Lane	8,348	11,350
16-3-015	West of Broadway Street	5,250	7,250
16-3-016	East of Broadway Street	8,670	11,970
16-3-017	East of Madison Avenue	9,550	13,190
16-3-032	West of Valley Center Spur Road	7,478	10,330
16-3A-017	West of Springhill Road	5,760	7,960
16-3A-016	East of Springhill Road	5,300	7,320
16-3B-119	North of Red Wing Drive	6,090	8,410
16-3B-019	North of Griffin Drive	9,930	13,710
16-3B-020	South of Griffin Drive	12,520	17,290

[i] Projected based on an average annual growth rate of 1.3 percent.

Heavy Vehicle Traffic

An analysis of heavy vehicle traffic along the study corridor was made using the 24-hour turning movement count data. The turning movement count data include breakouts for vehicle type. For this analysis, vehicles classified as single-unit trucks and articulated trucks were considered heavy vehicles.

Based on the turning movement counts, the percent of heavy vehicles at the major intersections ranges from just over two percent to almost seven percent of all vehicle traffic. On average, heavy vehicle traffic accounts for approximately 4.5 percent of traffic along the corridor. **Table 12** show the heavy vehicle traffic collected at each intersection over a 24-hour period.

Table 12: Heavy Vehicle Traffic

INTERSECTION	TOTAL VEHICLES	HEAVY VEHICLES	% HEAVY VEHICLES
1. Jackrabbit Lane	20,205	441	2.18
2. Broadway Street	12,134	489	4.03
3. Oregon Street	10,446	336	3.22
4. Airway Boulevard	17,629	1,173	6.65
5. Airport Road	9,074	569	6.27
6. Valley Center Spur Road	10,241	486	4.75
7. Nelson Road	7,743	479	6.19
8. Springhill Road	9,681	290	3.00
9. Griffin Drive	17,987	888	4.94
Average	**12,793**	**572**	**4.58**

School-related Traffic

Traffic data was originally collected during the summer months, while school was not in session. To supplement the data, additional field observations were made to evaluate the effects traffic related to Belgrade High School had on the study corridor. Observations were made in early November, 2016 during school pick-up and drop-off times. The field review showed that traffic operates relatively smoothly throughout most of the day. However, when students are released from school in the afternoon, traffic congestion and operational issues were observed.

When school gets out, a large number of vehicles are released onto the traffic network during a short period of time. The main roads connecting the school and Main Street are Grogan Street and Hoffman Street. The primary movement of vehicles involves right turns onto Main Street followed by left turns onto Jackrabbit Lane. This heavy movement results in long queues along Main Street between Jackrabbit Lane and Hoffman Street.

Vehicles attempting to turn from Grogan Street are effectively blocked from moving due to queues extending from the westbound left-turn movement at Jackrabbit Lane. Queues along both Grogan and Hoffman Streets were observed to extend to Central Avenue (approximately 500 feet). Traffic queueing was also noted at the intersection with Broadway Street with queues in the eastbound direction extending west of Quaw Boulevard (approximately 800 feet).

School bus traffic also influences traffic operations. School busses are required to stop at all railroad crossings. When a school bus turns onto Jackrabbit Lane, it must stop at the tracks immediately to the south of the intersection. With multiple busses in a row this can cause traffic to queue through the intersection with Jackrabbit Lane.

2.2.2. Major Intersections

The study corridor has multiple intersections of varying volume. Nine intersections were identified as major intersections which merit more in-depth investigation. Vehicle turning movement data was collected at each of the nine intersections over a 24-hour period. Each turning movement count was adjusted based on seasonal traffic adjustment factors published by MDT[12]. The data was used to evaluate intersection operations and peak hour conditions.

The operational conditions of the intersections are characterized by the Level of Service (LOS). The LOS is based on an alphabetic scale which represents the full range of operating conditions. This scale is defined based on the vehicle delay experienced at the intersection. The scale ranges from “A” which indicates little, if any, vehicle delay, to “F” which indicates significant vehicle delay and traffic congestion.

Table 13 summarizes the peak hour intersection operational analysis under existing and projected conditions. Additionally, **Figures 5** and **6** present the traffic operations graphically. The following discusses the general operational characteristics of the nine major intersections along the study corridor. More detailed information on the intersection operational analysis is provided in **Appendix 4**.

1. Jackrabbit Lane

The intersection with Jackrabbit Lane is currently signalized. The eastbound approach consists of dedicated right-turn, through, and left-turn lanes. The westbound approach consists of a dedicated left-turn lane and a shared through/right-turn lane. Both the northbound and southbound approaches consist of dedicated left-turn and through lanes along with right-turn slip lanes as a result of the skewed intersection.

The adjacent railroad pre-empts the traffic signal when a train approaches Jackrabbit Lane. Approximately 60 seconds before the train reaches Jackrabbit Lane, all northbound movements are given green signals and all other movements are given red signals. The northbound phase lasts for approximately 45 seconds, after which the east and westbound movements are given green signals. The traffic signal remains in this phase until the train has cleared the level crossing and the barrier gates have been raised.

Under existing traffic conditions, this intersection operates at a LOS of C during the AM and PM peak hours. Under projected conditions, the intersection is shown to remain at a LOS of C during the peak hours.

2. Broadway Street

The intersection with Broadway Street is a four-legged all-way stop controlled intersection. All of the approaches consist of a single shared lane allowing all movements. On-street parking is available on the north side of Main Street and on both sides of Broadway Street on the north approach. Angle parking is available on the south side of Main Street on the east approach. The MRL railroad line is located approximately 180 feet south of the northbound stop bar.

Under existing traffic conditions, the intersection operates at a LOS of A and C during the AM and PM peak hours, respectively. Under projected conditions, the intersection is shown to operate at a LOS of B and F during the respective peak hours. The failing projected PM peak hour is mainly a result of heavy westbound through and left-turn movements.

3. Oregon Street

The intersection of Oregon Street is a three-legged stop controlled intersection. The northbound approach is stop controlled and consists of channelized through/left- and right-turn lanes. There is a median dividing the right-turn and through/left-turn lanes. There is also a median dividing the southbound and northbound lanes. The eastbound and westbound approaches consist of single lanes with free movements. An entrance approach for a gas station is located on the north side of the intersection.

Under existing traffic conditions, the intersection operates at a LOS of C and D during the AM and PM peak hours, respectively. Under projected conditions, the intersection is shown to operate at a LOS of C and F during the respective peak hours. The intersection is shown to experience excessive delay for the northbound left-turn movement during the PM peak hour.

4. Airway Boulevard

The intersection with Airway Boulevard was recently reconstructed with the East Belgrade Interchange project. The intersection was reconstructed to include a traffic signal. All approaches at the intersection include dedicated right-turn, through, and left-turn lanes. The traffic signal operates with protected/permissive left-turn movements along all approaches. The intersection is shown to operate at a LOS of C or better during the peak hours under existing and projected conditions.

5. Airport Road

The intersection with Airport Road was also reconstructed with the East Belgrade Interchange project. Prior to reconstruction, the intersection was a four-legged intersection. The reconstruction of the intersection included the removal of the south approach leg. The intersection is now a three-legged intersection with stop control along the north approach. There are no dedicated turn lanes along any approach. The intersection is shown to operate at a LOS C during the peak hours under existing and projected conditions.

6. East Valley Center Spur Road

The intersection with East Valley Center Spur Road is a stop controlled four legged junction. However, the north leg is a closed private approach. The eastbound leg of the intersection consists of a dedicated right-turn, through, and left-turn lanes. The westbound leg consists of a dedicated left-turn bay and a shared through/right lane. The north-bound approach consists of a shared left/right-turn lane. The MRL rail line crosses East Valley Center Spur Road immediately south of the intersection. The at-grade crossing is controlled with an automatic crossing gate. The traffic control at the intersection is scheduled to be upgraded to signal control in the near future. As such, signalized traffic control was used for all projected traffic conditions.

Under existing traffic conditions (stop control along the northbound approach), the intersection operates at a LOS of C during the peak hours. Under projected conditions (traffic signal), the intersection is shown to operate at a LOS of B during the peak hours.

7. Nelson Road

The intersection with Nelson Road is a three-legged intersection with stop control along Nelson Road. The eastbound approach consists of a dedicated left-turn lane and a through lane. The westbound approach consists of a dedicated right-turn lane and a through lane. The southbound approach has a shared left/right-turn lane.

Under existing traffic conditions, the intersection operates at a LOS of B during the peak hours. Under projected conditions, the intersection is shown to operate at a LOS of C during the peak hours.

A traffic study is planned for this intersection to evaluate if signal warrants are met. The study is likely to take place during the winter of 2016/2017.

8. Springhill Road

The intersection with Springhill Road is a three-legged intersection. The intersection is controlled by a traffic signal. The southbound approach consists of dedicated left- and right-turn lanes. The eastbound approach consists of a dedicated left-turn lane and a through lane. The westbound approach includes a dedicated right-turn lane and a through lane. The intersection operates at a LOS B during the AM and PM peak hours under existing and projected conditions.

9. Griffin Drive

Griffin Drive and 7th Avenue intersect at an urban four-legged signal controlled intersection. The northbound approach consists of a shared through/left-turn lane and a dedicated right-turn lane. The southbound approach has a shared through/left-turn lane and a shared through/right-turn lane. The eastbound and westbound approaches are single lanes which allow for all movements.

The traffic signal does not provide for protected left-turn movements along any approach and allows for permissive left-turn movements only. Under existing traffic conditions, the intersection operates at a LOS of C and D during the AM and PM peak hours, respectively. Under projected conditions, the intersection is shown to operate at a LOS of D and F during the respective peak hours. The intersection experiences delay due to the southbound and westbound left-turn movements.

A traffic and geometric analysis was completed for this intersection by MDT in October, 2016[13]. The purpose of the analysis was to identify improvements to signal timing and geometrics to address operational concerns. A recommendation was made to reconstruct the intersection to include dual westbound left-turn lanes and to realign the northbound and southbound legs to include left-turn lanes. The intersection is planned for reconstruction in 2019.

Table 13: Intersection Operations Analysis

INTERSECTION	EXISTING CONDITIONS (2016)				PROJECTED CONDITIONS (2040)			
	AM		PM		AM		PM	
	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS	DELAY (S)	LOS
1. Jackrabbit Lane (S)	**23.8**	**C**	**21.1**	**C**	**31.4**	**C**	**24.2**	**C**
Northbound	*15.7*	*B*	*13.6*	*B*	*24.5*	*C*	*17.8*	*B*
Southbound	*24.5*	*C*	*19.3*	*B*	*36.7*	*D*	*14.3*	*B*
Eastbound	*31.9*	*C*	*28.9*	*C*	*37.8*	*D*	*35.0*	*C*
Westbound	*13.8*	*B*	*31.3*	*C*	*16.0*	*B*	*32.9*	*C*
2. Broadway Street (AWSC)	**9.2**	**A**	**15.5**	**C**	**11.0**	**B**	**57.7**	**F**
Northbound	*9.1*	*A*	*14.2*	*B*	*10.9*	*B*	*33.5*	*D*
Southbound	*8.8*	*A*	*12.0*	*B*	*9.9*	*A*	*18.9*	*C*
Eastbound	*9.4*	*A*	*12.9*	*B*	*11.4*	*B*	*26.1*	*D*
Westbound	*9.4*	*A*	*19.3*	*C*	*11.1*	*B*	*108.1*	*F*
3. Oregon Street (TWSC)	**16.8**	**C**	**27.1**	**D**	**22.3**	**C**	**98.9**	**F**
Northbound	*12.9*	*B*	*19.3*	*C*	*15.6*	*C*	*59.1*	*F*
Southbound	*14.4*	*B*	*16.8*	*C*	*18.4*	*C*	*30.7*	*D*
Eastbound	*0.8*	*A*	*0.8*	*A*	*0.8*	*A*	*0.9*	*A*
Westbound	*0.7*	*A*	*1.0*	*A*	*0.7*	*A*	*1.0*	*A*
4. Airway Boulevard (S)	**20.8**	**C**	**21.8**	**C**	**21.7**	**C**	**23.6**	**C**
Northbound	*14.9*	*B*	*14.4*	*B*	*18.4*	*B*	*20.1*	*C*
Southbound	*13.4*	*B*	*14.5*	*B*	*16.3*	*B*	*19.2*	*B*
Eastbound	*31.0*	*C*	*30.5*	*C*	*29.8*	*C*	*28.0*	*C*
Westbound	*22.1*	*C*	*27.5*	*C*	*20.3*	*C*	*26.9*	*C*
5. Airport Road (TWSC)	**15.7**	**C**	**17.6**	**C**	**19.1**	**C**	**24.8**	**C**
Southbound	*10.7*	*B*	*11.9*	*B*	*11.7*	*B*	*14.5*	*B*
Eastbound	*2.2*	*A*	*3.2*	*A*	*2.3*	*A*	*3.3*	*A*
Westbound	*0.0*	*A*	*0.0*	*A*	*0.0*	*A*	*0.0*	*A*
6. Valley Center Spur (TWSC/S)[(i)]	**15.8**	**C**	**23.1**	**C**	**12.8**	**B**	**13.4**	**B**
Northbound	*13.9*	*B*	*20.1*	*C*	*28.6*	*C*	*27.2*	*C*
Eastbound	*0.0*	*A*	*0.0*	*A*	*7.3*	*A*	*7.1*	*A*
Westbound	*3.5*	*A*	*2.4*	*A*	*8.2*	*A*	*10.3*	*B*
7. Nelson Road (TWSC)	**13.2**	**B**	**13.8**	**B**	**15.8**	**C**	**17.8**	**C**
Southbound	*12.2*	*B*	*12.9*	*B*	*14.3*	*B*	*16.4*	*C*
Eastbound	*0.2*	*A*	*0.6*	*A*	*0.2*	*A*	*0.7*	*A*
Westbound	*0.0*	*A*	*0.0*	*A*	*0.0*	*A*	*0.0*	*A*
8. Springhill Road (S)	**11.7**	**B**	**14.9**	**B**	**12.4**	**B**	**19.1**	**B**
Southbound	*29.5*	*C*	*27.0*	*C*	*28.5*	*C*	*25.2*	*C*
Eastbound	*4.4*	*A*	*5.5*	*A*	*5.7*	*A*	*8.4*	*A*
Westbound	*8.2*	*A*	*13.2*	*B*	*9.6*	*A*	*21.7*	*C*
9. Griffin Drive (S)	**30.9**	**C**	**54.3**	**D**	**45.2**	**D**	**184.3**	**F**
Northbound	*31.4*	*C*	*40.9*	*D*	*49.6*	*D*	*38.7*	*D*
Southbound	*25.8*	*C*	*47.6*	*D*	*29.3*	*C*	*82.9*	*F*
Eastbound	*20.7*	*C*	*14.5*	*B*	*21.5*	*C*	*21.8*	*C*
Westbound	*37.3*	*D*	*72.8*	*E*	*58.2*	*E*	*380.7*	*F*

(AWSC) – All-way Stop Control; (S) – Signal; (TWSC) – Two-way Stop Control

[(i)] Modeled as a two-way stop control under existing conditions and as a traffic signal under projected conditions.

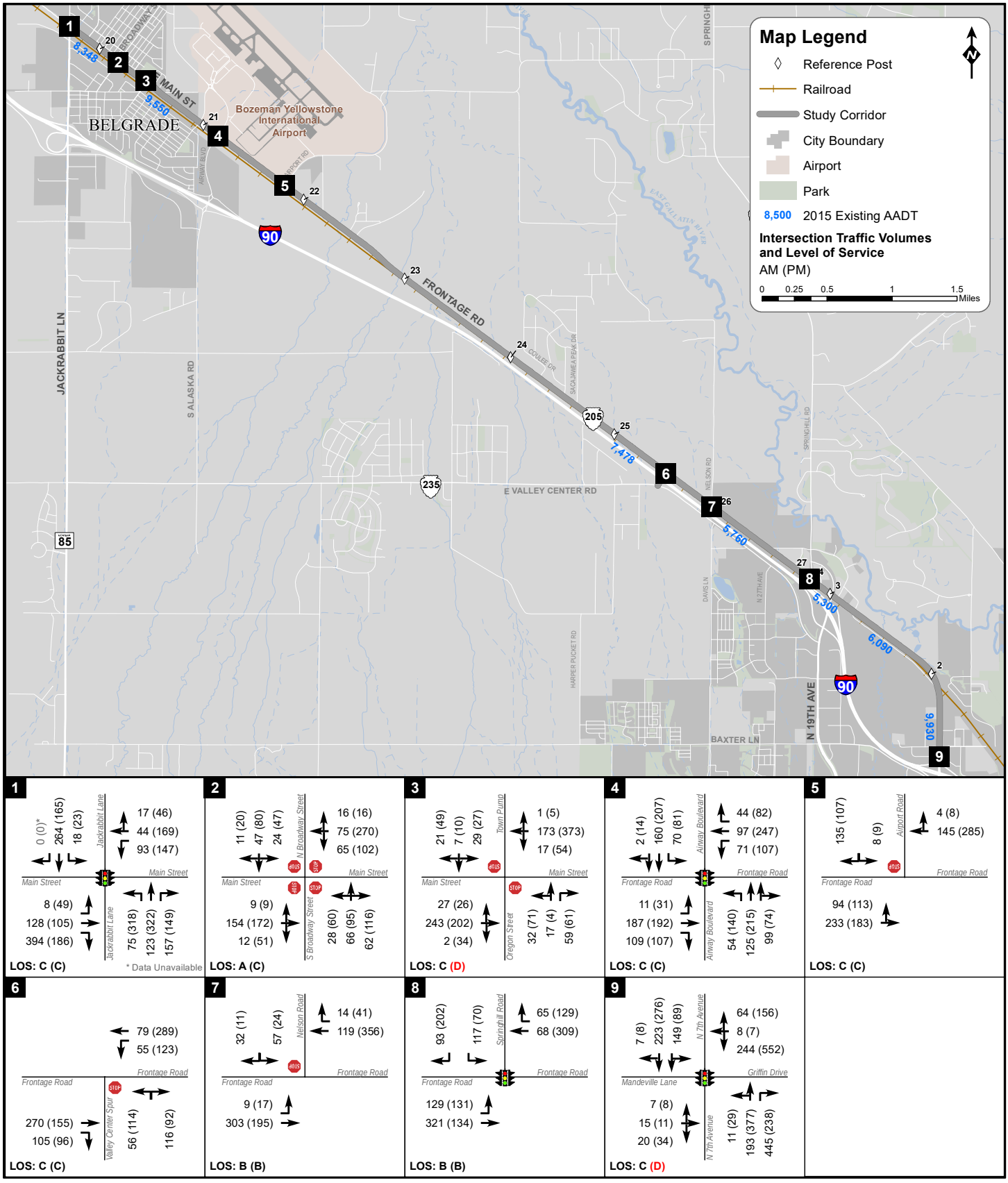

Figure 5: Existing Traffic Operations

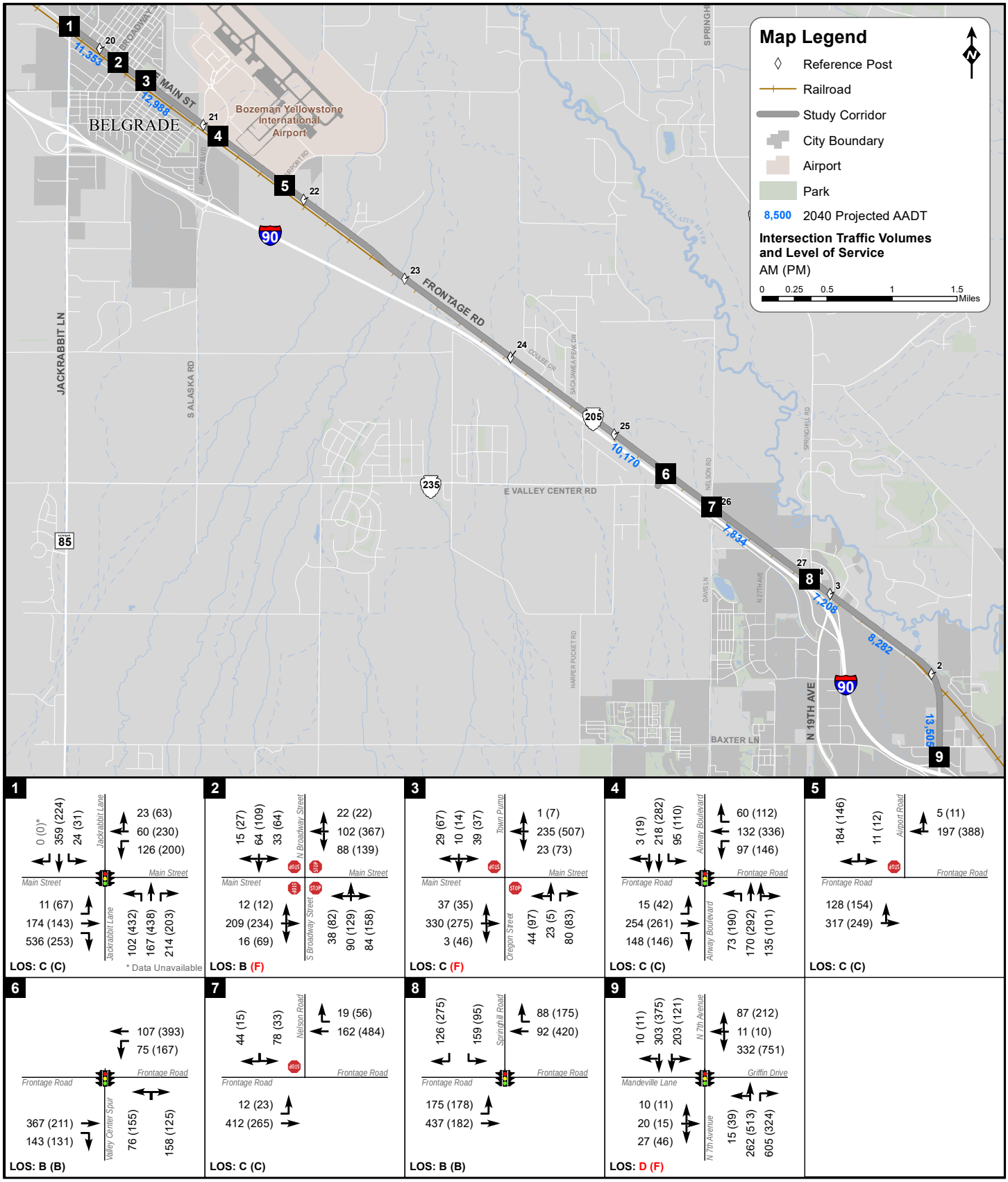

Figure 6: Projected Traffic Operations

2.2.3. Roadway Segments

The traffic operations of the study corridor were evaluated by dividing the corridor into roadway segments. The segments were generally defined between major intersections. Two categories of roadway segments can be used to describe each portion of the study corridor: urban and rural. Urban segments are characterized by frequent access points and intersections. Operations on urban segments are controlled by the intersections within the segment. An evaluation of the intersection operations is included in **Section 2.2.2**. The portions of the corridor between Jackrabbit Lane and Airway Boulevard and between the railroad viaduct and the I-90 ramps were considered urban in nature.

Rural segments are defined as having few access points and intersections. The operations on rural segments are controlled by driver's behavior on the segment. The corridor between Airway Boulevard and the railroad viaduct is generally more rural. The operational characteristics of the rural portion of the corridor were evaluated in terms of LOS. The LOS of rural two-lane segments can be further defined by one of the following three categories:

- **Class I** – Users can expect both high speeds and the ability to pass. Both average travel speed and percent time spent following criteria are used to determine LOS.
- **Class II** – Speed is rarely an issue as a result of restricted design speeds due to terrain or roadway context. Only percent time spent following is used to determine LOS.
- **Class III** – Speed limits are low due to surrounding development and passing is generally restricted. Only percent of free-flow speed is used to determine LOS.

The rural segments along the study corridor are likely categorized as Class III highways due to limited passing opportunities. It was assumed that the free flow speed for all segments is 55 miles per hour based on the existing speed limits and past speed studies conducted along the corridor. Each segment was further broken down into eastbound and westbound direction for peak hour operational analysis. The following discusses the operations of each rural roadway segment. A summary of the analysis findings is tabulated in **Table 14**.

Airway Boulevard to Airport Road

Airway Boulevard and Airport Road are approximately 0.8 miles apart. There are no approaches within this segment. The percent of the segment that is striped as no passing is 84 and 59 percent in the westbound and eastbound directions, respectively. Under existing conditions, the LOS for this segment is B and C in the westbound direction and B and B in the eastbound direction during the AM and PM peak hours, respectively. Under projected traffic conditions, the LOS is C for both directions of travel during the peak hours.

Airport Road to East Valley Center Spur Road

Airport Road and East Valley Center Spur Road are approximately 3.7 miles apart. The approach density on this segment is nine approaches per mile. The percent of the segment that is striped as no passing is 60 and 57 percent in the west and eastbound directions, respectively. Under existing conditions, the LOS for this segment is B in both directions during both peak hours. Under projected traffic conditions, the LOS is B and C in the west and eastbound directions during the AM peak hour and C for both directions during the PM peak hour.

East Valley Center Spur Road to Nelson Road

East Valley Center Road and Nelson Road are approximately 0.4 miles apart. The approach density on this segment is two approaches per mile. The percent of the segment that is striped as no passing is 100 percent in both the west and eastbound directions. Under existing traffic conditions, the LOS for this segment is B for both directions during the AM peak hour and C and B for the west and

eastbound directions, respectively, during the PM peak hour. Under projected traffic conditions, the LOS remains the same as under existing traffic conditions.

Nelson Road to Springhill Road

Nelson Road and Springhill Road are approximately 0.9 miles apart. The approach density on this segment is six approaches per mile. The percent of the segment that is striped as no passing is 81 and 95 percent in the west and eastbound directions. Under existing traffic conditions, the LOS for this segment is B in both directions during the AM peak hour and C and B for the west and eastbound directions, respectively, during the PM peak hour. Under projected traffic conditions, the segment LOS is C and B for the west and eastbound directions during the AM peak hour and C in both directions during the PM peak hour.

Springhill Road to Rail Road Viaduct

The distance from Springhill Road to the south side of the rail road viaduct is approximately 1.4 miles. The approach density for this section is seven approaches per mile. The percent of the segment that is striped no passing is 93 and 73 percent for the west and eastbound directions, respectively. Under existing traffic conditions, the AM peak hour LOS is B for both directions. During the PM peak hour, the LOS is C and B for the west and eastbound directions, respectively. Under projected traffic conditions, the segment LOS is C in both directions during both the AM and PM peak hours.

Table 14: Existing and Projected Corridor Operations

Segment	Direction	EXISTING CONDITIONS (2016)				PROJECTED CONDITIONS (2040)			
		AM		PM		AM		PM	
		% FFS	LOS	% FFS	LOS	% FFS	LOS	% FFS	LOS
Airway Boulevard to Airport Road	Westbound	84.5	B	81.1	C	82.2	C	78.8	C
	Eastbound	84.3	B	83.7	B	81.8	C	80.6	C
Airport Road to East Valley Center Spur Road	Westbound	86.8	B	85.5	B	85.1	B	81.9	C
	Eastbound	86.9	B	85.7	B	83.1	C	83.2	C
East Valley Center Spur Road to Nelson Road	Westbound	85.9	B	82.2	C	84.1	B	79.7	C
	Eastbound	84.8	B	84.4	B	80.9	C	81.9	C
Nelson Road to Springhill Road	Westbound	85.5	B	81.0	C	83.5	B	78.0	C
	Eastbound	83.5	B	83.4	B	79.3	C	80.4	C
Springhill Road to south of railroad Viaduct	Westbound	85.3	B	81.1	C	83.1	C	78.2	C
	Eastbound	84.3	B	84.6	B	79.2	C	81.9	C

2.3. Geometric Conditions

Existing roadway geometrics were evaluated and compared to current MDT standards. The analysis was conducted based on a review of public information, MDT as-built drawings, GIS data, and field observations. The use of as-built drawings was limited due to the drawings being unavailable for some segments and out dated for other segments of the corridor.

2.3.1. Design Criteria

The MDT *Road Design Manual* specifies general design principles and controls that determine the overall operational characteristics of the roadway and enhance its aesthetic appearance. The geometric design criteria for the study corridor are based on the current MDT design criteria for principal arterials on the NHS and minor arterial non-NHS routes. Standards for rural and urban conditions for both classifications are appropriate for the corridor.

The portion of the corridor through Belgrade is an urban NHS principal arterial. Between Belgrade and Airway Boulevard, the roadway is likely a rural NHS principal arterial. East of Airway Boulevard to

Bozeman, the roadway is a rural minor arterial. Through Bozeman, the roadway is an urban minor arterial.

Table 15 provides existing standards for the various roadway classifications. Depending on classification, design speeds may vary from as low as 35 mph in the urban areas, up to 70 mph in the rural areas. The entire corridor is likely considered level terrain. The table provides critical design criteria depending on design speed and roadway classification. Further evaluation of design speed and terrain type may be necessary during the project development process.

Table 15: Recommended Geometric Design Criteria Standards

	DESIGN ELEMENT		PRINCIPAL ARTERIAL			MINOR ARTERIAL		
			URBAN			URBAN		
			CURBED	UNCURBED	RURAL	CURBED	UNCURBED	RURAL
Design Controls	Design Forecast Year (Geometrics)		20 Years			20 Years		
	Design Speed[i]		40-45 mph	40-50 mph	70 mph	35 mph		60 mph
	Level of Service		Desirable: B Minimum: C		B	Desirable: B Minimum: C		B
Roadway Elements	Travel Lane Width[i]		12’			11’		12’
	Shoulder Width[i]		Varies			0’	4’	Varies
	Cross Slope[i]		2%			2%		
	Median Width		n/a		Varies	n/a		Varies
	TWLTL Width		16’		n/a	11’		n/a
Earth Cut Sections	Ditch	Inslope	n/a	Desirable: 6:1 Minimum: 4:1	6:1 Width: 10’	n/a	Desirable: 6:1 Minimum: 4:1	6:1 Width: 10’
		Width	n/a	10’ Min.		n/a	10’ Min.	
		Slope	n/a	20:1 towards back slope		n/a	20:1 towards back slope	
	Back Slope; Cut Depth at Slope Stake	0’-5’	5:1			5:1		
		5’-10’	4:1			4:1		
		10’-15’	3:1			3:1		
		15’-20’	2:1			2:1		
		>20’	1.5:1			1.5:1		
Earth Fill Slopes	Fill Height at Slope Stake	0’-10’	6:1			6:1		
		10’-20’	4:1			4:1		
		20’-30’	3:1			3:1		
		>30’	2:1			2:1		
Alignment Elements	Design Speed		40 mph	50 mph	70 mph	30 mph	40 mph	60 mph
	Stopping Sight Distance[i]		305’	425’	730’	200’	305’	570’
	Passing Sight Distance		n/a	n/a	2480’	n/a	n/a	2135’
	Minimum Radius[i]		533’	760’	1810’	250’	533’	1200’
	Superelevation Rate[i]		e_{max}=4.0%	e_{max}=8.0%		e_{max}=4.0%		e_{max}=8.0%
	Vertical Curvature[i]	Crest	44	84	247	19	44	151
		Sag	64	96	181	37	64	136
	Maximum Grade[i]		6%		3%	7%	6%	3%
	Minimum Vertical Clearance		17.0’			17.0’		

[i] *Controlling design criteria*
Source: MDT Road Design Manual, Chapter 12 Geometric Design Tables

2.3.2. Roadway Alignment

Roadway alignment can be viewed as a combination of two primary components: horizontal alignment and vertical alignment. Horizontal alignment is a measure of the degree of turns and bends in the road, and includes consideration of horizontal curvature, superelevation, curve type, and entering and passing sight distance. Geometric design criteria specific to horizontal alignment are based upon the functional classification of the roadway. Vertical alignment is a measure of the elevation change on a roadway, and includes consideration of grade, vertical curve length, vertical curve type (either a sag

curve or a crest curve), and rate of curvature (K-value). K-value is the horizontal distance needed to produce a one percent change in gradient and is directly correlated to the roadway design speed and stopping sight distance.

Limited as-built information was available for the study corridor. As-built information available and provided by MDT included the following segments:

- Yellowstone Trail – 1921 (RP 20.7 to 23.4)
- Yellowstone Trail – 1933 (RP 25 to 29.2)
- Curve Realignment 2 Miles East of Belgrade – 1996 (RP 22.8)

Aside from the 1996 as-built plans, which realigned substandard horizontal curves to meet current design standards, the 1921 and 1933 as-built information is outdated and difficult to decipher. There have been other projects along the study corridor since that time for which as-built information is unavailable. This includes the urban roadway section between Jackrabbit Lane and Grogan Street (in Belgrade), the recently completed East Belgrade Interchange and connecting roads, interim intersection improvements at Valley Center Spur Road, improvements to the intersection with Nelson Road, and the bridge crossing the MRL tracks (constructed in 1993). All of these improvements brought the roadway and associated infrastructure up to standards current at the time.

Because of the relatively straight horizontal alignment that parallels the MRL tracks, and the relatively flat nature of the surrounding topography, it is likely that the roadway meets current geometric design standards for horizontal and vertical alignment. As improvement options are developed, detailed on-site investigation should be performed to confirm alignment standards are met.

2.3.3. Roadside Clear Zone

The roadside clear zone, starting at the edge of the traveled way, is the total roadside border area available for safe use by errant vehicles. This area may consist of a shoulder, a recoverable slope, a non-recoverable slope, and/or a recovery area. The desired clear zone width varies depending on traffic volumes, speeds and roadside geometry. Clear zones are evaluated individually based on the roadside cross section. According to MDT, clear zone should be attained by removing or shielding obstacles, if costs are reasonable.

In certain instances within the study area, it may be impractical to protect or remove certain obstacles within the clear zone. As improvement options develop, roadside clear zones should be designated, to a practical extent, to meet current MDT design standards.

2.4. Safety

Crash data were provided by the MDT Traffic and Safety Bureau for the six-year period between January 1st, 2010 and December 31st, 2015. The crash reports are a summation of information collected at the scene of the crash provided by responding officers. Some of the information contained in the crash reports may be subjective. Any crash records from other law enforcement agencies that were not reported to or by the Montana Highway Patrol were not contained in the database and are not included in this analysis.

The crash locations were plotted using latitude and longitude assigned to each record. The crashes were plotted and grouped based on if they occurred at an intersection or along a roadway segment. According to the records, there were 382 crashes reported along the study corridor during the six-year analysis period. The crash records were reviewed to identify trends, contributing factors, and characteristics. The crash locations are shown in **Figure 7**. An analysis of the crash data is provided in the following sections.

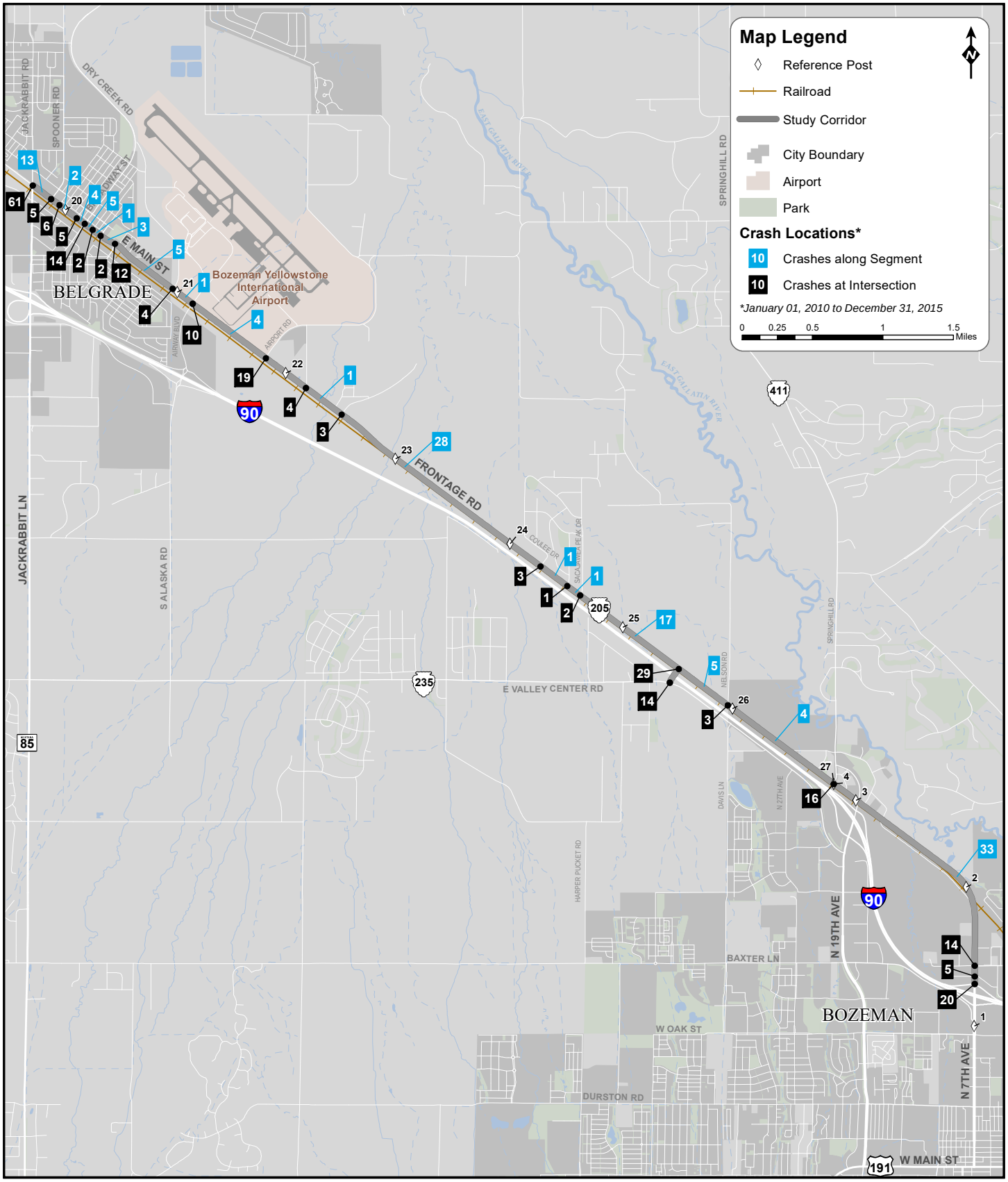

Figure 7: Crash Locations

2.4.1. Crash Type

Crash types were grouped into two categories, single and multiple vehicle crashes. Single vehicle crashes are those types that involve only one vehicle. Single vehicle crashes accounted for 27 percent (102) of all reported crashes. Of the single vehicle crashes, fixed object crashes were the most common type, followed by roll over and wild animal crashes.

Multiple vehicle crashes involve two or more vehicles. Multiple vehicle crashes accounted for 73 percent (280) of all crashes. The most common multiple vehicle crash types were rear-end and right angle crashes. **Figure 8** presents the distribution of crash types.

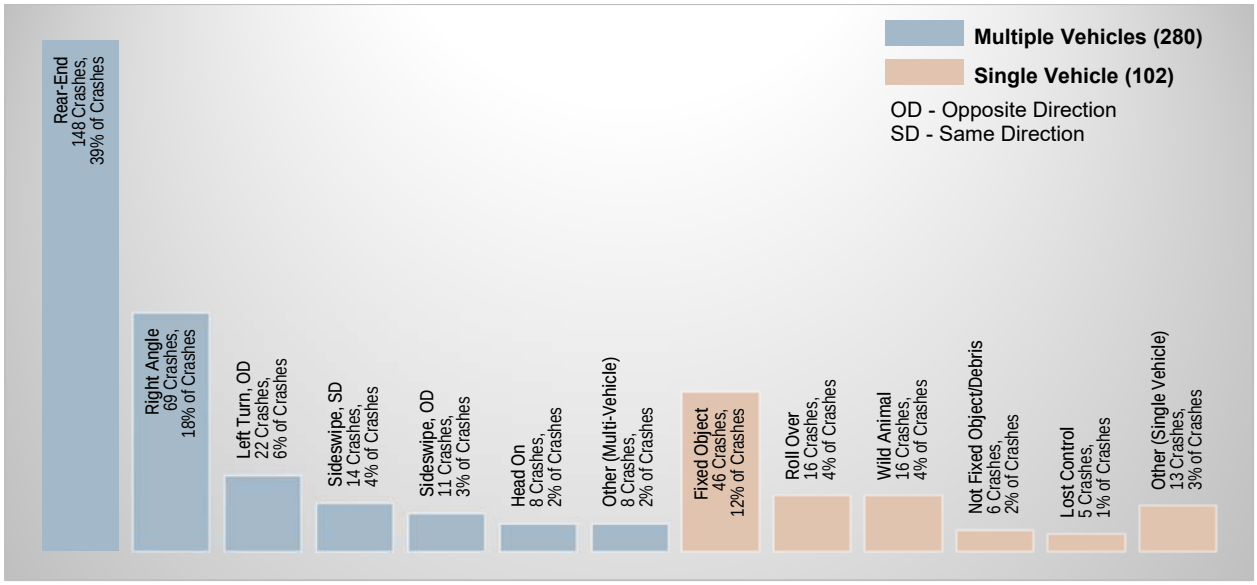

Figure 8: Crash Type

Crash types tend to be intrinsically associated with their relation to a junction (i.e. intersection or driveway). For example, multiple vehicle crashes are more common in locations near junctions. As such, analysis of relation to junction information can help to identify systemic issues within the study area. Of the 382 total reported crashes, 34 percent (131) of crashes were non-junction related. The remaining 66 percent (251) of crashes were, in some way, junction related.

2.4.2. Crash Severity

Crashes can be categorized by the severity that is reported. The most severe injury defines the severity for the crash. For example, if a crash results in a fatality and an injury, the crash would be defined as a fatal crash. Crash severity includes, from least severe to most, property damage only (PDO), possible injury, non-incapacitating evident injury, incapacitating injury, and fatal injury.

The distribution of reported crash severity is presented in **Figure 9**. There were three fatal crashes (0.8 percent) resulting in three fatalities. There were eight incapacitating injury crashes resulting in ten incapacitating injuries. The locations of severe crashes (fatal and incapacitating injury) are shown in **Figure 10**.

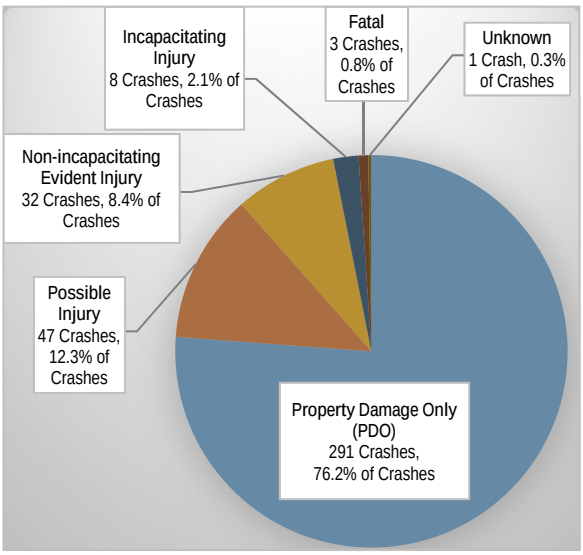

Figure 9: Crash Severity

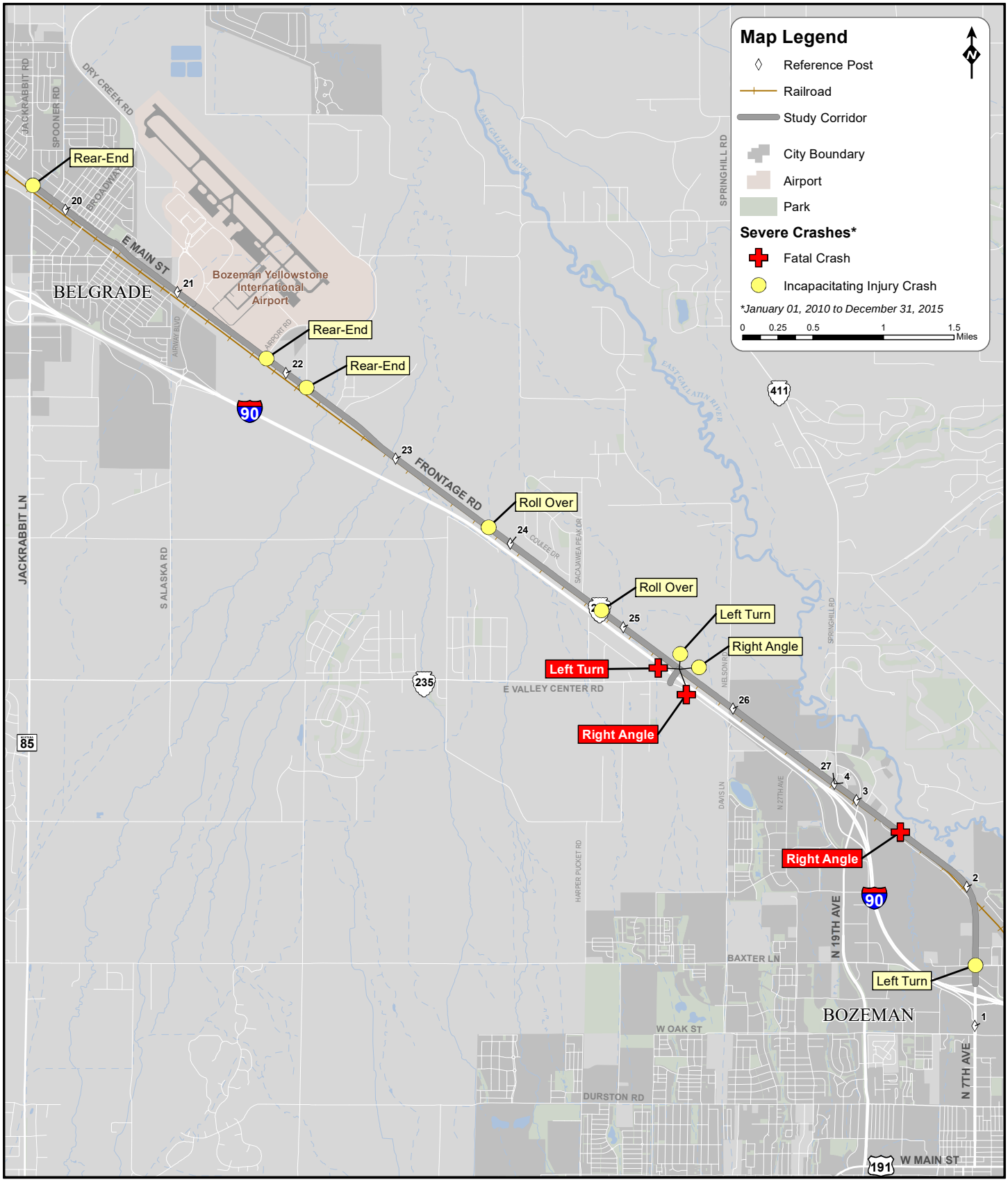

Figure 10: Severe Crashes

2.4.3. Crash Period

Each crash record includes the date and time when the crash occurred. These data can be used to determine seasonal and other time dependent trends. Time of day data was analyzed to determine if any specific trends were present. The data were plotted based on the hour the crash occurred and whether the crash occurred on a weekday or weekend. For weekday crashes (83 percent of all crashes), two peaks are apparent. One peak occurs between 7:00 and 8:00 AM which accounted for 9 percent of weekday crashes. The remaining peak occurs between 3:00 and 7:00 PM, accounting for 35 percent of crashes. For the weekend crashes (17 percent of all crashes), peak periods were less defined. **Figure 11** presents the distribution of crashes with respect to the time of day that the crashes occurred.

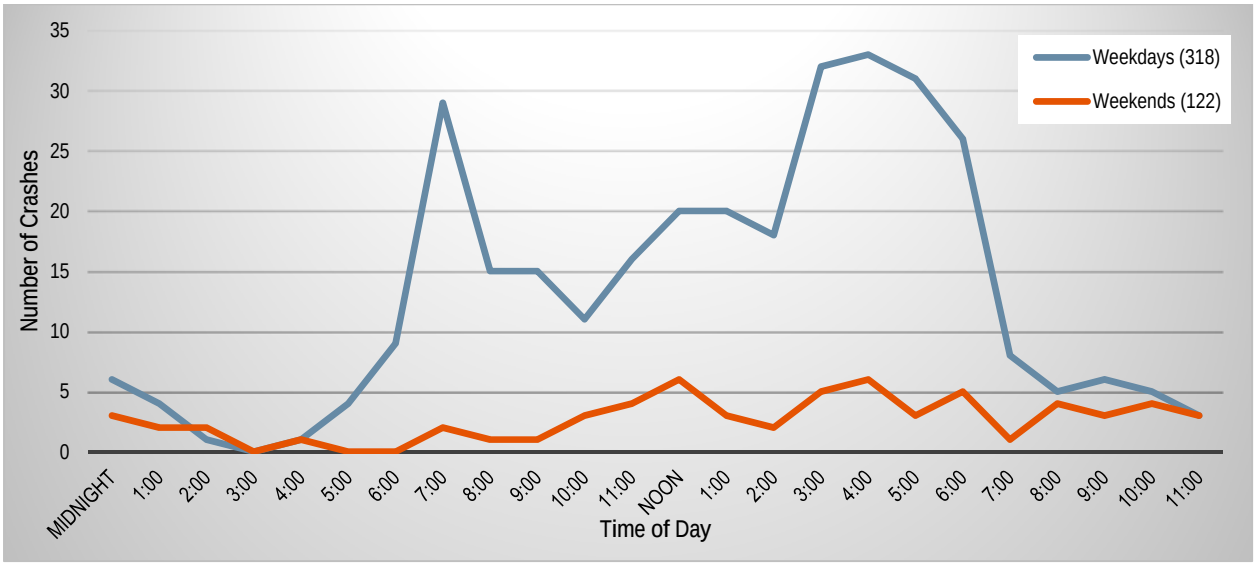

Figure 11: Crash Statistics for Time of Day

The frequency of crashes occurring on a given day and during each month were potted in **Figure 12**. As shown in the figures, the crashes were generally distributed throughout the week, with the fewest crashes occurring on a Sunday. Small peaks were observed during the early winter months and later summer. Between November and the end of January, there were 125 crashes (33 percent). There were 73 crashes (19 percent) in August and September.

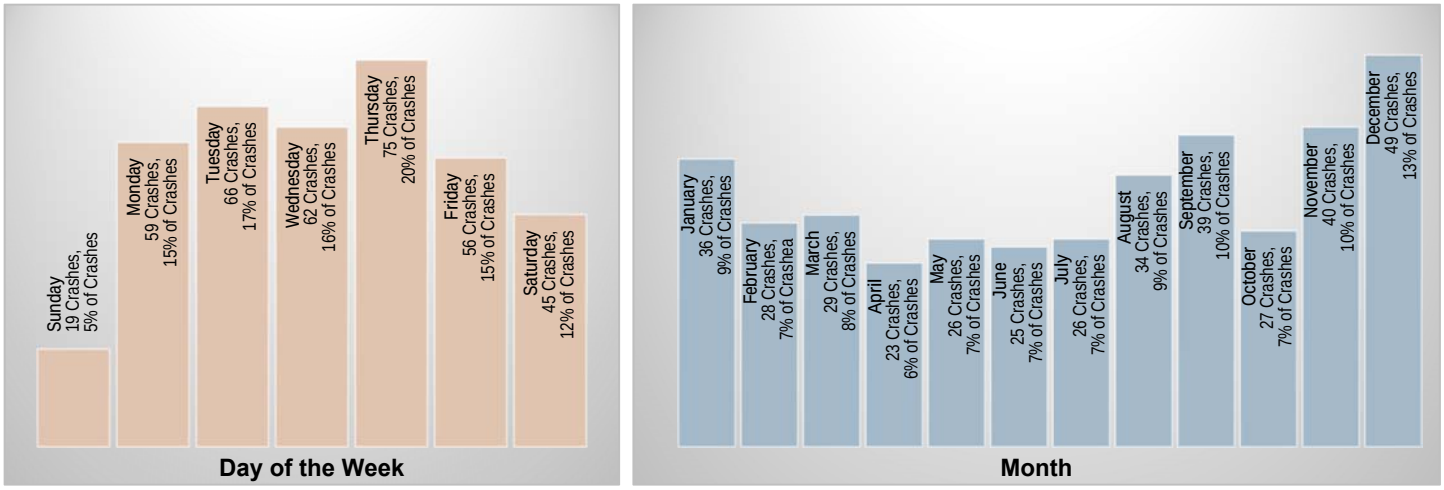

Figure 12: Crash Statistics for Day of the Week and Month

2.4.4. Environmental Factors

Each crash record includes information relating to environmental factors such as roadway surface, weather, and lighting conditions. This information was analyzed to determine in any trends exist. The road condition was reported as dry for 252 (66 percent) crashes. Daylight conditions were reported for 279 (73 percent) crashes. With respect to weather conditions, clear weather was reported for 218 (57 percent) crashes. **Table 16** details the relationship between the three environmental factors – weather, road, and lighting. **Figure 13** presents the distribution of crashes based on environmental factors.

Table 16: Relationship between Environmental Factors

ROAD CONDITION	WEATHER					
LIGHTING	CLEAR	CLOUDY	SNOW	RAIN	OTHER	TOTAL
Dry	**180**	**69**	**2**		**1**	**252**
Daylight	*140*	*58*			*1*	*199*
Dark-Lighted	*15*	*5*	*2*			*22*
Dark-Not Lighted	*20*	*3*				*23*
Other	*5*	*3*				*8*
Ice/Frost	**21**	**15**	**15**		**2**	**53**
Daylight	*15*	*7*	*7*		*1*	*30*
Dark-Lighted	*2*	*3*	*5*		*1*	*11*
Dark-Not Lighted	*3*	*3*	*2*			*8*
Other	*1*	*2*	*1*			*4*
Snow	**7**	**8**	**21**			**36**
Daylight	*5*	*6*	*12*			*23*
Dark-Lighted	*1*	*2*	*5*			*8*
Dark-Not Lighted	*1*		*4*			*5*
Wet	**6**	**11**	**2**	**11**	**1**	**31**
Daylight	*2*	*8*	*1*	*8*	*1*	*20*
Dark-Lighted		*2*		*2*		*4*
Dark-Not Lighted	*3*	*1*	*1*	*1*		*6*
Other	*1*					*1*
Other	**4**	**1**	**3**		**2**	**10**
Daylight	*4*	*1*	*2*			*8*
Dark-Not Lighted			*1*			*1*
Other					*2*	*2*
Total	**218**	**104**	**43**	**11**	**6**	**382**

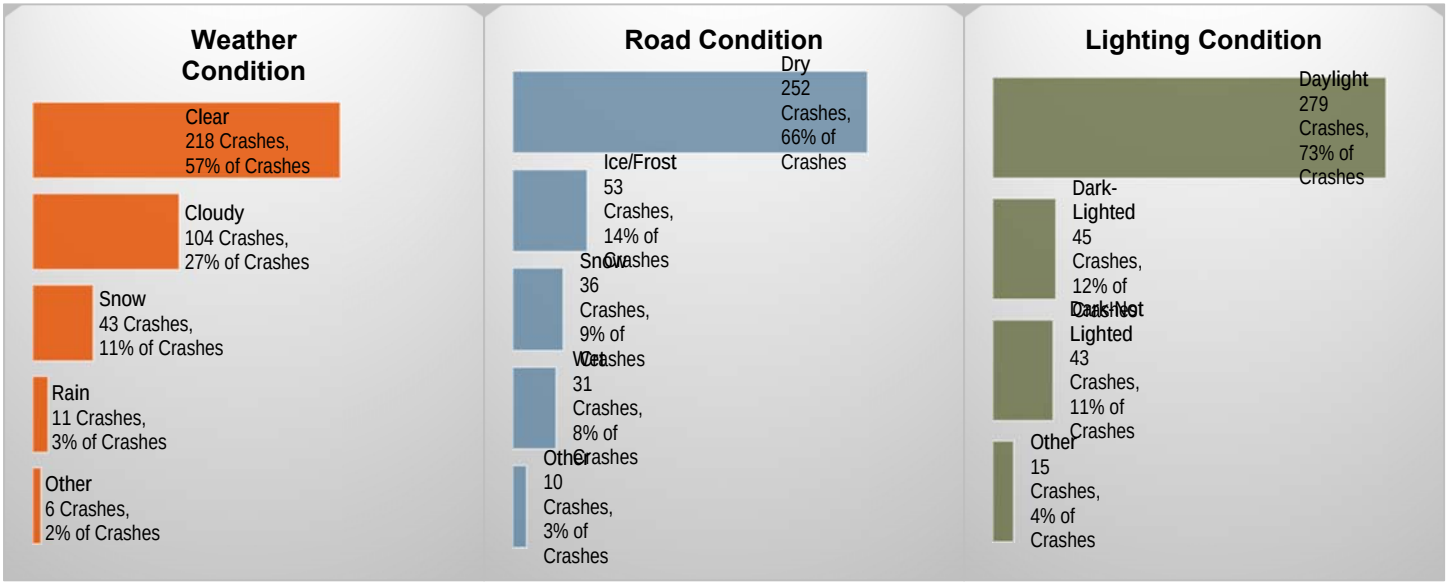

Figure 13: Environmental Factors

2.4.5. Driver Details

Driver gender and age were analyzed to identify any trends that may be present in the data set. Note that in multi-vehicle crashes there are two or more drivers, therefore the total number of drivers exceeds the total number of crashes. A total of 679 drivers were involved in the 382 reported crashes. Male drivers accounted for 361 (53 percent) drivers, while females accounted for 306 (45 percent) drivers. The remaining 12 (2 percent) drivers where reported as unknown gender.

With respect to driver's age, it was found that the average age of drivers was 38 years. The youngest and oldest drivers were reported as 15 and 90 years, respectively. Drivers younger than 20 years accounted for 102 (15 percent) drivers. The age distribution and gender of drivers involved in the reported crashes is shown in **Figure 14**.

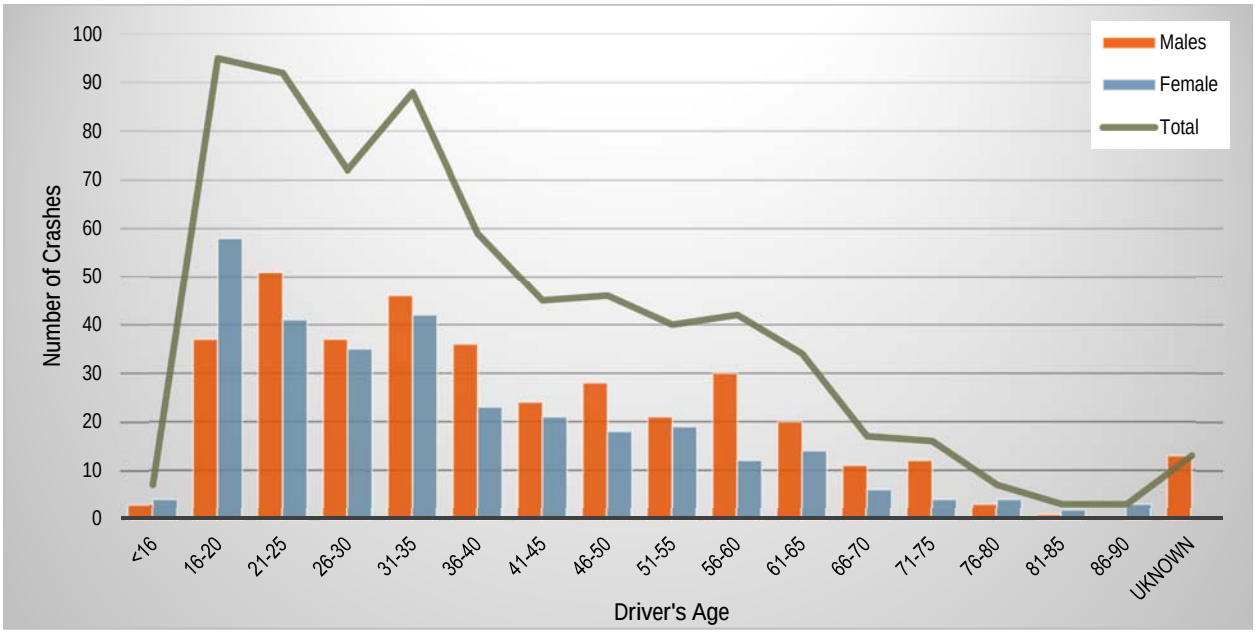

Figure 14: Driver's Age and Gender

2.4.6. Vehicle Details

A total of 689 vehicles were involved in the 382 reported crashes. The number of vehicles does not match the number of reported drivers due to bicyclists not being listed as drivers and some vehicles listed as "other" may not have a listed driver. Of the 689 vehicles involved in crashes, passenger vehicles accounted for 649 (94 percent). There were 16 heavy vehicles involved in crashes (2 percent) and 3 low speed vehicles (bicycles).

2.4.7. Crash Trends

Identification of crash trends based on the supplied data can help identify areas of concern and can inform possible mitigation options. Within the study area, multiple trends were identified. These trends vary based on type of crash, cluster location, and other factors. The following sections overview the identified trends.

Total Crashes

Crash clusters based on total number of crashes occurring in a given area were identified throughout the study area. These clusters tend to be located in areas with higher traffic volumes and at or near intersections. Between Jackrabbit Lane and Oregon Street, a total of 135 crashes were reported. This area is urban in character and represents a section of the corridor with higher traffic volumes. In the

area surrounding the Valley Center Spur Road, a total of 46 crashes were reported. Again, this intersection is a location with high traffic volumes. Two other locations appear to have total crash clusters, Springhill Road and Griffin Drive with 18 and 41 reported crashes, respectively.

Rear-end Crashes

Rear-end crashes are more common in urban areas and near intersections. Rear-end crashes may be indicative of the need for improved traffic control or roadway geometrics. Between Jackrabbit Lane and Broadway Street, 66 rear-end crashes were reported. This section of the corridor is urban in nature with a large number of intersections and access points. The area surrounding Griffin Drive had 19 reported rear-end crashes. The area surrounding Airport Road had 11 reported rear-end crashes. Corridor wide, 102 of the 148 reported rear-end crashes (69 percent) occurred on dry roads.

Right Angle Crashes

Right angle crashes tend to occur in areas with higher traffic and high access density. Right angle crash clusters were identified between Jackrabbit Lane and Oregon Street with 28 crashes, the area surrounding Airport Road with 4 crashes, the area surrounding Valley Center Spur Road with 11 crashes, and the area surrounding Griffin Drive with 4 crashes. Each of these clusters is located at or near an intersection or access point.

Roadway conditions can be a factor in right-angle crashes. It was reported that corridor wide, 46 of the 69 right angle crashes (67 percent) occurred under dry roadway conditions.

Junction and Non-junction Related Crashes

Junction crashes include those in, or related to intersections or driveways. Junction crashes tend to be multi-vehicle crashes, conversely, non-junction related crashes tend to be single vehicle crashes. There were 254 junction crashes and 128 non-junction or segment crashes. This finding can be compared to the total number of multiple vehicle crashes at 280 and single vehicle crashes at 102 crashes.

Clusters of fixed object crashes were noted at many of the major intersections along to corridor. Of specific note is the cluster of four fixed object crashes near Nelson Road. Non-junction related crashes often include run-off-the-road crashes which are reported as roll-over, fixed object, and lost control type crashes. Between Dollar Drive and Sacajawea Peak Drive, 21 crashes were reported as either fixed object (10 crashes), lost control (3 crashes), or roll over crashes (8 crashes).

Urban versus Rural Crashes

In general, urban areas tend to see a higher percentage of crashes involving multiple vehicles. This is due to higher amounts of exposure to conflicts with vehicles. Conversely, rural areas tend to have higher percentages of single vehicle crashes. Within the study corridor there are two areas defined as urban, within Belgrade and within Bozeman. Between Belgrade and Bozeman, the corridor is considered rural. An evaluation of the number of single and multiple vehicle crashes was made for the urban and rural segments. Crashes within the urban areas accounted for just over half of all crashes along the corridor. Within the urban areas, over 87 percent of crashes involved two or more vehicles. Along the rural segments, multiple vehicle crashes accounted for 58 percent of reported crashes. The distribution of crashes along the urban and rural segments is shown in **Table 17**.

Table 17: Crashes within Urban and Rural Areas

TYPE	URBAN SEGMENTS		RURAL SEGMENTS	
Single Vehicle	26	12.9%	76	42.0%
Multiple Vehicle	175	87.1%	105	58.0%
Total	**201**	**52.6%**	**181**	**47.4%**

3.0. ENVIRONMENTAL SETTING

This section provides a summary of the *Environmental Scan*[14]. The primary objective of the *Environmental Scan* is to provide a planning-level overview of resources and to determine potential constraints and opportunities within the study area. As a planning-level scan, the information was obtained from various publicly available reports, websites, and other documentation, as well as a "windshield survey" conducted by MDT staff. The scan is not a detailed environmental investigation. Information in the scan is accurate as of May, 2015. Further analysis may be necessary during project development. Refer to the MDT *Environmental Scan* for more detailed information.

If improvement options are forwarded from this study into project development, an analysis for compliance with the National and Montana Environmental Policy Acts (NEPA and MEPA) will be completed as part of the project development process. Information provided in the Environmental scan may be included in the NEPA/MEPA process at that time.

3.1. PHYSICAL ENVIRONMENT

The following subsections present an overview of items related to the physical environment.

3.1.1. Soil Resources and Prime Farmland

Information obtained on soils is used to determine the presence of prime and unique farmland in the study area to demonstrate compliance with the Farmland Protection Policy Act (FPPA). Farmland includes prime farmland, some prime if irrigated farmland, unique farmland, and farmland (other than prime or unique farmland) that is of statewide or local importance. Prime farmland soils are those that have the best combination of physical and chemical characteristics for producing food, feed, and forage: the area must also be available for these uses. Prime farmland can be either non-irrigated or lands that would be considered prime if irrigated. Farmland of statewide importance is defined as follows: land, in addition to prime and unique farmlands, that is of statewide importance for the production of food, feed, fiber, forage, and oilseed crops.

Soil surveys of the study area are available from the United States Department of Agriculture (USDA) Natural Resources Conservation Services (NRCS). NRCS soil surveys indicate the presence of farmland of state or local importance, or prime farmland if irrigated within the study area. From approximately RP 22.5 to the east, the study area has a high percentage of farmland of state or local importance or prime farmland if irrigated. Some of this land has already been developed and is no longer subject to the FPPA.

If a federally funded improvement option forwarded from this study requires acquisition of land from these areas, MDT will have to complete a CPA-106 Farmland Conservation Impact Rating Form for Linear Projects and coordinate with NRCS. NRCS will use information from that form to keep an inventory of the prime and important farmlands within the state.

3.1.2. Geologic Resources

Information on the geology and seismicity in the study area was obtained from several published sources. Geologic mapping was reviewed for rock type, the presence of unconsolidated material, and fault lines. The seismicity and potential seismic hazards were also reviewed. This geologic information can help determine potential design and construction issues related to embankments and road design.

In the study area well rounded, poorly graded boulder gravel and sand, with some thin beds of clayey silt, are commonly encountered. Many gravel pits are adjacent to the study area. The majority of soils along the corridor are sandy gravel with cobbles and minor amounts of clay and silt. The soils west of Aajker Creek exhibit high corrosion potential for steel, and variable potential to the east. Corrosion potential for concrete is generally low throughout the study area.

Additionally, the Gallatin Valley consistently has an organic lean clay layer, which can be problematic for construction and long-term stability if not accounted for during design. The organic clay soils as the topmost layer should help to promote quick revegetation. If an area lacking a topsoil layer is encountered, the sandy gravel layer will be exposed and extra care will be required to provide vegetative soil stabilization.

Improvements brought forward from the study will be subject to a more detailed analysis of the aforementioned geotechnical risk factors. Part of this detailed analysis may involve taking advance borings to evaluate soil characteristics at exact project locations. This is standard procedure for most MDT road projects. The design of any improvements should consider specific requirements that come from the detailed analysis.

3.1.3. Surface Water

Topographic maps and GIS data were reviewed to identify the location of surface water bodies such as rivers, streams, lakes, and reservoirs within the study area. There are five streams and three irrigation ditch crossings within the study area.

Effects on water bodies near the study area will have to be identified and coordinated with applicable agencies during any future project design. Permitting may be required for improvement options involving construction in or near waterways. Coordination with federal, state, and local agencies would be necessary to determine the appropriate permits based on choice of improvement options forwarded from this study. Impacts should be avoided and minimized to the maximum extent practicable.

Total Maximum Daily Loads

Section 303 subsection “d” of the Clean Water Act requires the state of Montana to develop a list, subject to the United States Environmental Protection Agency (USEPA) approval, of water bodies that do not meet water quality standards. When water quality fails to meet state water quality standards, the Department of Environmental Quality (DEQ) determines the causes and sources of pollutants in a sub-basin assessment and set maximum pollutant levels called total maximum daily loads (TMDL).

TMDLs set by DEQ become the basis for implementation plans to restore water quality to a level that supports state designated beneficial water uses. The implementation plans identify and describe pollutant controls and management measures to be undertaken (such as best management practices), the mechanisms by which the selected measures would be put into action, and the individuals and entities responsible for implementation projects.

DEQ lists both Hyalite Creek and Mandeville Creek as having impairments. Both water bodies are category 4A, defined as waters where one or more applicable beneficial uses are impaired or threatened, and a TMDL has been completed to address the factors causing the impairment or threat. For Hyalite Creek inside the study area, probable sources of impairment are irrigated crop production, leaking underground storage tanks, managed pasture grazing, and natural sources. Mandeville Creek probable sources of impairment are municipal point source discharges, municipal (urbanized high-density area), and residential districts. Currently the probable sources of impairments are not listed as being associated with road construction activities. That said, if improvement options are advanced, it will be necessary to reevaluate the 303(d)/305(b) integrated report for changes to listed impairments along with possible changes to TMDLs on a project level if a project is forwarded from this study.

Storm water

The eastern end of the corridor is located within the Bozeman Municipal Separate Storm Sewer System (MS4) area. Under the current Small MS4 General Permit, new development or redevelopment projects greater than or equal to one acre in size must implement, when practicable, low impact development practices that infiltrate, evapo-transpire, or capture for reuse the runoff

generated from the first half-inch of rainfall from a 24-hour storm preceded by 48 hours of no measurable precipitation.

The City of Bozeman and MDT both manage MS4 programs that overlap the study area. Each program has specific requirements based on their individual Storm Water Management Plans. These and other MS4 issues will need to be further evaluated during any future project design. The current MS4 permit is in the process of being reissued and MDT has applied for an Individual MS4 permit. As such, it is likely the permit requirements will be slightly different in the future.

Wild and Scenic Rivers

The Wild and Scenic Rivers Act, created by Congress in 1968, provided for the protection of certain rivers, and their immediate environments, that possess outstandingly remarkable scenic, recreational, geologic, fish and wildlife, historic, or cultural resources, or similar values. Based on a review of the United States National Park Service website, none of the waterways within the study area carry the wild and scenic designation.

3.1.4. Groundwater

There are 16,770 wells on record in Gallatin County. Within the study area, there are numerous domestic wells and seven public water supply wells. Wells can be a costly item to mitigate if they are not avoided. Mitigation of a well usually involves drilling a new well for the owner in a new location that will not be impacted by the potential project. Well costs are based on per foot price; the deeper and higher volume needed results in a higher cost. In addition, there is a 100-foot setback requirement for public water supply wells in which no source of pollutant can be located. Public water supply wells can also be deeper and require a higher volume of water to be discharged. This can translate into a more expensive well to replace, along with affecting larger number of users compared to a private well if impacted. Impacts on existing wells should be considered if a project is forwarded from this study.

3.1.5. Wetlands

The U.S. Army Corps of Engineers (USACE) defines wetlands as those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas.

Based on review of available information, potential wetlands are present within the study area. Future wetland delineations would be required if improvement options are forwarded from this study that could potentially impact wetlands. Future projects in the study area would need to incorporated project design features to avoid and minimize adverse impacts to wetlands to the maximum extent practicable. Unavoidable impact to wetlands must be compensated through mitigation in accordance USACE regulatory requirements and/or requirements of Executive Order 11990. The need for any stream or wetland mitigation would be identified and secured prior to the permitting process if a project was forwarded from this study.

3.1.6. Floodplains and Floodways

Executive Order 11988, Floodplain Management, requires federal agencies to avoid to the extent possible, the long- and short-term adverse impacts associated with the occupancy and modification of floodplains, and to avoid direct and indirect support of floodplain development wherever there is a practicable alternative. Federal Emergency Management Agency-issued flood maps for Gallatin County indicate that flood plain zones exist within or are adjacent to the study area.

If roadway improvements or developments could involve placement of fill within the regulatory flood plain then a flood plain permit would be required. Project development would then require coordination

with Gallatin County to minimize flood plain impacts and obtain necessary floodplain permits for project construction. As only Zone X (outside the 500-year flood) cross into the study area, this should not impact possible improvements but should be reevaluated if a project is forwarded.

3.1.7. Irrigation

Irrigated agriculture land exists within the study area. Depending on the improvement option(s) proposed during the study, there is potential to impact irrigation facilities. Impacts to irrigation facilities should be avoided when practicable. Future modifications to existing irrigation canals, ditches, or pressurized systems could require redesigning and constructing in consultation with the owners to minimize impacts to agricultural operations. If there is impact to irrigation structures, there could be additional costs above typical project costs associated with the redesign or moving of the irrigation structure(s).The available Water Resources Survey data indicate that there is an abundance of water rights and agriculture land use throughout the study area. There are a large number of irrigation structures not easily identified at the high-level review appropriate for this study. An in-depth review for irrigation structures would occur at the project development stage to identify possible impacts if a project is forwarded from this study.

3.1.8. Air Quality

The USEPA designates communities that do not meet National Ambient Air Quality Standards (NAAQS) as “non-attainment areas”. States are the required to develop plans to control source emissions and ensure future attainment of NAAQS. The study area is not located in a non-attainment area for any of the criteria pollutants. Additionally, there are currently no non-attainment areas nearby. As a result, special design considerations are likely not required in future project design to accommodate NAAQS non-attainment issues.

Depending on the scope of improvements forwarded in the study area, an evaluation of mobile source air toxics (MSATs) may be required. MSATs are compounds emitted from highway vehicle and off-road equipment, which are known or suspected to cause cancer or other serious health and environmental effects.

3.1.9. Hazardous Substances

The NRIS and Montana Board of Oil and Gas databases were searched for information on underground storage tank sites, leaking underground storage tank sites, abandoned mine sites, remediation response sites, landfills, National Priority Lists sites, hazardous waste, crude oil pipelines, and toxic release inventory sites. There were no abandoned mines sites, National Priority List sites, oil and gas production wells, or toxic release inventory sites identified within the study area. At this time, none of the hazardous substances sites are expected to be “must avoid” locations or drivers of the ultimate project design. However, if a project were to overlap a hazardous substance site, a soil investigation would likely be needed. If contaminated soils are present, a special provision regarding handling contaminated soils is recommended to be included in project documentation. In addition, the contaminated soils could result in the need for remediation.

3.2. Biological Environment

The following information applies to the biological environment within the study area and reflects a baseline natural resource condition. Depending on the level of detail available through the high-level baseline scan, some of the information is presented at the country level, some at the study area level, and some at the corridor level.

3.2.1. Vegetation

According to the Montana Natural Heritage Program Land Cover Report, the dominate land cover type in the study area is a combination of high and light intensity residential development which is shown by human land use being 71 percent of land cover. Typically, any drainages within the study area are lined with deciduous riparian vegetation and some wetlands. The majority of the different land types in the study area are either moderately or highly disturbed.

If improvement options are forwarded from the study, practice outlined in MDT standard specifications should be followed to minimize adverse impact to vegetation and facilitate establishment of final stabilization of disturbed areas. Removal of mature trees and shrubs should be limited to the extent practicable.

3.2.2. Noxious Weeds

Noxious weeds can degrade native vegetative communities; damage riparian areas; compete with native plants; create fire hazards; degrade agricultural and recreational lands; pose threats to the viability of livestock, humans, and wildlife; and are expensive to manage. Areas with a history of disturbance, like highway right-of-ways, are at particular risk of weed encroachment.

The Invaders Database System lists 262 exotic plant species and 49 noxious weed species in Gallatin County, some of which may be present in the study area. Gallatin County has weed management criteria in place that can be found on their website.

Reseeding of disturbed areas with desirable native plant species will help to reduce the spread and establishment of noxious weeds and to re-establish permanent vegetation. If improvements are forwarded from this study, field surveys for noxious weeds should take place prior to any ground disturbance and coordination with the Gallatin County Weed Board should occur. Proposed projects should incorporate the practices outlined in MDT standard specifications to minimize adverse impacts.

3.2.3. General Wildlife Species

The following subsections present an overview of the mammals, fish, birds, and amphibians and reptiles that may be found in or near the study area.

Mammals

Wildlife species inhabiting or traversing the study area are typical of those that occur in moderately developed areas of southwest Montana. Since many species in this area are habituated to somewhat disturbed areas and are tolerant of moderate levels of development, species present in this area are predominately, though not exclusively, generalists. Mammal species present, but not limited to, the study area include whitetail and mule deer, coyote, red fox, porcupine, raccoon, striped skunk, badger, beaver, muskrat, Richardson's ground squirrel, deer mouse, vole species, and a variety of bat species. Black bear, bobcat, mountain lion, and wolf may also occur as transients through the study area on occasion. Moose may occasionally occur along the drainages and riparian areas in proximity to the study area.

Whitetail and mule deer are prevalent in the study area, traversing between the riparian corridors and agricultural fields for daily resource needs, and a resident migrants. A review of the MDT Maintenance Animal Incident Database between January 1st, 2009 and December 31st, 2013, indicates that 27 animal carcasses were collected throughout the length of the corridor. The reported carcasses were all deer, mostly whitetail deer. If improvement options are forwarded from this study, the need for and viability of wildlife crossing mitigation measures should be explored during the project development phase.

Fisheries

There are four perennial streams in the study area listed as providing suitable habitat for an array of cold-water species. Other unnamed stream crossings exist that could also support fish species within the study area. Permitting from regulatory agencies for any future study areas improvements will require incorporation of design measures to facilitate aquatic species passage.

Birds

The MNHP Natural Heritage Tracker database indicates a variety of birds have been documented with the potential to occur and nest in the study area. These species include representative songbirds, birds of prey, waterfowl, owls, and shorebirds. Additionally, game birds including the gray (Hungarian) partridge, pheasant, and sharp-tailed grouse have habitat present in the study area. The study area provides marginal habitat for migratory birds which may nest in the mature trees or move through the area as seasonal migrants.

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA). Under this strict liability law, it is unlawful to pursue, hunt, take, capture, or kill; attempt to take, capture, or kill; possess; offer to sell, barter, purchase, deliver; cause to be shipped, exported, imported, transported, carried, or received any migratory bird, part, nest, egg, or product, manufactured or not. Direct disturbance of a nest occupied with birds or eggs is prohibited under the law. The destruction of unoccupied nest of eagles; colonial nesters such as cormorants, herons, and pelicans; and some ground/cavity nesters such as burrowing owls or bank or cliff swallows may also be prohibited under the MBTA.

There are multiple bald eagle nest which occur within the general proximity of the study area. However, currently the half-mile buffer areas around these nest do not cross into the study area. The study area is not typical golden eagle habitat, so the presence of golden eagle nests is unlikely.

Any improvements forwarded form this study should consider potential constraints that may result from nesting/breeding periods of migratory birds and presence of unknown or future bald and golden eagle nest. If a project is forwarded that involves tree and shrub removal and/or structure replacement or rehabilitation must be conducted in compliance with MBTA, which may entail a timing restriction between April 15th and August 15th.

Amphibians and Reptiles

The presence of amphibians and reptiles in the study area is likely limited by a lack of suitable habitat and level of development. Common species may occur in low numbers along irrigation facilities, drainages, and within wetland areas. Any improvements forwarded from the study should take into consideration and minimize impacts to amphibian and reptile habitat where practicable.

Crucial Area Planning System

The Montana Fish, Wildlife, and Parks (FWP) Crucial Planning System (CAPS) is a resource intended to provide non-regulatory information during early planning stages of projects, conservation opportunities, and environmental review. The finest data resolution within CAPS is at the square-mile section scale or water body. Use of these data layers at a more localized scale is not appropriate and may lead to inaccurate interpretations since the classification may or may not apply to the entire square-mile section.

CAPS provides general and specific recommendations for transportation projects for both terrestrial and aquatic species and habitats. These recommendations from CAPS can have a generic application to possible project locations moving forward from the study. Coordination with FWP wildlife biologists should occur if a project is forwarded from this study.

3.2.4. Threatened and Endangered Species

The U.S. Fish and Wildlife Service (USFWS) maintains the federal list of threatened and endangered species. Species on this list receive protection under the Endangered Species Act. An "endangered" species is in danger of extinction throughout all or a significant portion of its range. A "threatened" species is likely to become endangered in the foreseeable future. The USFWS also maintains a list of species that are candidates or proposed for possible addition to the federal list. As of May, 2015, the following six threatened, endangered, proposed, or candidate species are listed as occurring in Gallatin County according to USFWS:

- Greater Sage-Grouse (Candidate)
- Sprague's Pipit (Candidate)
- Whitebark Pine (Candidate)
- Grizzly Bear (Threatened)
- Canada Lynx (Threatened and Critical Habitat)
- Ute Ladies' Tresses (Threatened)

The Montana Natural Heritage Program – Natural Heritage Map Viewer database records and maps documented observations of species in a known location. According to the database, there are no records of any threatened, endangered, proposed, or candidate species within the study area. Due to the lack of suitable habitat resulting from the level of development in the study area, density of roads, and presence of the interstate and railroad, it is not anticipated that any of the listed species occurring in Gallatin County would normally occur in the study area. It is anticipated that any project forwarded from this study would result in a *"no effect"* determination for listed species in Gallatin County.

If improvements are forwarded from this study, an evaluation of potential effects to threatened and endangered species will need to be completed during the project development process. As the federal status of protected species changes over time, reevaluation of the listed status and afforded protection to each species should be completed prior to issuing a determination of effect relative to potential impacts.

3.2.5. Species of Concern

Montana species of concern (SOC) are native plants or native animals breeding in the stat that are considered to be "at risk" due to declining population trends, threats to their habitats, and/or restricted distribution. Designation of a species as a Montana SOC is not a statutory or regulatory classification. Instead, these designations provide a basis for resource managers and decision-makers to direct limited resources to priority data collection needs and address conservation needs proactively.

A search of the MNHP species of special concern database in May, 2015 revealed eleven SOC in Gallatin County that have the potential to occur and breed in the study area based on presence of suitable habitat. These species are as follows:

Mammals

- **Little Brown Myotis** – Documented presence in study area; found in variety of habitats including structures

Birds

- **Bobolink** – Historic record 1911; far western edge of range; tall grass specialist, "old" hay fields.
- **Bald Eagle** – Four active nests located between 1.0 and 3.0 miles from the study area.
- **Great Blue Heron** – Cottonwood galleries in riparian corridors of rivers and lakes; urban wetlands.

- **Pacific Wren** – Large uncut stands of old-growth and mature coniferous forests; riparian cottonwoods and aspens.
- **Veery** – Riparian forests with moderate disturbance and denser understory; willow thickets and cottonwood galleries along streams and lakes.

Insects

- **Hooked Snowfly** – Found along creeks and rivers; small winter stonefly; shredder-detritivore; 1977 last record

Mussels/Clams

- **Western Pearlshell Mussel** – East Gallatin River north of Bozeman; cold running streams, low-mod gradient, stable sand or gravel substrates.

Plants

- **Small Drop Seed** – Historic record 1941; dry packed soil at road crossing of railroad track in Belgrade area.
- **Slender Wedgegrass** – Historic record unknown; prefers wet sites often in disturbance-prone settings.
- **Rocky Mountain Twinpod** – Historic record 1899; sandstone ledges in Bozeman area.

A thorough field investigation for the presence and extent of these species should be conducted if improvement options are forwarded from this study. If present, special conditions that apply to the project design and/or during construction such as timing restrictions should be considered to avoid or minimize impacts to these species.

3.3. Social and Cultural Environment

The following subsections present an overview of the social and cultural environment within the study area.

3.3.1. Population Demographics and Economic Conditions

Under NEPA/MEPA and associated implementing regulations, state and federal agencies are required to assess potential social and economic impacts resulting from proposed actions. FHWA guidelines recommend consideration of impacts to neighborhoods and community cohesion, social groups including minority populations, and local and/or regional economies, as well as growth and development that may be induced by transportation improvements. Demographic and economic information presented in this section is intended to assist in identifying human populations that might be affected by improvements within the study area.

Title VI of the United States Civil Rights Act of 1964, as amended (USC 2000(d)) and Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-income Populations, require that no minority, or by extension, low-income person shall be disproportionately adversely impacted by any project receiving federal funds. For transportation projects, this means that no particular minority or low-income person may be disproportionately isolated, displaces, or otherwise subjected to adverse effects. If a project is forwarded from the improvement option(s), environmental justice will need to be further evaluated during the project development process.

According to the United States Census Bureau's estimate, Gallatin County had a population of 94,720 people in 2013, and was the 3rd most populous county in Montana. Bozeman, the 4th largest city in the state, had a population of 39,860, with Belgrade coming in 13th at 7,620. As presented in **Figure 15**, Gallatin County has experienced large growth in population over the last 25 years, from around 50,000

in 1990 to nearly 95,000 in 2015 and that trend is likely to continue. Montana State University, Big Sky Resort, Yellowstone National Park, and a thriving high tech industry are the key drivers of population and economic growth in Gallatin County. As shown in **Figure 16**, Gallatin County population growth has outpaced Montana over the last 15 years and that trend is projected to continue.

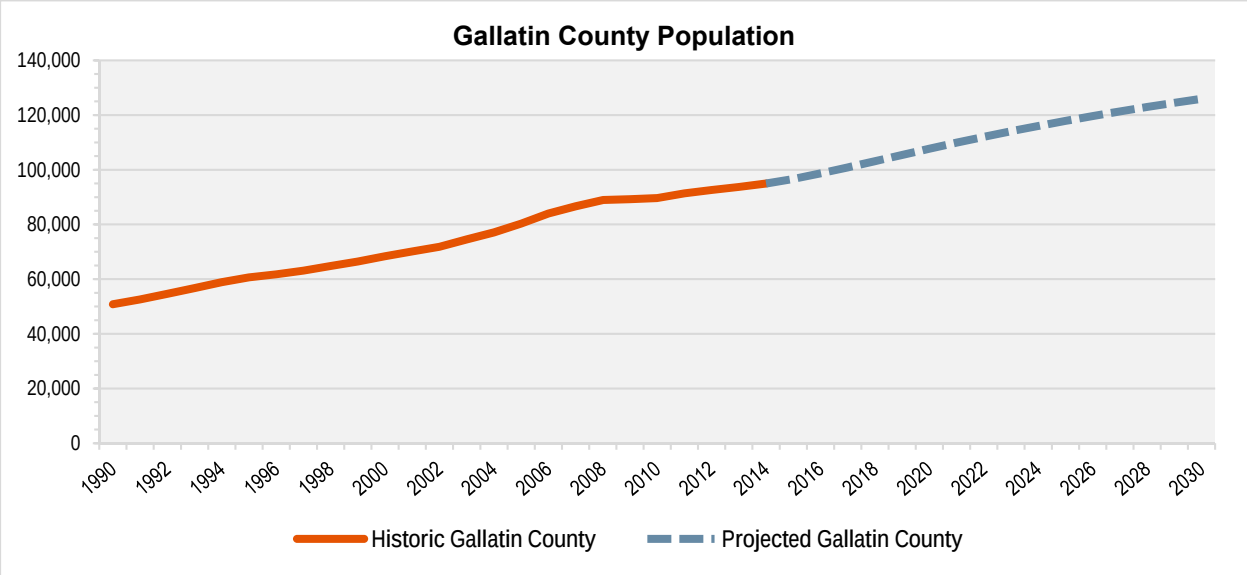

Figure 15: Gallatin County Population

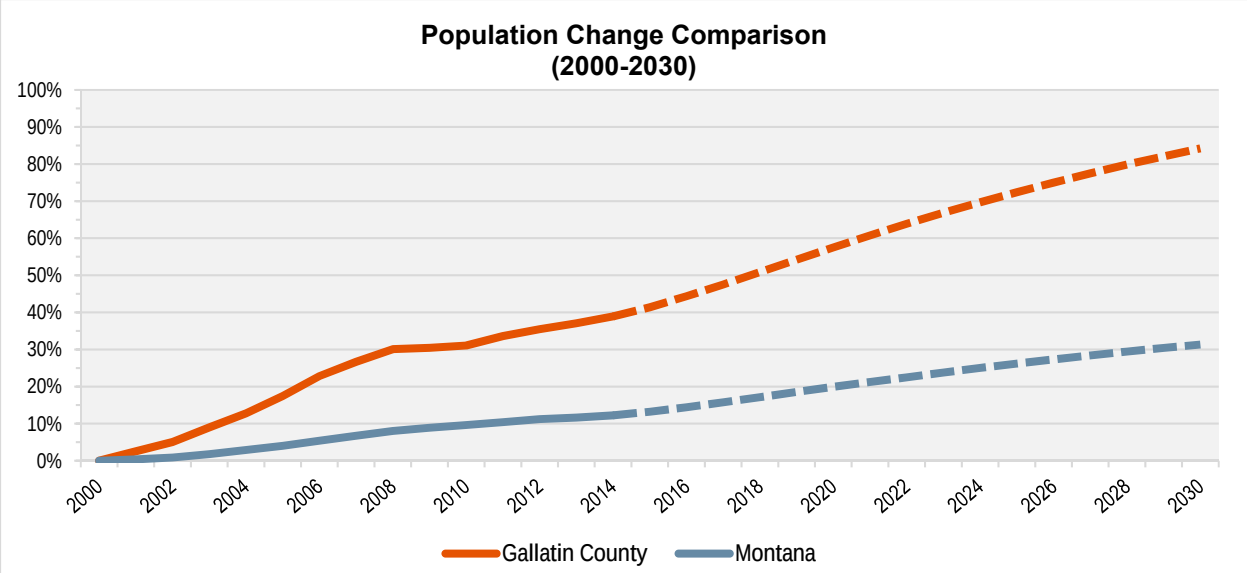

Figure 16: Population Comparison (Gallatin County and Montana)

The distribution of ethnicity in Gallatin County is primarily white/Caucasian (95.4 percent). Hispanic or Latino individuals comprise 3.1 percent of the population. Gallatin County has a slightly less diverse ethnic distribution as compared to the Montana average. There are no American Indian Reservations within a short distance of Gallatin County, which could be an indicator for the lower diversity seen in Gallatin County as compared to Montana.

Gallatin County residents are younger on average than the average Montana resident. The median age of 32.8 years is relatively young, but this is explained in part by considering that Bozeman is home

to Montana State University, and has a large population of 18 to 25 year olds. Bozeman has a median age of 27.3 years while Belgrade's median age is 28.6, both of which pull Gallatin County's average lower.

Gallatin County's labor market has shown strong performance as evidenced by its 3.2 percent unemployment rate. The county is one of many in Montana showing strong labor market conditions and low unemployment, especially as compared to the rest of the United States. The high tech industry accounts for 12.1 percent of employment in Gallatin County. Retail trade and arts, entertainment, and accommodation industries employ 13.1 percent and 13.6 percent, respectively, of the employed population (16 years and over) of Gallatin County.

A factor for the high retail and entertainment numbers is the large amount of tourism and subsequent out-of-state dollars spend in Gallatin County. As the largest urban center in southwest Montana, Bozeman serves as a hub for people travelling to Yellowstone National Park as well as Big Sky Resort. Both Yellowstone and Big Sky attract many tourists each year in both winter and summer seasons whereas in many Montana destinations, tourism is largely a summer occurrence. A large part of Bozeman's economy is in some way related to Montana State University. Growth in enrollment is expected to continue and the economic effects are likely to increase in coming years.

Median household income for Gallatin County is $52,833, which is above state average. Bozeman proper has a median household income of $44,615 while Belgrade's median household income is $38,343, both lower than state averages. Bozeman's perceived high quality of life and college town labor market could play a role in this fact. The poverty level is 14.1 percent in Gallatin County, which is slightly lower than Montana. Bozeman however, has a poverty rate of 21.2 percent, which is well above the Montana average, due in part to college students.

Gallatin County has one of the strongest economies in Montana and the outlook for future growth is positive. The development of the high tech sector has created many well-paying jobs and Montana State University continues to grow. Additionally, strong non-resident travel numbers have solidified Bozeman and Gallatin County as one of Montana's best performing economies after the recession. Gallatin County's economy is predicted to remain strong in the coming years. Even though the Gallatin County median income is above the Montana average further investigation should take place to determine the possibility of low-income person(s) being disproportionately isolated, displaced, or otherwise subjected to adverse effect by any forwarded improvements on a project-by-project basis.

3.3.2. Land Ownership

Ownership of land in the study area is predominantly private, with some interspersed state and federal owners. The specific public landowners are the FWP, Montana State Trust, and MDT. The FWP land, which is on the east end of the study area, is a fishing access site. Directly across Frontage Road from the FWP land is the Montana State Trust lands. The remainder of the state-owned land is MDT land, which is the roadway around which the study area is structured. Much of the private land throughout the study area is residential or agricultural. Commercial land use is seen at a higher frequency near the cities of Belgrade and Bozeman. Gallatin Field – Bozeman Yellowstone International Airport has a sizable amount of land adjacent to the east side of Belgrade.

Mixed land use arises from the varied land ownership throughout the study area. These land uses include commercial, industrial, crop/pasture, and mixed urban. Even though there is a large amount of privately owned land in the study area, the need to purchase right-of-way for possible improvements is minimal as most improvements expected to be brought forward would not require additional right-of-way. In Addition, the corridor parallels Montana Rail Link tracks for a large portion of the study area. The railroads have strict policies on working near or in their right-of-way, which could add time constraints to projects along with limiting the ability to acquire right-of-way on the south side of

Frontage Road. If improvements are forwarded from this study, land use at and adjacent to possible projects will need to be considered during design.

3.3.3. Recreational Resources

Gallatin County and the Belgrade/Bozeman area offer a variety of year round outdoor activities including fishing, hiking, hunting, boating, and swimming in the summer. In the winter, snowmobiling, ice-skating, downhill skiing, and cross-country skiing occur in the surrounding area. There are a collection of city parks within Bozeman, but none of them are within the study area. The city of Belgrade has one city park within the study area.

Recreational resource information was gathered through review of FWP resource lists for Gallatin County. Recreational areas may be protected under Section 4(f) of the US Department of Transportation Act of 1966, which was enacted to protect publically owned parks, recreation areas, wildlife and waterfowl refuges, and public and private historic sites of local, state, and national significance. Federally funded transportation projects cannot impact Section 4(f)-protected properties unless there are no feasible and prudent avoidance alternatives and all possible planning to minimize harm has occurred.

From a high level evaluation there appears to be two recreational-related potential 4(f) resources that could potentially be impacted from possible improvements with the study area. These are the Belgrade Lewis and Clark Park located at approximately RP 20.4 and Cherry River Fishing Access Site located at approximately RP 2.25. In addition there is a linear parcel adjacent to the Las Campanas Subdivision along the northeast side of I-90 between Sunnyside Park and Alaska Road owned by the city of Belgrade. This parcel of land is currently used as a pedestrian path and dog trail. MDT has previously corresponded with city of Belgrade officials who agree that this park was not significant; therefore, section 4(f) does not apply. Acquiring right-of-way from potential 4(f) lands would need to go through the evaluation process described above which could add time and costs to a project.

According to the FWP National Land and Water Conservation Fund Act (LWCFA) Sites by County, there are two Section 6(f) resources within the study area. The Cherry River fishing access site and Belgrade's Lewis and Clark Park have both received LWCFA funds. These 6(f) resources should be taken into consideration for any potential forwarded projects, as converting to a non-recreational resource will be both difficult and time-consuming.

Reevaluation of 4(f) and 6(f) resources would be completed if a project was forwarded from this study. If future resources are discovered, efforts should be made to avoid adverse impacts to, or right-of-way acquisition from, these community recreational resources.

3.3.4. Cultural Resources

A file search of the study area through the Montana State Historic Preservation Office revealed four cultural resources and historical properties. These properties include the Northern Pacific Railway, Farmers' Canal Co., Spain-Ferris Ditch Co., and Mammoth Ditch Co.

In addition to the known historic resources, other potentially historic resources exist in the study area. An examination of the Montana Cadastral Survey information for the designated corridor indicates that at least 39 historic-age properties face onto Frontage Road. Twenty of the properties are residences and 19 are commercial businesses. Furthermore, a historic district potentially exists along Main Street in Belgrade.

In addition to the historic properties, there are two cemeteries located within the corridor study area. The Holy Cross Cemetery is located at the intersection of North 7th Avenue and Mandeville Drive. The Sunset Memorial Gardens cemetery is located in Section 16, T1S, R5E.

Direct and indirect impacts (such as visual, noise, and access impacts) to eligible or listed properties would need to be considered if improvement options are carried forward. If a project is forwarded from this study, a cultural resource survey for unrecorded historic and archaeological properties with the area of potential effect will need to be completed during the project development process.

3.3.5. Noise

Traffic noise may have to be evaluated for planned improvements to the study corridor. Noise analysis is necessary for "Type I" projects. If the roadway improvements are limited (e.g., the horizontal and vertical alignments are not changes, and the highway remains a two-lane facility), then the project would not be considered a Type I project.

If the improvements planned for the road would include a substantial shift in the horizontal or vertical alignments, increasing the number of through-lanes, passing lanes, or turning lanes, or increasing the traffic speed and volume, then the project would be considered a Type I project, which would require a detailed noise analysis. The analysis would include measuring ambient noise levels at selected receivers and modeling design-year noise levels using projected traffic volumes.

Noise abatement measures would be considered for the project if noise levels would approach or substantially exceed the noise abatement criteria. The noise abatement measures must be considered reasonable and feasible before implementation. If noise abatement measures were deemed necessary, they could increase costs of proposed future Type I roadway improvements. Construction activities in the study area may cause localized, short-duration noise impacts. These impacts can be minimized by using standard MDT specifications for the control of noise sources during construction.

3.3.6. Visual Resources

The visual resources of an area include landforms, vegetation, water features, and physical modifications caused by human activities that give the landscape its visual character and aesthetic qualities. Visual resources are typically assessed based on the landscape character (what is seen), visual sensitivity (human preferences and values regarding what is seen), and landscape quality (relative distance to seen areas) of geographically defines view shed. There are no properties or corridors within the study area listed on the Department of Interior's National Landscape Monument System.

4.0. AREAS OF CONCERN AND CONSIDERATION

This section provides a list and description of areas of concern and consideration along the study corridor. These areas were identified through review of as-built drawings, field review, public databases, and other resources. More discussion has been provided in the previous sections, and it is reiterated here as appropriate.

4.1. TRANSPORTATION SYSTEM

Physical Features and Characteristics

- The roadway surfacing is generally considered in poor condition.
- The majority of the Frontage Road sits within railroad right-of-way through easement. Additional investigation regarding railroad easements will be necessary depending on the location of potential improvement options within the corridor.
- There is a crude oil pipeline along the study corridor beginning at approximately RP 25.5. The pipeline travels along the study corridor until approximately RP 2.8 where it crosses Primary 118 then crosses again at RP 1.8 of Primary 118. A natural gas pipeline also crosses the study corridor at approximately RP 26.7 of the Frontage Road and RP 1.8 of Primary 118.
- A BNSF owned (MRL leased) railroad parallels the southern side of the Frontage Road. Any improvement option(s) identified for portions of the corridor paralleling close to the tracks must not move the southern edge of the roadway shoulder any closer to the tracks.
- There are gaps in the sidewalk network within Belgrade east of Kennedy Street and within Bozeman south of the railroad viaduct.
- A total of 14 passing zones, seven eastbound and seven westbound, exist along the study corridor. Eight of the passing zones are less than 1,000 feet in length.
- Many areas of the study corridor, particularly within Belgrade, have poor drainage due to flat slopes and topography.
- The bridge located at RP 26.6 has a structure condition of “poor” which means it is a candidate for repair or replacement. The bridge also has a width narrower than the recommended standard for new bridges. The bridge located at RP 2.1 over the railroad tracks has a structure condition of “good” which indicates it is a candidate for continued preservation. Both of the bridges have bridge deck ratings of “fair-1”, which means they are candidates for healer/sealer treatments.
- Local planning documents conflict on long-term non-motorized infrastructure for the Frontage Road. Guidelines for the railway state that trails parallel to the track on railroad right-of-way are not permitted.

Traffic Operations

- Existing AADT volume on the study corridor ranged from a low of 5,250 vehicles per day (vpd) west of Broadway Street in Belgrade, to a high of 12,520 vpd south of Griffin Drive in Bozeman. Volumes are projected to grow at an average annual rate of 1.3 percent.
- On average, heavy vehicle traffic accounts for approximately 4.5 percent of vehicles along the study corridor.
- The intersections with Broadway Street, Oregon Street, and Griffin Drive are projected to have failing operations in the future.
- The corridor operates, or is projected to operate, at a LOS of C. Standards recommend a LOS of B for the rural portions of the corridor and a desirable LOS of B and minimal LOS of C for the urban portions.

- During the school year, Main Street between Jackrabbit Lane and Broadway Street experiences congestion due to students leaving the schools.

Geometric Conditions

- The corridor is divided into segments classified as both urban and rural NHS principal arterials and minor arterial roadways.
- The horizontal and vertical alignments are generally flat with little to no deflection.

Safety

- There were 382 crashes along the study corridor during the six-year analysis period. Approximately 52 percent of crashes occurred within the cities of Belgrade and Bozeman.
- Corridor-wide, 75 percent of reported crashes involved multiple vehicles. The most common crash type was rear-end crashes, which accounted for almost 40 percent of all reported crashes.
- Over 87 percent of crashes in Belgrade or Bozeman involved multiple vehicles. Within the rural areas, multiple vehicle crashes accounted for 58 percent of crashes.
- There were three fatal crashes resulting in three fatalities and eight incapacitating injury crashes resulting in ten incapacitating injuries.

4.2. Environmental Considerations

Physical Environment

- The majority of the study area is either farmland of local or statewide importance, prime farmland if irrigated, or prime farmland. Much of the designated farmland areas have been developed in or near the urban areas of Belgrade and Bozeman.
- Study area soils are considered to have moderate frost susceptibility. Moisture-sensitive soils occur in the study area. There is an organic lean clay layer in the Gallatin Valley which can be problematic for construction and long-term stability if not taken into consideration during design. This organic clay layer ranges from zero to eight (0 to 8) feet thick.
- There are four perennial streams that are located in the study area; Hyalite Creek, Aajker / McDonald Creek, Baxter Creek and Mandeville Creek. One unnamed intermittent/ephemeral stream is also present and parallels and/or crosses the Frontage Road at various locations.
- Narrow emergent wetland fringe is common along the banks of irrigation ditches/canals crossing the Frontage Road within the study area boundary.
- Approximately 60 private wells are located within the study area, with hundreds more immediately adjacent to and outside of the boundary. These wells are primarily used for domestic water followed by irrigation. Seven public water supply wells are found within the study area boundary.
- There are three primary irrigation ditch crossings of the Frontage Road in the study area. These crossings are Mammoth Ditch (RP 19.8), Spain Ferris Fork Ditch (RP 21.0) and Dry Creek (RP 22.3).
- Outside of the study area and to the north, numerous lateral ditches are present, providing diverted irrigation water to farmland in the area.
- There are no floodplain zones located within the study area. There are three floodplain zones, however, just to the north of the study area associated with the East Gallatin River.
- There are five active UST sites, two active LUST sites, two petroleum pipelines, and one remediation response site located within the study area. Several other hazardous sites are located outside of the study area of all types. Additionally, there are three open cut permits for

sand and gravel pits. None of the hazardous substances sites discussed are expected to be "must avoid" locations or drivers of any ultimate project design.

Biological Environment

- Several noxious weeds have been observed in the study area. Gallatin County has weed management criteria in place.
- The study area and vicinity are home to a number of wildlife species, and are considered primary, general, secondary, transient and/or winter range for white-tailed deer, mule deer, black bear, moose, and other small mammals. Additionally, there are four streams in the area that support fish species.
- Due to the lack of suitable habitat resulting from the level of development in the study area, density of roads and presence of the Interstate and railroad, it is not anticipated that any of the T/E/SOC/SPC listed in Gallatin County would normally occur in the study area.

Social and Cultural Environment

- Future land use growth areas for residential, commercial, and industrial use are located north of the study area between Belgrade and Bozeman.
- Recreational resources within the study area include the Lewis and Clark Park in Belgrade, and the Cherry River Fishing Access Site (FAS).
- Section 6(f) grants were used for both of the recreational sites noted above.
- Two historic properties face onto the Frontage Road; one has since been obliterated (Northern Pacific Railway's Low Line) and the other has been previously recorded (Northern Pacific Railway).
- There are six irrigation ditches that are historic and likely eligible for registration.
- There are at least 39 historic-age properties within Belgrade that face the Frontage Road; 20 of the properties are residences and 19 are commercial businesses. Thus, it is likely that a historic district potentially exists along Main Street in Belgrade.

5.0. REFERENCES

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