

BRIDGER CANYON
Corridor Planning Study

APPENDIX D
Improvement Options Report

April 2015

Prepared for:



Prepared by:



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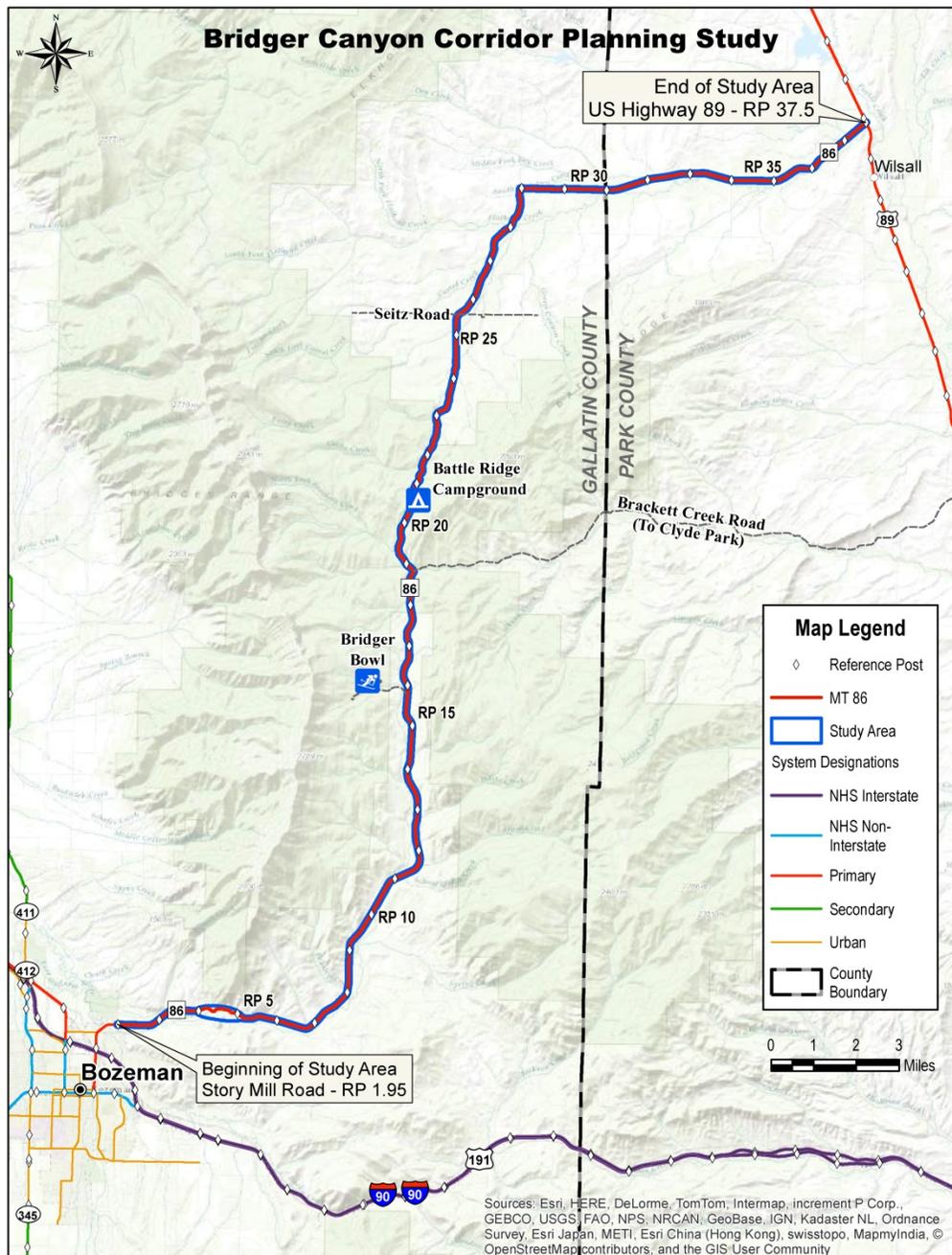
Abbreviations and Acronyms

AADT	Annual Average Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
CWA	Clean Water Act
DEQ	Montana Department of Environmental Quality
ETW	Edge of Traveled Way
FHWA	Federal Highway Administration
FWP	Montana Department of Fish, Wildlife, and Parks
LOSS	Level of Safety of Service
MDT	Montana Department of Transportation
MPDES	Montana Pollutant Discharge Elimination System
MT 86	Montana Highway 86
NHPA	National Historic Preservation Act
NHS	National Highway System
NRCS	Natural Resources Conservation Service
PROWAG	Public Rights-of-Way Accessibility Guidelines
RDM	MDT Road Design Manual
RP	Reference Post
SHPO	State Historic Preservation Office
SPA	Montana Stream Protection Act
UPN	Uniform Project Number
USACE	United States Army Corps of Engineers
US 89	United States Route 89

1.0 Introduction

This report outlines potential improvement options for the Montana Highway 86 (MT 86) corridor between the intersection of Story Mill Road at reference post (RP) 1.95 and the junction with United States Route 89 (US 89) at RP 37.5. This report, along with the *Existing and Projected Conditions Report* and the *Environmental Scan*, are appendices to the corridor planning study. Information presented in other appendices is not repeated in this report. The planning study incorporates information from all appendices. Figure 1 illustrates the study area boundary.

Figure 1 Study Area



2.0 Needs and Objectives

Needs and objectives for the Bridger Canyon Corridor Planning Study were developed based on existing and projected conditions within the corridor, input from the public and resource agencies, and coordination with the study advisory committee. Needs, objectives, and considerations are not listed in order of priority.

Need 1: Improve the safety of MT 86 for all users.

Objectives:

To the extent practicable:

- Improve roadway elements to meet current MDT design criteria.
- Identify strategies to address locations with high potential for crash reduction and other areas of safety concern.

Need 2: Maintain infrastructure assets in the corridor.

Objectives:

To the extent practicable:

- Address areas with inadequate drainage.
- Conduct appropriate maintenance and repair activities.

Other Considerations

- Local planning efforts for all modes, planned projects, and potential future development in the corridor.
- Wildlife movement and animal-vehicle conflicts.
- Scenic character of the corridor and potential adverse impacts to environmental resources that may result from improvement options.
- Funding availability.
- Temporary construction impacts.
- Construction feasibility and physical constraints.

2.1 Design Criteria

MT 86 improvements will be designed in accordance with state laws and standards. MDT has generally adopted AASHTO policies and Public Rights-of-Way Accessibility Guidelines (PROWAG) in compliance with the Americans with Disabilities Act (ADA). MDT design criteria and guidelines consulted for this study include the *Road Design Manual (RDM)*, *Traffic Engineering Manual*, and *Environmental Manual*, among others.

MT 86 is classified as a rural minor arterial on the primary system (non-NHS). MDT geometric design criteria listed in the RDM specify 12-foot travel lanes for rural minor arterials. The RDM references the Route Segment Map to determine applicable total roadway width (including shoulders). The 2004 Route Segment Plan Map (non-NHS Primary) indicates a total MT 86 roadway width of 32 feet or greater from RP 1.95 to approximately RP 20, and a total roadway width of 28 feet or greater from approximately RP 20.0 to RP 38.0. Any potential deviation from the recommended roadway width in the Route Segment Plan must be evaluated by the Roadway Width Committee. The AASHTO *Policy on Geometric Design of Highways and Streets* recommends a minimum usable shoulder width of 6 feet for daily traffic volumes between 400 and 2000, and consideration of a minimum continuous usable shoulder width of 4 feet where bicyclists and pedestrians are to be accommodated.

3.0 Improvement Options

Improvement options were identified in cooperation with the study advisory committee to address the needs and objectives for this study. Local planning documents and input from resource agencies and members of the public were also considered during identification of improvement options.

Improvement options are presented alphabetically by category. Planning-level cost estimates are listed in 2014 dollars for each improvement option. Estimates include anticipated costs associated with preliminary engineering, construction engineering/inspection, and right-of-way acquisition where appropriate. Cost estimates reflect contingency ranges to account for the high degree of unknown factors at the planning level. Attachment 1 provides cost estimates assumptions, including construction materials.

Project Development Considerations

The following sections present a range of options MDT may consider for implementation in the MT 86 corridor in the future. MDT may elect to implement a single option or combine multiple options at the time a project is nominated. Should this corridor planning study lead to one or more projects, compliance with NEPA/MEPA will be required if federal or state funding or involvement occurs. This corridor planning study will be used as the basis for determining impacts and subsequent mitigation for improvement options in future NEPA/MEPA documentation. Any project developed will comply with CFR Title 23 Part 771 and ARM 18, sub-chapter 2, which set forth requirements for documenting environmental impacts on highway projects.

During the project development process, MDT will determine the need for and feasibility of including wildlife mitigation strategies based on the scope and location of a particular project. Specific strategies that may be appropriate in the Bridger Canyon corridor are listed below.

- Fencing modifications (including wildlife-friendly fencing and/or barrier fencing) will be considered to facilitate safe wildlife movement and alleviate animal-vehicle conflicts throughout the corridor. Fencing modifications would likely require the cooperation of adjacent landowners.
- Seasonal/variable message signage, and/or flashing lights and signage will be considered in conjunction with nominated projects as appropriate.
- Wildlife crossing structures will be evaluated where opportunistically feasible. These locations include topographical opportunities (e.g. gullies/gulches) in the canyon section where drainage features would require fill material or drainage structures. The potential may exist to install an oversized box or arch culvert to allow wildlife passage. Additionally, in the Shields River Valley where several older timber bridges may be replaced or rehabilitated, oversized bridges or box culverts may provide opportunities to encourage wildlife passage under the highway.

Specific wildlife mitigation measures will be considered during project-level analysis.

Potentially-impacted Resources and Associated Permitting

Improvement options forwarded from this study may impact the human and natural environment. Potentially-impacted resources include wetlands, streams, floodplains, cultural resources, threatened and endangered species, and protected farmlands. A list of permits

associated with potentially-impacted resources within the Bridger Canyon corridor is presented in Table 1.

Table 1 Potentially-impacted Resources and Associated Permits

Permit/Authorization	Regulatory Entity	Potentially-impacted Resources
Clean Water Act (CWA) Section 401/404 Permit	United States Army Corps of Engineers (USACE)/Montana Department of Environmental Quality (DEQ)	Wetlands, Streambed and Streambanks
Stream Protection Act (SPA) 124 Authorization	Montana Fish, Wildlife & Parks (FWP)	Streambed and Streambanks
Floodplain Development Permit	County Floodplain Administrator	Wetlands, Streambanks, Floodplains
Short-term Water Quality Standard for Turbidity (318 Authorization)	Montana Department of Environmental Quality (DEQ)	Wetlands, Streambed and Streambanks, Floodplains
Montana Pollutant Discharge Elimination System (MPDES) General Permit for Storm Water Discharges Associated with Construction Activity	Montana Department of Environmental Quality (DEQ)	Wetlands, Streambanks, Floodplains
National Historic Preservation Act (NHPA) Section 106 Coordination/Consultation	State Historic Preservation Office (SHPO)	Cultural Resources
Endangered Species Act (ESA) Section 7 Coordination/Consultation	United States Fish and Wildlife Service (USFWS)	Threatened or Endangered Species
Farmland Conversion Coordination (CPA-106 Form)	Natural Resources Conservation Service (NRCS)	Protected Farmlands

If improvements are forwarded from this study, detailed analysis would be required during the project development process to quantify specific resource impacts and identify associated permits that may apply.

Future Implementation Timeframes

Implementation of improvement options is dependent on funding availability, construction feasibility, right-of-way needs, personnel resources, and other project delivery elements. Recommended timeframes for implementation are defined as follows.

- Short-term: Implementation is recommended within a 1- to 3-year period
- Mid-term: Implementation is recommended within a 3- to 6-year period
- Long-term: Implementation is recommended within a 6- to 20-year period
- As Needed: Implementation should occur based on observed need throughout the 2035 planning horizon

Responsibility for Implementation

The improvement options outlined in this report are intended for implementation by MDT. Additional efforts that may affect safety and operations in the corridor are the responsibility of others. As examples, speed limit enforcement, enactment of distracted driving ordinances, and regulation of development in the corridor would fall under the jurisdiction of state and local agencies including the Montana Highway Patrol and Gallatin and Park Counties. Any costs

associated with improvements required to mitigate new development would be the responsibility of the developer.

3.1 Bridge Repairs

Bridge repairs are intended to address bridge elements that are in fair condition (as identified by MDT condition assessments) and where field review indicated localized failures in order to extend the life of the structures and improve safety.

Option 1 Bridge Repairs

Specific bridge repair locations are listed below.

- RP 7.8 (Stock Pass) – This structure was built in 1939 and is rated in fair condition for superstructure elements. Recommendations for the structure include removal of existing guardrail and installation of new guardrail to meet current design criteria. Additionally, this improvement would include a mill and overlay on the bridge deck
- RP 24.4 (Cache Creek) – This structure was built in 1939 and is rated in fair condition for substructure elements. Recommendations for the structure include removal of existing guardrail and installation of new guardrail to meet current design criteria. Additionally, this improvement would include a mill and overlay on the bridge deck.
- RP 26.8 (Carrol Creek) – This structure was built in 1986 and is rated in fair condition for substructure elements. A damaged wing wall and substantial erosion were noted on the structure during the field review. Recommendations for the structure include reconstruction of the bridge approach, reconstruction of the damaged wing wall, guardrail removal and replacement, and pavement rehabilitation (mill and overlay).
- RP 28.0 (Flathead Creek) – This structure was built in 1939 and is rated in good condition. However, transverse and longitudinal cracking is observable on pavement adjacent to and on top of the bridge. A mill and overlay of the bridge surface to extend the service life is recommended at the location.

Planning-level Cost Estimate

\$50,000 to \$110,000 per bridge

Recommended Implementation Timeframe

Short-term to mid-term

Potentially-impacted Resources /Anticipated Right-of-Way

Potential impacts to streams, riparian wetlands, floodplains, protected species, cultural resources, protected farmlands, and utilities may result from this option. The need for additional right-of-way is not anticipated.

3.2 Curve Geometry and Roadway Width

There are a number of locations within the MT 86 corridor that do not meet current MDT design criteria for horizontal/vertical alignment and/or total roadway width. Where an existing roadway does not meet current MDT design criteria, it may not be cost effective to reconstruct the roadway to address geometric issues unless there are documented safety issues. The

following options focus on areas identified by MDT as high potential for crash reduction – Level of Service of Safety (LOSS) IV for total crashes or for crash severity.

Option 2.a Roadway Realignment at Slide Area

The roadway segment from RP 4.3 to RP 4.6 contains several horizontal curves which do not meet current MDT design criteria. This location is identified as a high potential for crash reduction (LOSS IV). Due to the active landslide in the vicinity and natural features such as rock outcroppings and Bridger Creek, the placement of the horizontal alignment is restricted. Recommendations for this location include realignment of the roadway and relocation of landslide material currently covering a portion of the original MT 86 alignment.

Figure 2 illustrates one potential configuration, where MT 86 would follow an alignment between the original alignment and the current detour route. Other options could include a couplet (with one-way traffic along the original and detour routes), as well as other curve configurations.

Figure 2 RP 4.3 to RP 4.6 Roadway Realignment



Planning-level Cost Estimate

Reconstruction: \$1,100,000 to \$1,200,000

Recommended Implementation Timeframe

Long-term

Potentially-impacted Resources /Anticipated Right-of-Way

Potential impacts to streams, wetlands, floodplains, protected species, cultural resources, and utilities may result from this option. The need for additional right-of-way is not anticipated.

Option 2.b Horizontal and Vertical Curve Improvements with Shoulder Widening

The alignment of a highway is composed of vertical and horizontal elements. The vertical alignment includes straight (tangent) highway grades and the parabolic curves that connect these grades. The horizontal alignment includes the straight (tangent) sections of the roadway and the circular curves that connect their change in direction. Design criteria for horizontal and vertical curves are largely determined by the design speed of the roadway. The following curve

locations do not meet current MDT design criteria and are located in an area identified as high potential for crash reduction (LOSS IV).

Table 2 Curves Not Meeting Current Design Criteria Located in LOSS IV Area

Location	Horizontal	Vertical
RP 4.1 to RP 5.1	x	x
RP 6.7	x	
RP 8.0		x
RP 8.7 to RP 8.8		x
RP 9.0 to RP 9.1	x	x
RP 11.7 to RP 11.8	x	x
RP 12.0		x
RP 16.2	x	
RP 16.5 to RP 16.8		x
RP 18.5		x
RP 18.7 to RP 18.8	x	x
RP 19.0 to RP 19.4	x	x
RP 20.2		x
RP 20.4		x
RP 20.6		x
RP 20.8 to RP 22.0	x	x
RP 22.8 to RP 23.8	x	x
RP 28.3 to RP 29.1	x	x
RP 29.7 to RP 30.0		x
RP 35.8	x	

Listed curves are located within a LOSS IV roadway segment (total crashes and/or crash severity).

This improvement option would involve reconstruction and realignment of the roadway to comply with current MDT design criteria for horizontal and vertical curves in the listed locations, as well as shoulder widening to provide an appropriate total roadway width as determined during project development. Using information from Table 2, MDT could elect to nominate a project to address one or multiple curve locations through a corridor segment. Provision of consistent shoulder width through a corridor segment would provide the greatest benefit for safety and non-motorized usage.

Planning-level Cost Estimate (average)

\$360,000 to \$390,000 per 0.1 mile (including curve reconstruction and shoulder widening)

Recommended Implementation Timeframe

Mid-term to long-term

Potentially-impacted Resources /Anticipated Right-of-Way

Potential impacts to streams, wetlands, floodplains, protected species, cultural resources, protected farmlands, and utilities may result from this option. The need for additional right-of-way is anticipated.

3.3 Drainage Corrections

The design of subsurface drainage should be carried out as an integral part of the complete design of a highway, since inadequate subsurface drainage may have detrimental effects on the stability of slopes and pavement performance. However, certain design elements of the highway such as geometry, site soil conditions and properties of the drainage materials are required for the design of the subdrainage system. Thus, the procedure usually adopted for subsurface drainage design is first to determine the geometric and structural requirements of the highway based on standard design practice, and then to subject these to a subsurface drainage analysis to determine the requirements. In some cases, the subsurface drainage requirements determined from this analysis will require some changes in the original design.

Option 3 Drainage Corrections

Based on field observations, there are three drainage issues within the MT 86 corridor. At RP 15.9, standing water has been observed in the roadway ditch and adjacent to the roadway. This location is being addressed as part of a programmed overlay and widen project (UPN 8112000). Insufficient drainage at the bridge crossing Carrol Creek (RP 26.8) is addressed in improvement option 1.

At RP 23.4, standing water has been observed adjacent to the roadway. A culvert extending under the roadway appears to be plugged and appears to not meet minimum cover depths. Based on the deteriorated pavement, water likely periodically saturates the subgrade at this location. Installation of a new culvert and reconstruction of the subgrade and surface at this location is recommended.

Planning-level Cost Estimate

\$48,000 to \$51,000

Recommended Implementation Timeframe

Short-term

Potentially-impacted Resources/Anticipated Right-of-Way

Potential impacts to streams, riparian wetlands, floodplains, protected species, cultural resources, protected farmlands, and utilities may result from this option. The need for additional right-of-way is not anticipated.

3.4 Intersection Improvements

Current MDT design criteria note roadways should intersect at or as close to 90° as practicable. Skewed intersections are undesirable for several reasons:

- vehicular turning movements and sight distance are restricted;
- additional pavement and channelization may be required to accommodate large vehicle turning movements; and
- the exposure time for vehicles and pedestrians crossing the main traffic flow is increased.

Crash potential at an intersection can be reduced by providing appropriate sight distance to allow drivers an unobstructed view of the entire intersection at a distance great enough to permit control of the vehicle.

Additionally, turn lanes can be considered to provide a protected location for left-turning vehicles to wait for an acceptable gap in the opposing traffic stream, and remove decelerating right-turning vehicles from the through traffic lane to reduce the potential for collisions. Turn lanes may be appropriate at un-signalized intersections on two-lane highways that meet MDT guidelines for opposing volumes and/or advancing volumes and percentage of turn movements, or where there is a crash trend involving turning vehicles.

Option 4.a Approach Sight Distance Mitigation

Laying back the slopes adjacent to the intersections listed below is recommended to improve sight distance.

- RP 4.2 ¹ (“M” trailhead parking area)
- RP 6.7 ¹ (Kelly Canyon Road)
- RP 15.2 (private approach)
- RP 18.8 ¹ (Brackett Creek)
- RP 22.7 (private approach)

¹ Indicates area is located within a LOSS IV roadway segment (total crashes and/or crash severity). LOSS IV roadway segments are areas with a high potential for crash reduction.

Additionally, potential improvements at RP 18.8 (Brackett Creek) include installation of delineation to guide traffic along the primary route, and re-vegetation alongside the roadway to reduce confusion of travelers, as indicated in

Figure 3.

Figure 3 Brackett Creek (RP 18.8) Sight Distance Improvements



Planning-level Cost Estimate
 \$40,000 to \$390,000 (per approach)
 \$960,000 to \$1,120,000 (total)

Recommended Implementation Timeframe
 Mid-term to long-term

Potentially-impacted Resources/Anticipated Right-of-Way

Potential impacts to streams, wetlands, floodplains, protected species, cultural resources, protected farmlands, and utilities may result from this option. The need for additional right-of-way is anticipated.

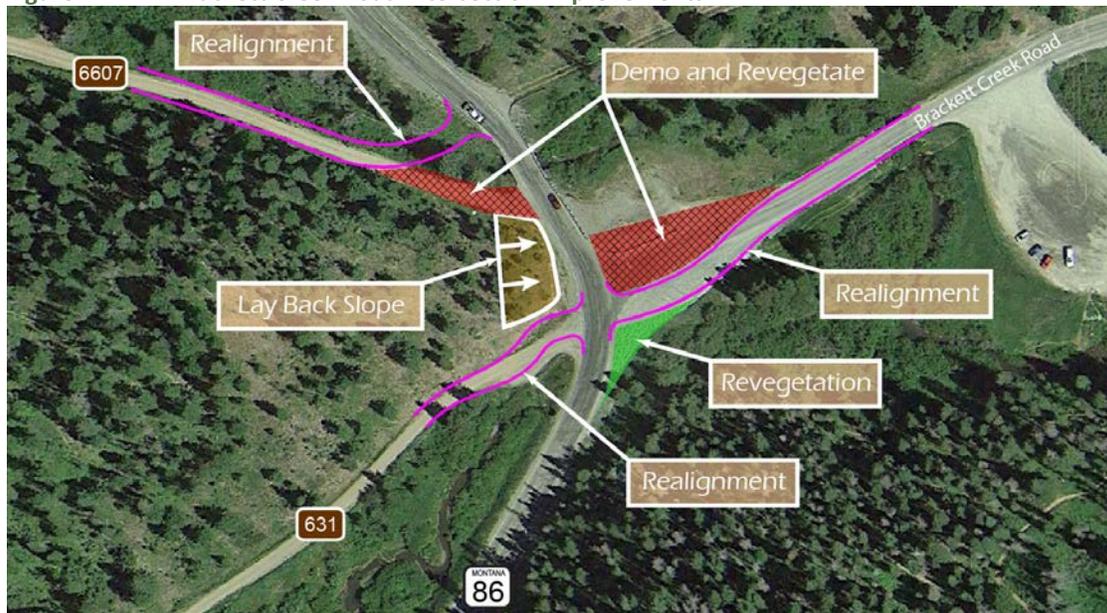
Option 4.b Intersection Realignment

MDT design guidance notes intersection angles should not exceed 30° from perpendicular at maximum. Intersections with a skew greater than 30° may require geometric improvements, including realignment. The best alignment for an at-grade intersection is when the intersecting roads meet at right or nearly right angles (90°). This alignment is superior to acute-angle alignments. Less road area is required for turning at the intersection, there is a lower exposure time for vehicles crossing the main traffic flow, and visibility limitations (particularly for trucks) are not as serious as those at acute-angle intersections.

A number of intersecting roads within the study corridor are aligned to MT 86 at an angle greater than 30° from perpendicular. Realignment of these intersections is recommended to improve sight distance and accommodate passenger vehicle and large vehicle turning movements. Recommended intersection realignment locations are listed below.

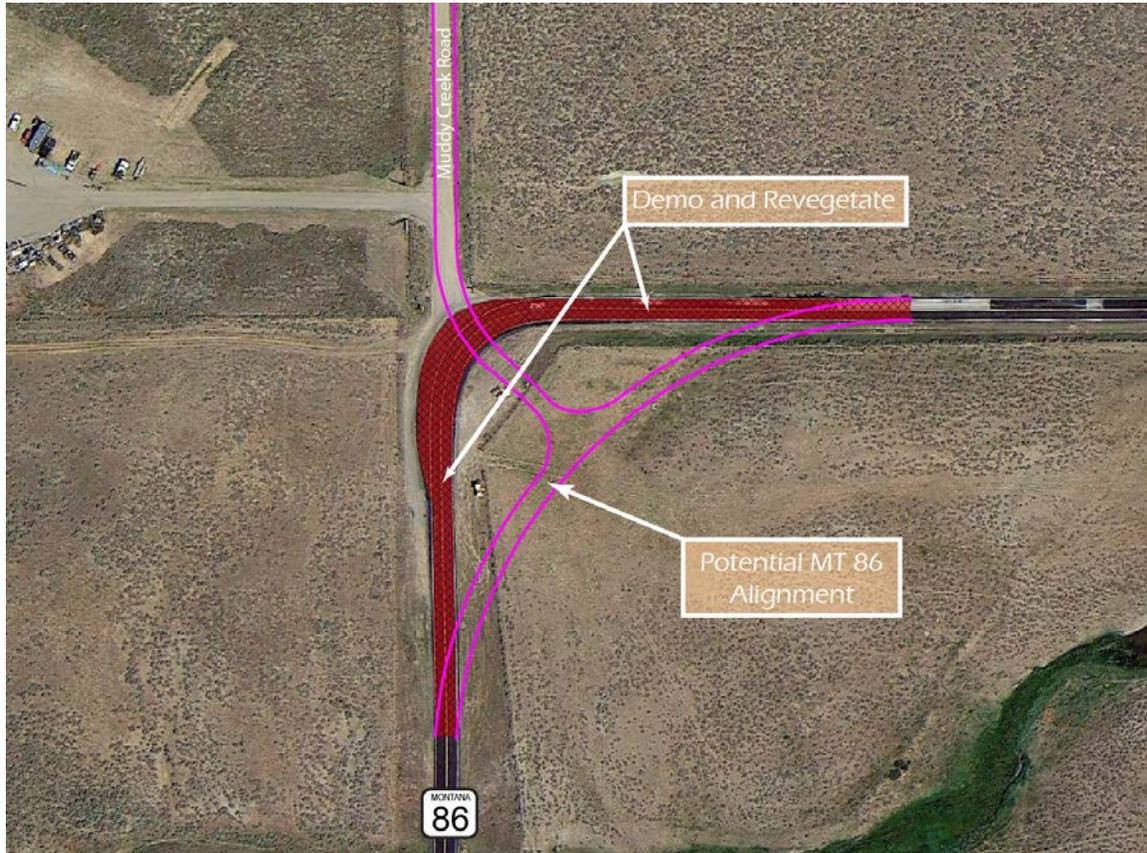
- RP 18.8 – Brackett Creek Road
 This improvement builds upon the previously-discussed option 4.a. Improvements include slope flattening to improve site distance between approaches; installation of delineation to guide traffic along the primary route; re-vegetation alongside the roadway to reduce confusion of travelers; and realignment of approaches to provide additional distance between approaches and to improve alignment in relation to each other and to the primary route. These improvements are depicted in Figure 4.

Figure 4 Brackett Creek Road Intersection Improvements



- RP 28.8 – Muddy Creek Road
This improvement includes realignment of the primary route to improve the horizontal alignment and realignment of the intersection in relation to the primary route (approximately 90 degrees). Improvements are depicted in Figure 5.

Figure 5 Muddy Creek Road Intersection Improvements



Planning-level Cost Estimate

\$340,000 to \$790,000 (per location)

Recommended Implementation Timeframe

Mid-term to long-term

Potentially-impacted Resources /Anticipated Right-of-Way

Potential impacts to streams, wetlands, floodplains, protected species, cultural resources, protected farmlands, and utilities may result from improvements to the Brackett Creek Road intersection. Potential impacts to protected species, sensitive cultural resources, protected farmlands, and utilities may result from improvements to the Muddy Creek Road intersection. The need for additional right-of-way is anticipated for both intersections.

Option 4.c Turn Lanes

The following locations were identified as intersections where a turn lane may improve safety.

- RP 4.2¹ ("M" Trailhead)
- RP 6.7¹ (Kelly Canyon Road)
- RP 9.5¹ (Jackson Creek Road)
- RP 15.7¹ (Bridger Bowl Road)
- RP 18.8¹ (Brackett Creek Road)
- RP 20.5¹ (Battle Ridge Campground Road)

¹Indicates area is located within a LOSS IV roadway segment. LOSS IV roadway segments are areas with a high potential for crash reduction.

An example left-turn lane typical section shown in Figure 6 assumes widening (shown in red) on both sides of the existing MT 86 roadway (shown in white) to achieve a desired road width. Figure 7 depicts a plan view of a left-turn lane layout. A traffic study would be required before installing a turn lane at the locations identified in this study.

Figure 6 Left-turn Lane Typical Section

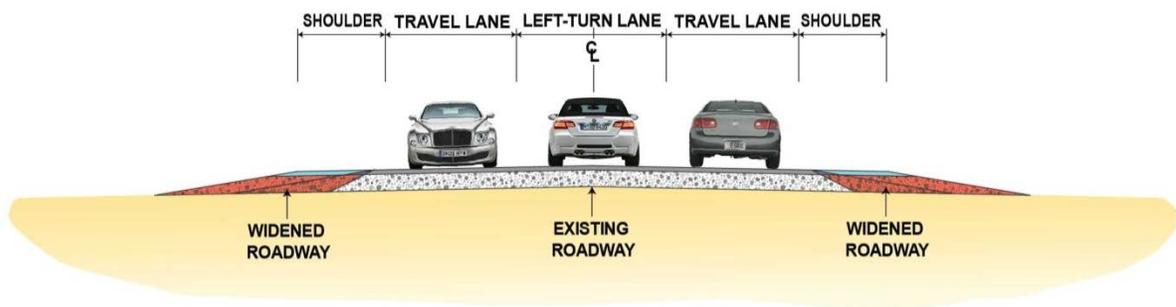
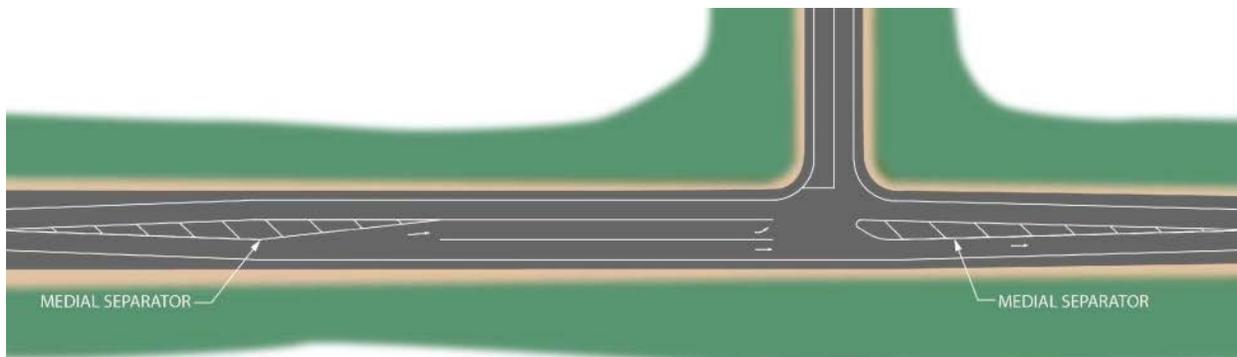


Figure 7 Left-Turn Lane Plan View



Planning-level Cost Estimate

Construction: \$900,000 to \$1,100,000 per location

Recommended Implementation Timeframe

Mid-term to long-term

Potentially-impacted Resources/Anticipated Right-of-Way

Impacts to wetlands, streams, floodplains, sensitive species, cultural resources, protected farmland, and utilities may result from this option. The need for additional right-of-way is anticipated.

3.5 Roadside Safety

The safest roadside is flat and free of obstructions or steep slopes. The RDM specifies an offset distance from the edge of the traveled way (ETW) to be free of any obstructions. The ETW is delineated by the white pavement marking located on the right-hand side of the travel lane. This offset distance, known as the “clear zone,” includes the roadway shoulder and is defined based on design speed, average annual daily traffic (AADT), and the slope and offset of cut/fill sections from the ETW.

Roadside ditches can present a hazard if an errant vehicle cannot easily travel its slopes, regain control, and return to the traveled way. An errant vehicle leaving the roadway may not be able to safely negotiate a critical slope (also called a non-traversable slope). Depending on encroachment conditions, a vehicle on a critical slope may overturn. For most embankment heights, fill slopes steeper than 3:1 are considered critical. A non-recoverable slope can be safely traversed, although an errant vehicle may not be able to return to the roadway. Slopes greater than or equal to 3:1 and less than 4:1 are considered traversable but non-recoverable.

When steep side slopes occur adjacent to a roadway, the hazardous condition ideally should be eliminated by providing slopes and dimensions specified in current MDT design criteria. Oftentimes, this is not practicable due to economic, environmental, or drainage conditions. If steep side slopes cannot be flattened due to these reasons, it may be necessary to shield the hazard with a roadway barrier such as guardrail, depending on the fill section height. Cut slopes and blunt objects also present a hazard, and may warrant protection.

Option 5.a Guardrail Improvements

Guardrail is a longitudinal barrier placed on the outside of sharp curves and in locations with high fills. Its main function is to prevent vehicles from leaving the roadway and to offer protection against objects within the clear zone. Guardrail placement is evaluated where embankments are higher than 8 feet and where shoulder slopes are greater than 4:1. Shapes commonly used include the W beam, cable rail, and the box beam. The weak post system provides for the post to collapse on impact, with the rail deflecting and absorbing the energy due to impact. Field review conducted for this study identified unprotected slopes and inadequate clear zone distances intermittently from RP 4.0 to RP 24.0. Additionally, some of the existing guardrail in the corridor does not meet current design criteria, including height and end treatments. Installation of compliant guardrail is recommended as needed throughout the corridor.

Planning-level Cost Estimate

Cost will vary depending on treatment and location.

Recommended Implementation Timeframe

Short-term and as needed throughout planning horizon

Potentially-impacted Resources /Anticipated Right-of-Way

Resource, utility, and right-of-way impacts are not anticipated.

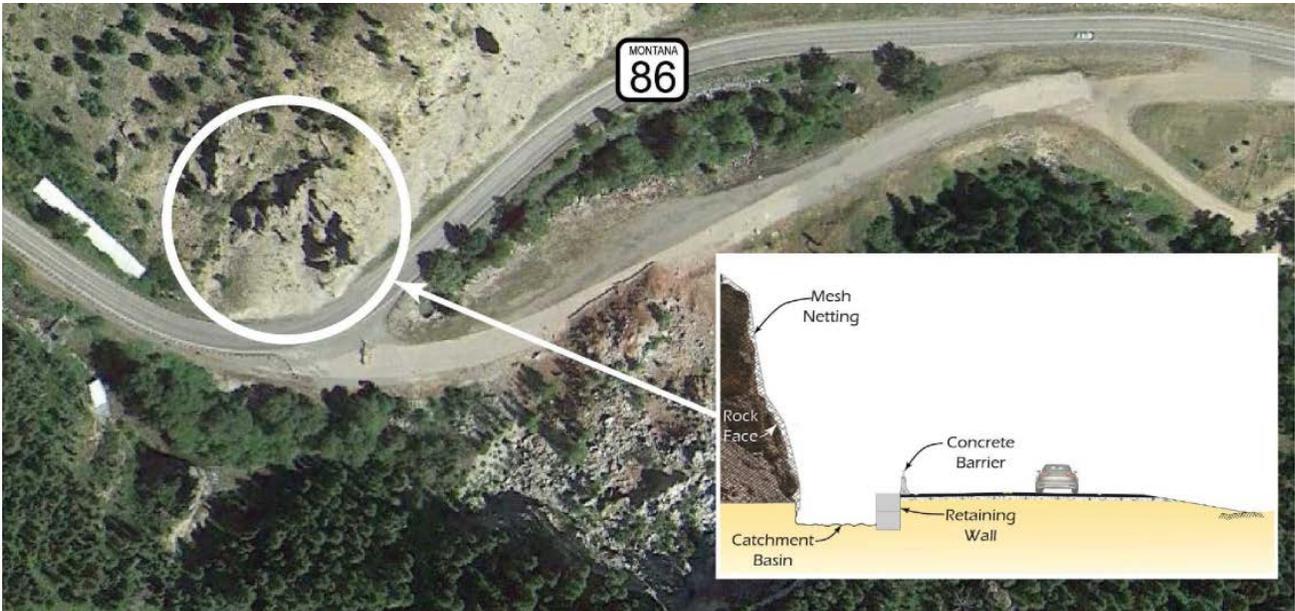
Option 5.b Rockfall Hazard Mitigation

The 2005 MDT *Rockfall Hazard Classification and Mitigation System* report identified nine locations within the MT 86 corridor with a moderate to high potential to develop a hazardous

situation. One of these nine sites (at approximately RP 4.4 north of MT 86) was rated 36 out of the top 100 sites statewide.

A potential rockfall mitigation strategy at RP 4.4 (north) would entail construction of a catchment basin and mesh netting along the slope. The netting would contain falling rock and prevent disturbance of the roadway. The rock would fall into the catchment basin which would hold the material until maintenance operations and removal occurred. Figure 8 illustrates this potential rockfall mitigation strategy.

Figure 8 Rockfall Mitigation at RP 4.4 (North)



Additional investigation and appropriate mitigation is recommended at the remaining eight sites.

- RP 4.7
- RP 5.1
- RP 12.3
- RP 12.4
- RP 12.7
- RP 15.9
- RP 18.5
- RP 18.9

Planning-level Cost Estimate

Mitigation: \$740,000 to \$800,000 (RP 4.4 north); Unknown (other locations)

Recommended Implementation Timeframe

Mid-term to long-term

Potentially-impacted Resources /Anticipated Right-of-Way

Impacts to wetlands, streams, floodplains, sensitive species, cultural resources, protected farmlands, and utilities may result from this option. The need for additional right-of-way is anticipated.

Option 5.c Pullouts

Vehicle pullouts allow travelers to safely leave the roadway to allow faster-moving traffic to pass by, view adjacent sites, address vehicle maintenance issues, or for any other reason causing the vehicle to stop. The following locations were identified as potential pullout locations.

- RP 7.5 Northbound
- RP 11.9 Northbound
- RP 8.5 Southbound
- RP 15.3 Southbound

These locations correspond with areas of higher traffic volumes, potential demand, and appropriate topography. A minimum sight distance of 1,000 feet would be needed to allow vehicles to accelerate to cruising speed from the pullout without impeding upstream traffic. Additional analysis will be required to determine the optimal location of pullouts along the corridor.

Planning-level Cost Estimate

Mitigation: \$150,000 to \$160,000 per location

Recommended Implementation Timeframe

Mid-term

Potentially-impacted Resources/Anticipated Right-of-Way

Impacts to wetlands, streams, floodplains, sensitive species, cultural resources, protected farmlands, and utilities may result from this option. The need for additional right-of-way is anticipated in certain locations.

3.6 Traffic Control Devices

Traffic control devices are used to promote highway safety and efficiency through the orderly movement of all road users. Traffic control devices notify drivers of regulations and provide warning and guidance to promote efficient operation and minimize crash occurrences.

Option 6.a Variable Message Signage

Portable variable message signage can be used for various purposes to notify the traveling public of information pertaining to the roadway. Messages displayed on the variable message signs may include, but are not limited to, wildlife hazards, traffic conditions, road conditions, and cyclists on the roadway.

Variable message signage could be considered from RP 6.0 to RP 10.0 where wildlife crossings are known to occur. Variable message signage may also be beneficial within the mountainous portion of the MT 86 corridor (approximately RP 15.6 to RP 29.2) where bicycle traffic and limited sight distance have been noted.

Planning-level Cost Estimate

\$15,000 to \$35,000 each

Recommended Implementation Timeframe

Short-term to mid-term

Potentially-impacted Resources/Anticipated Right-of-Way

Resource, utility, and right-of-way impacts are not anticipated

Option 6.b Static Wildlife Signage

The study area is home to a variety of mammal species including white-tail deer, mule deer, elk, moose, black bear, mountain lion, gray wolf, and coyote. According to communications

between FWP and MDT, elk are plentiful in the southern portion of the study area, especially in the winter months. From RP 6.0 to RP 10.0 in the Kelly Canyon area, as well as near the intersection with Bridger Canyon Spur Road (RP 8.3) and Jackson Creek Road (RP 9.5), elk are frequently observed crossing the road in the winter months. This option would entail the installation of seasonal static signage between RP 6.0 and RP 10.0.

Planning-level Cost Estimate

\$500 per sign

Recommended Implementation Timeframe

Short-term

Potentially-impacted Resources /Anticipated Right-of-Way

Resource, utility, and right-of-way impacts are not anticipated.

3.7 Summary of Improvement Options

This report outlines a range of improvement options MDT may consider for future implementation in the MT 86 corridor. Improvement options are intended to address corridor needs and objectives, which were identified through a review of existing and projected conditions within the corridor, input from the public and resource agencies, and coordination with the study advisory committee. Figure 9 and Table 3 summarize potential improvement options for the MT 86 corridor.

Figure 9 Summary of Improvement Options

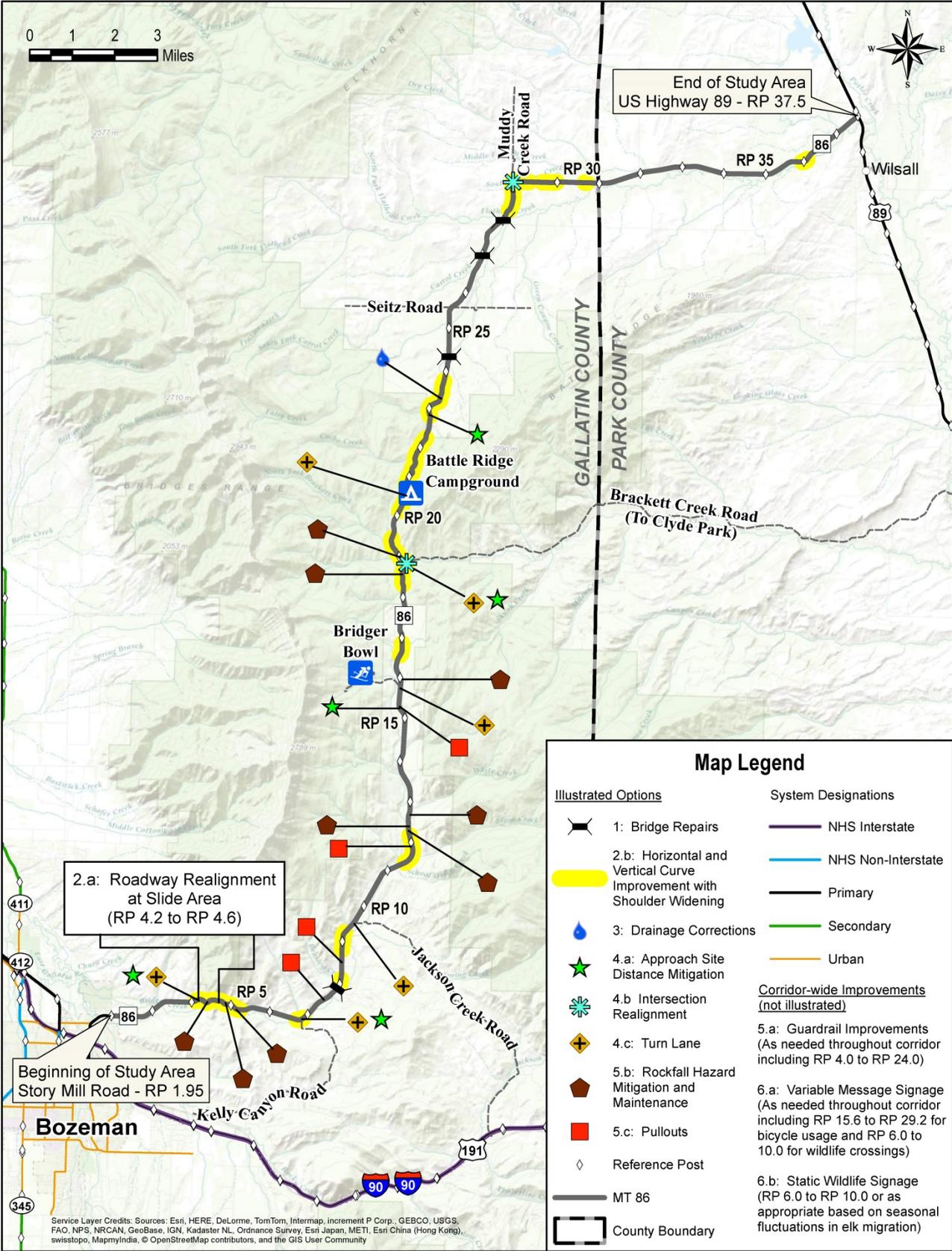


Table 3 Improvement Options Summary

Option Category	Option ID	Option Description	Locations	Planning-level Cost Estimate ⁽¹⁾	Potential Implementation Timeframe ⁽²⁾	Potentially-impacted Resources	Anticipated ROW																																																														
Bridge Repairs	Option 1	Bridge Repairs	RP 7.8 (Stock Pass) RP 24.4 (Cache Creek) RP 26.8 (Carrol Creek) RP 28.0 (Flathead Creek)	\$50,000 to \$110,000 (per bridge)	Short-term to mid-term	Yes	No																																																														
Curve Geometry and Roadway Width	Option 2.a	Roadway Realignment at Slide Area ⁽³⁾	RP 4.3 to RP 4.6 (slide area)	\$1,100,000 to \$1,200,000	Long-term	Yes	No																																																														
	Option 2.b	Horizontal and Vertical Curve Improvements with Shoulder Widening	<table border="1"> <thead> <tr> <th>Location⁽³⁾</th> <th>Horizontal</th> <th>Vertical</th> </tr> </thead> <tbody> <tr><td>RP 4.1 to RP 5.1</td><td>✓</td><td>✓</td></tr> <tr><td>RP 6.7</td><td>✓</td><td></td></tr> <tr><td>RP 8.0</td><td></td><td>✓</td></tr> <tr><td>RP 8.7 to RP 8.8</td><td></td><td>✓</td></tr> <tr><td>RP 9.0 to RP 9.1</td><td>✓</td><td>✓</td></tr> <tr><td>RP 11.7 to RP 11.8</td><td>✓</td><td>✓</td></tr> <tr><td>RP 12.0</td><td></td><td>✓</td></tr> <tr><td>RP 16.2</td><td>✓</td><td></td></tr> <tr><td>RP 16.5 to RP 16.8</td><td></td><td>✓</td></tr> <tr><td>RP 18.5</td><td></td><td>✓</td></tr> <tr><td>RP 18.7 to RP 18.8</td><td>✓</td><td>✓</td></tr> <tr><td>RP 19.0 to RP 19.4</td><td>✓</td><td>✓</td></tr> <tr><td>RP 20.2</td><td></td><td>✓</td></tr> <tr><td>RP 20.4</td><td></td><td>✓</td></tr> <tr><td>RP 20.6</td><td></td><td>✓</td></tr> <tr><td>RP 20.8 to RP 22.0</td><td>✓</td><td>✓</td></tr> <tr><td>RP 22.8 to RP 23.8</td><td>✓</td><td>✓</td></tr> <tr><td>RP 28.3 to RP 29.1</td><td>✓</td><td>✓</td></tr> <tr><td>RP 29.7 to RP 30.0</td><td></td><td>✓</td></tr> <tr><td>RP 35.8</td><td>✓</td><td></td></tr> </tbody> </table>	Location ⁽³⁾	Horizontal	Vertical	RP 4.1 to RP 5.1	✓	✓	RP 6.7	✓		RP 8.0		✓	RP 8.7 to RP 8.8		✓	RP 9.0 to RP 9.1	✓	✓	RP 11.7 to RP 11.8	✓	✓	RP 12.0		✓	RP 16.2	✓		RP 16.5 to RP 16.8		✓	RP 18.5		✓	RP 18.7 to RP 18.8	✓	✓	RP 19.0 to RP 19.4	✓	✓	RP 20.2		✓	RP 20.4		✓	RP 20.6		✓	RP 20.8 to RP 22.0	✓	✓	RP 22.8 to RP 23.8	✓	✓	RP 28.3 to RP 29.1	✓	✓	RP 29.7 to RP 30.0		✓	RP 35.8	✓		Average Reconstruction Cost: \$360,000 to \$390,000 per 0.1 mile	Mid-term to long-term	Yes
Location ⁽³⁾	Horizontal	Vertical																																																																			
RP 4.1 to RP 5.1	✓	✓																																																																			
RP 6.7	✓																																																																				
RP 8.0		✓																																																																			
RP 8.7 to RP 8.8		✓																																																																			
RP 9.0 to RP 9.1	✓	✓																																																																			
RP 11.7 to RP 11.8	✓	✓																																																																			
RP 12.0		✓																																																																			
RP 16.2	✓																																																																				
RP 16.5 to RP 16.8		✓																																																																			
RP 18.5		✓																																																																			
RP 18.7 to RP 18.8	✓	✓																																																																			
RP 19.0 to RP 19.4	✓	✓																																																																			
RP 20.2		✓																																																																			
RP 20.4		✓																																																																			
RP 20.6		✓																																																																			
RP 20.8 to RP 22.0	✓	✓																																																																			
RP 22.8 to RP 23.8	✓	✓																																																																			
RP 28.3 to RP 29.1	✓	✓																																																																			
RP 29.7 to RP 30.0		✓																																																																			
RP 35.8	✓																																																																				
Drainage Corrections	Option 3	Drainage Corrections	RP 23.4	\$48,000 to \$51,000	Short-term	Yes	No																																																														

Option Category	Option ID	Option Description	Locations	Planning-level Cost Estimate ⁽¹⁾	Potential Implementation Timeframe ⁽²⁾	Potentially-impacted Resources	Anticipated ROW
Intersection Improvements	Option 4.a	Approach Sight Distance Mitigation	RP 4.2 ("M" Trailhead Parking Area) ⁽³⁾ RP 6.7 (Kelly Canyon Road) ⁽³⁾ RP 15.2 (Private Approach) RP 18.8 (Brackett Creek) ⁽³⁾ RP 22.7 (Private Approach)	\$40,000 to \$390,000 (per approach) \$960,000 to \$1,120,000 (total)	Mid-term	Yes	Yes
	Option 4.b	Intersection Realignment ⁽³⁾	RP 18.8 (Brackett Creek) RP 28.8 (Muddy Creek Road)	\$340,000 to \$790,000 (per location)	Mid-term to Long-term	Yes	Yes
	Option 4.c	Turn Lanes ⁽³⁾	RP 4.2 ("M" Trailhead) RP 6.7 (Kelly Canyon Road) RP 9.5 (Jackson Creek Road) RP 15.7 (Bridger Bowl) RP 18.8 (Brackett Creek) RP 20.5 (Battle Ridge Campground)	\$900,000 to \$1,100,000 (per location)	Mid-term to long-term	Yes	Yes
Roadside Safety	Option 5.a	Guardrail Improvements	As needed throughout corridor (including intermittently from RP 4.0 to RP 24.0)	Varies depending on treatment and location	Short-term and as needed	No	No
	Option 5.b	Rockfall Hazard Mitigation and Maintenance	RP 4.4 RP 4.8 RP 5.2 RP 12.3 RP 12.4 RP 12.7 RP 16.0 RP 18.6 RP 19.0	RP 4.4: \$740,000 to \$800,000 All Others: Unknown	Mid-term to long-term	Yes	Yes
	Option 5.c	Pullouts	RP 7.5 (NB) RP 8.5 (SB) RP 11.9 (NB) RP 15.3 (SB)	\$150,000 to \$160,000 (per location)	Mid-term	Yes	Yes
Traffic Control Devices	Option 6.a	Variable Message Signage	As needed throughout corridor (including RP 15.6 to RP 29.2 for bicycle usage and RP 6.0 to 10.0 for wildlife crossings)	\$15,000 to \$35,000 (each)	Short-term	No	No
	Option 6.b	Static Wildlife Signage	RP 6.0 to 10.0 or as appropriate based on seasonal fluctuations in elk migration	\$500 (per static sign)	Short-term	No	No

⁽¹⁾ Planning-level construction cost estimates are provided in 2014 dollars and are rounded for planning purposes. Cost estimates reflect contingency ranges to account for the high degree of unknown factors at the planning level. Costs associated with right-of-way acquisition, preliminary engineering, and construction engineering/inspection are included where appropriate.

⁽²⁾ The potential implementation timeframe does not indicate when projects will be programmed. Project programming is based on available funding and other system priorities. Timeframes are defined as follows – Immediate: Implementation is currently ongoing or will be initiated in 2015; Short-term: Implementation is recommended within a 1- to 3-year period; Mid-term: Implementation is recommended within a 3- to 6-year period; Long-term: Implementation is recommended within a 6- to 20-year period.

⁽³⁾ Locations are identified as high potential for crash reduction (LOSS IV).

4.0 References

- AASHTO. (2011). A Policy on Geometric Design of Highways and Streets. Section 4.4.2 Width of Shoulders; Table 7-1 Minimum Width of Traveled Way and Usable Shoulder for Rural Arterials; Figure 2-24 Acceleration of Passenger Cars, Level Conditions.
- FHWA. (2009). Manual on Uniform Traffic Control Devices for Streets and Highways.
- Montana Department of Transportation. (2004). Road Design Manual. Retrieved December 2014 from: <http://www.mdt.mt.gov/publications/manuals.shtml>
- Montana Department of Transportation. (2007). Traffic Engineering Manual. Retrieved December 2014 from: <http://www.mdt.mt.gov/publications/manuals.shtml>
- Montana Department of Transportation. (2010). Environmental Manual. Retrieved December 2014 from: <http://www.mdt.mt.gov/publications/manuals.shtml>
- Montana Department of Transportation. (2005). Rockfall Hazard Classification and Mitigation System.

Attachment 1

Cost Estimate Spreadsheets





Option 1 - BRIDGE REPAIRS
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	2014 MDT Bid Prices ¹		Adjusted Unit Prices		
			Unit Price	Amount	Unit Price	Amount ²	
			Dollars	Dollars	Dollars	Dollars	
BRIDGE - STOCK PASS (RP 7.8)							
COLD MILL	462	SQYD	\$1.70	\$786.00	\$10.00	\$4,622.00	
COMMERCIAL MIX PG 64-28 ³	130	TON	\$96.99	\$12,609.00	\$150.00	\$19,500.00	
EMULSIFIED ASPHALT CRS-2P	1.2	TON	\$613.48	\$725.00	\$650.00	\$768.00	
COVER-TYPE 1	462	SQYD	\$0.54	\$250.00	\$1.00	\$462.00	
CRUSHED AGGREGATE COURSE ³	119	CUYD	\$18.79	\$2,244.00	\$25.00	\$2,986.00	
SPECIAL BORROW ³	12	CUYD		\$0.00	\$35.00	\$411.00	
REMOVE GUARD RAIL	24	LNFT	\$1.60	\$38.00	\$5.00	\$120.00	
GUARDRAIL-OPTIONAL TERM SECT	4	EACH	\$2,574.32	\$10,297.00		\$10,297.00	
GUARDRAIL-BR APP	4	EACH	\$2,301.05	\$9,204.00		\$9,204.00	
GUARD RAIL-STEEL	24	LNFT	\$15.97	\$383.00	\$20.00	\$480.00	
BRIDGE - STOCK PASS (RP 7.8) SUBTOTAL						\$48,850	
ADDITIONAL COSTS							
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					20%	\$9,800	
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					15%	\$7,300	
SUBTOTAL 2						\$66,000	
PRELIMINARY ENGINEERING					10%	\$6,600	
CONSTRUCTION ENGINEERING					10%	\$6,600	
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$6,000	
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$100,000	
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$110,000	
BRIDGE - CACHE CREEK (RP 24.4)							
COLD MILL	462	SQYD	\$1.70	\$786.00	\$10.00	\$4,622.00	
COMMERCIAL MIX PG 64-28 ³	130	TON	\$96.99	\$12,609.00	\$150.00	\$19,500.00	
EMULSIFIED ASPHALT CRS-2P	1.2	TON	\$613.48	\$725.00	\$650.00	\$768.00	
COVER-TYPE 1	462	SQYD	\$0.54	\$250.00	\$1.00	\$462.00	
CRUSHED AGGREGATE COURSE ³	119	CUYD	\$18.79	\$2,244.00	\$25.00	\$2,986.00	
SPECIAL BORROW ³	13	CUYD		\$0.00	\$25.00	\$317.00	
REMOVE GUARD RAIL	24	LNFT	\$1.60	\$38.00	\$5.00	\$120.00	
GUARDRAIL-OPTIONAL TERM SECT	4	EACH	\$2,574.32	\$10,297.00		\$10,297.00	
GUARDRAIL-BR APP	4	EACH	\$2,301.05	\$9,204.00		\$9,204.00	
GUARD RAIL-STEEL	24	LNFT	\$15.97	\$383.00	\$20.00	\$480.00	
BRIDGE - CACHE CREEK (RP 24.4) SUBTOTAL						\$48,756	
ADDITIONAL COSTS							
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					20%	\$9,800	
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					15%	\$7,300	
SUBTOTAL 2						\$65,900	
PRELIMINARY ENGINEERING					10%	\$6,590	
CONSTRUCTION ENGINEERING					10%	\$6,590	
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$6,000	
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$100,000	
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$110,000	
BRIDGE - CARROL CREEK (RP 26.8)							
EXCAVATION-UNCLASSIFIED ⁴	154	CUYD	\$1.70	\$261.00	\$8.00	\$1,229.00	
EXCAVATION-UNCLASSIFIED BORROW ⁴	154	CUYD	\$11.36	\$1,749.00	\$12.00	\$1,848.00	
COLD MILL	154	SQYD	\$1.70	\$261.00	\$6.00	\$922.00	
COMMERCIAL MIX PG 64-28 ³	40	TON	\$96.99	\$3,880.00	\$150.00	\$6,000.00	
EMULSIFIED ASPHALT CRS-2P	0.4	TON	\$613.48	\$223.00	\$650.00	\$236.00	
COVER-TYPE 1	154	SQYD	\$0.54	\$83.00	\$1.00	\$154.00	
CRUSHED AGGREGATE COURSE ³	30	CUYD	\$18.79	\$570.00	\$35.00	\$1,061.00	
SPECIAL BORROW ³	51	CUYD		\$0.00	\$35.00	\$1,769.00	
REMOVE GUARD RAIL	24	LNFT	\$1.60	\$38.00	\$5.00	\$120.00	
GUARDRAIL-OPTIONAL TERM SECT	4	EACH	\$2,574.32	\$10,297.00		\$10,297.00	
GUARDRAIL-BR APP	4	EACH	\$2,301.05	\$9,204.00		\$9,204.00	
GUARD RAIL-STEEL	24	LNFT	\$15.97	\$383.00	\$20.00	\$480.00	
BRIDGE - CARROL CREEK (RP 26.8) SUBTOTAL						\$33,320	



Option 1 - BRIDGE REPAIRS
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	2014 MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
ADDITIONAL COSTS						
					20%	\$6,700
					15%	\$5,000
						\$45,000
					10%	\$4,500
					10%	\$4,500
					9.13%	\$4,100
						\$70,000
						\$80,000
BRIDGE - FLATHEAD CREEK (RP 28.0)						
COMMERCIAL MIX PG 64-28 ³	140	TON	\$96.99	\$13,579.00	\$150.00	\$21,000.00
EMULSIFIED ASPHALT CRS-2P ³	1.3	TON	\$613.48	\$781.00		\$781.00
COVER-TYPE 1 ³	533	SQYD	\$0.54	\$288.00	\$1.00	\$533.00
COLD MILLING ³	530	SQYD	\$1.70	\$901.00	\$4.00	\$2,120.00
						BRIDGE - FLATHEAD CREEK (RP 28.0) SUBTOTAL
						\$24,434
ADDITIONAL COSTS						
					25%	\$6,109
					10%	\$2,443
						\$32,990
					8%	\$2,640
					10%	\$3,299
					9.13%	\$3,010
						\$50,000
						\$55,000
						SUBTOTAL 1 (ALL 4 BRIDGES)
						\$155,360
ADDITIONAL COSTS						
					20%	\$31,100
					15%	\$23,300
						\$209,800
					10%	\$20,980
					10%	\$20,980
					9.13%	\$19,200
						\$330,000
						\$350,000

¹ Average MDT bid prices provided for the period July 2013 to July 2014.

² Cost estimates are provided in 2014 dollars. All dollar amounts are rounded for planning purposes.

³ Proposed top width matches existing top width. Paved road typical section includes 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁴ 3 ft average cut and fill depth is assumed throughout the corridor.

⁵ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁶ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁷ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁸ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁹ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.



**Option 2.a - RP 4.3 to RP 4.6 REALIGN ROADWAY
Planning-level Estimate of Costs**

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
RP 4.3 TO RP 4.6						
ROADWAY OBLITERATION	31	STA	\$257.59	\$8,005.00	\$300.00	\$9,323.00
EXCAVATION - UNCLASSIFIED ⁴	25,000	CUYD	\$4.24	\$106,000.00	\$6.00	\$150,000.00
EXCAVATION-UNCLASSIFIED BORROW ⁴	3,500	CUYD	\$11.36	\$39,760.00	\$12.00	\$42,000.00
COMMERCIAL MIX PG 64-28 ³	1,560	TON	\$96.99	\$151,304.00	\$110.00	\$171,600.00
EMULSIFIED ASPHALT CRS-2P	14.2	TON	\$613.48	\$8,700.00	\$650.00	\$9,218.00
COVER-TYPE 1	6,083	SQYD	\$0.54	\$3,285.00	\$1.00	\$6,083.00
CRUSHED AGGREGATE COURSE ³	1,431	CUYD	\$22.16	\$31,705.00	\$25.00	\$35,769.00
SPECIAL BORROW ³	2,956	CUYD		\$0.00	\$20.00	\$59,116.00
REMOVE GUARD RAIL ¹⁰	424	LNFT	\$1.60	\$678.00	\$2.00	\$848.00
GUARD RAIL-STEEL ¹⁰	424	LNFT	\$15.97	\$6,771.00	\$20.00	\$8,480.00
STRIPING - WHITE EPOXY	30	GAL	\$64.78	\$1,943.00	\$100.00	\$3,000.00
STRIPING - YELLOW EPOXY	30	GAL	\$67.39	\$2,022.00	\$100.00	\$3,000.00
SUBTOTAL 1					\$498,437	
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					25%	\$125,000
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					10%	\$50,000
SUBTOTAL 2						\$670,000
PRELIMINARY ENGINEERING					12%	\$80,400
CONSTRUCTION ENGINEERING					10%	\$67,000
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$61,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,8}						\$1,100,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,8}						\$1,200,000

¹ Average MDT bid prices provided for the period July 2013 to July 2014.

² Cost estimates are provided in 2014 dollars. All dollar amounts are rounded for planning purposes.

³ Gravel road typical section includes a top width of 24 ft and 2 ft of crushed aggregate course. Paved road typical section includes a top width of 36 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁴ 2 ft average fill depth is assumed throughout the roadway segment. 2 ft average cut depth assumed throughout roadway segment with exception of the slide area.

⁵ The Miscellaneous category is estimated at 25 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁶ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁷ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁸ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁹ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.



**Option 2.b - HORIZONTAL AND VERTICAL CURVE IMPROVEMENTS
WITH SHOULDER WIDENING
Planning-level Estimate of Costs**

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ²		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ³
			Dollars	Dollars	Dollars	Dollars
RP 6.7						
COMMERCIAL MIX PG 64-28 ⁴	1,050	TON	\$96.99	\$101,840.00	\$100.00	\$105,000.00
EMULSIFIED ASPHALT CRS-2P	9.5	TON	\$613.48	\$5,856.00	\$650.00	\$6,205.00
COVER-TYPE 1	4,088	SQYD	\$0.54	\$2,207.00	\$1.00	\$4,088.00
CRUSHED AGGREGATE COURSE ⁴	962	CUYD	\$18.79	\$18,071.00	\$25.00	\$24,044.00
SPECIAL BORROW ⁴	1,987	CUYD		\$0.00	\$20.00	\$39,738.00
ROADWAY OBLITERATION	9.5	STA	\$257.59	\$2,447.00	\$300.00	\$2,850.00
EXCAVATION - UNCLASSIFIED ⁵	5,450	CUYD	\$4.24	\$23,108.00	\$6.00	\$32,700.00
RIGHT OF WAY ¹¹	1.8	ACRE		\$0.00	\$46,000.00	\$82,800.00
RP 6.7 SUBTOTAL						\$297,425
RP 17.3						
COMMERCIAL MIX PG 64-28 ⁴	330	TON	\$96.99	\$32,007.00	\$125.00	\$41,250.00
EMULSIFIED ASPHALT CRS-2P	3.0	TON	\$613.48	\$1,840.00	\$650.00	\$1,950.00
COVER-TYPE 1	1,290	SQYD	\$0.54	\$697.00	\$1.00	\$1,290.00
CRUSHED AGGREGATE COURSE ⁴	304	CUYD	\$18.79	\$5,707.00	\$25.00	\$7,593.00
SPECIAL BORROW ⁴	627	CUYD		\$0.00	\$20.00	\$12,549.00
ROADWAY OBLITERATION	3.0	STA	\$257.59	\$773.00	\$300.00	\$900.00
EXCAVATION - UNCLASSIFIED ⁵	2,222	CUYD	\$4.24	\$9,422.00	\$6.00	\$13,333.00
RIGHT OF WAY ¹¹	0.9	ACRE		\$0.00	\$46,000.00	\$41,400.00
RP 17.3 SUBTOTAL						\$120,265
RP 28.5						
COMMERCIAL MIX PG 64-28 ⁴	230	TON	\$96.99	\$22,308.00	\$100.00	\$23,000.00
EMULSIFIED ASPHALT CRS-2P	2.1	TON	\$613.48	\$1,283.00	\$650.00	\$1,359.00
COVER-TYPE 1	900	SQYD	\$0.54	\$486.00	\$1.00	\$900.00
CRUSHED AGGREGATE COURSE ⁴	210	CUYD	\$18.79	\$3,946.00	\$25.00	\$5,250.00
SPECIAL BORROW ⁴	433	CUYD		\$0.00	\$20.00	\$8,660.00
ROADWAY OBLITERATION	2.0	STA	\$257.59	\$515.00	\$300.00	\$600.00
EXCAVATION - UNCLASSIFIED ⁵	1,093	CUYD	\$4.24	\$4,636.00	\$6.00	\$6,560.00
RIGHT OF WAY ¹¹	0.8	ACRE		\$0.00	\$20,000.00	\$16,000.00
RP 28.4 SUBTOTAL						\$62,329
CATEGORY	LENGTH (0.1 MILE)¹			COST PER 0.1 MILE¹		
RP 6.7	1.80			\$165,236		
RP 17.3	0.60			\$200,442		
RP 28.5	0.40			\$155,823		
AVERAGE COST PER 0.1 MILE¹				\$173,833		
SUBTOTAL 1						\$173,833
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁶					20%	\$34,800
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁷					10%	\$17,400
SUBTOTAL 2						\$226,000
PRELIMINARY ENGINEERING					12%	\$27,120
CONSTRUCTION ENGINEERING					10%	\$22,600
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁸					9.13%	\$20,600
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ¹⁰						\$360,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ¹⁰						\$390,000

¹ 0.1 mile is 528 ft.

² Average MDT bid prices provided for the period July 2013 to July 2014.

³ Cost estimates are provided in 2014 dollars. All dollar amounts are rounded for planning purposes.

⁴ Gravel road typical section includes a top width of 24 ft and 2 ft of crushed aggregate course. Paved road typical section includes a top width of 36 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁵ 4 ft average cut depth is assumed.

⁶ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁷ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁸ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁹ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

¹⁰ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.



Option 3 - DRAINAGE CORRECTIONS
Planning-level Estimate of Costs

Item Description	Approx. Quantity (Per Station) ¹	Unit	Average MDT Bid Prices ²		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ³
			Dollars	Dollars	Dollars	Dollars
RP 23.4						
COMMERCIAL MIX PG 64-28 ⁴	110	TON	\$96.99	\$10,669.00	\$150.00	\$16,500.00
EMULSIFIED ASPHALT CRS-2P	1.0	TON	\$613.48	\$613.00	\$650.00	\$650.00
COVER-TYPE 1	428	SQYD	\$0.54	\$231.00	\$1.00	\$428.00
CRUSHED AGGREGATE COURSE ⁴	101	CUYD	\$22.16	\$2,243.00	\$30.00	\$3,037.00
SPECIAL BORROW ⁴	209	CUYD		\$0.00	\$30.00	\$6,274.00
EXCAVATION - UNCLASSIFIED ⁵	30	CUYD	\$4.24	\$126.00	\$15.00	\$444.00
REMOVE PIPE CULVERT	320	LNFT	\$13.88	\$4,442.00	\$15.00	\$4,800.00
CULVERT 18"	400	LNFT	\$43.63	\$17,452.00	\$45.00	\$18,000.00
				RP 23.4		\$50,133
CATEGORY	LENGTH (STA.)		COST PER STATION			
RP 23.4	0.50		50,133.00			\$25,000
ADDITIONAL COSTS						
			MISCELLANEOUS ITEMS SUBTOTAL 1 ⁶		20%	\$5,000
			MOBILIZATION @ 10% OF SUBTOTAL 1 ⁷		10%	\$3,000
			SUBTOTAL 2			\$30,000
			PRELIMINARY ENGINEERING		12%	\$3,600
			CONSTRUCTION ENGINEERING		10%	\$3,000
			INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁸		9.13%	\$3,000
			TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,10}			\$48,000
			TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,10}			\$51,000

¹ One station is equal to 100 feet.

² Average MDT bid prices provided for the period July 2013 to July 2014.

³ Cost estimates are provided in 2014 dollars. All dollar amounts are rounded for planning purposes.

⁴ Gravel road typical section includes a top width of 24 ft and 2 ft of crushed aggregate course. Paved road typical section includes a top width of 36 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁵ 1 ft average cut depth (ditch grading) is assumed.

⁶ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁷ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁸ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁹ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

¹⁰ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.



Option 4.a - APPROACH SIGHT DISTANCE MITIGATION
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
RP 4.18 ("M" TRAILHEAD PARKING AREA)						
EXCAVATION-UNCLASSIFIED ⁴	1,000	CUYD	\$4.24	\$4,240.00	\$6.00	\$6,000.00
TOPSOIL ³	335	CUYD	\$26.40	\$8,844.00	\$30.00	\$10,050.00
SEEDING AREA NO 1	0.20	ACRE	\$379.87	\$76.00	\$400.00	\$80.00
CONDITION SEEDBED SURFACE	0.20	ACRE	\$61.48	\$12.00	\$70.00	\$14.00
RIGHT OF WAY ¹⁰	0.4	ACRE		\$0.00	\$60,000.00	\$24,000.00
RP 4.18 ("M" TRAILHEAD PARKING AREA) SUBTOTAL				\$4,240.00		\$40,144
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					25%	\$10,000
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					15%	\$6,000
SUBTOTAL 2						\$56,000
PRELIMINARY ENGINEERING					10%	\$5,600
CONSTRUCTION ENGINEERING					10%	\$5,600
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$5,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$90,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$94,000
RP 6.68 (KELLY CANYON ROAD)						
EXCAVATION-UNCLASSIFIED ⁴	5,450	CUYD	\$4.24	\$23,108.00	\$6.00	\$32,700.00
TOPSOIL ³	1,800	CUYD	\$26.40	\$47,520.00	\$30.00	\$54,000.00
SEEDING AREA NO 1	1.10	ACRE	\$379.87	\$418.00	\$400.00	\$440.00
CONDITION SEEDBED SURFACE	1.10	ACRE	\$61.48	\$68.00	\$70.00	\$77.00
RIGHT OF WAY ¹⁰	1.3	ACRE		\$0.00	\$60,000.00	\$78,000.00
RP 6.68 (KELLY CANYON ROAD) SUBTOTAL				\$23,108.00		\$165,217
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					25%	\$41,300
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					15%	\$24,800
SUBTOTAL 2						\$231,000
PRELIMINARY ENGINEERING					10%	\$23,100
CONSTRUCTION ENGINEERING					10%	\$23,100
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$21,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$360,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$388,000
RP 15.24 (PRIVATE APPROACH)						
EXCAVATION-UNCLASSIFIED ⁴	2,930	CUYD	\$4.24	\$12,423.00	\$6.00	\$17,580.00
TOPSOIL ³	980	CUYD	\$26.40	\$25,872.00	\$30.00	\$29,400.00
SEEDING AREA NO 1	0.60	ACRE	\$379.87	\$228.00	\$400.00	\$240.00
CONDITION SEEDBED SURFACE	0.60	ACRE	\$61.48	\$37.00	\$70.00	\$42.00
RIGHT OF WAY ¹⁰	0.7	ACRE		\$0.00	\$60,000.00	\$42,000.00
RP 15.24 (PRIVATE APPROACH) SUBTOTAL				\$12,423.00		\$89,262
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					25%	\$22,300
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					15%	\$13,400
SUBTOTAL 2						\$125,000
PRELIMINARY ENGINEERING					10%	\$12,500
CONSTRUCTION ENGINEERING					10%	\$12,500
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$11,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$190,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$209,000
RP 18.75 (BRACKETT CREEK)						
EXCAVATION-UNCLASSIFIED ⁴	1,530	CUYD	\$4.24	\$6,487.00	\$10.00	\$15,300.00
REVEGETATION	0.1	ACRE	\$509.90	\$51.00	\$1,000.00	\$100.00
CHEVRON SIGN PANEL 24X30	8.0	EACH		\$0.00	\$250.00	\$2,000.00



**Option 4.a - APPROACH SIGHT DISTANCE MITIGATION
Planning-level Estimate of Costs**

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
RP 18.75 (BRACKETT CREEK) SUBTOTAL				\$6,487.00		\$17,400
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					30%	\$5,200
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					15%	\$2,600
SUBTOTAL 2						\$25,000
PRELIMINARY ENGINEERING					12%	\$3,000
CONSTRUCTION ENGINEERING					10%	\$2,500
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$2,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$40,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$42,000
RP 22.73 (PRIVATE APPROACH)						
EXCAVATION-UNCLASSIFIED ⁴	2,225	CUYD	\$4.24	\$9,434.00	\$6.00	\$13,350.00
TOPSOIL ³	745	CUYD	\$26.40	\$19,668.00	\$30.00	\$22,350.00
SEEDING AREA NO 1	0.45	ACRE	\$379.87	\$171.00	\$400.00	\$180.00
CONDITION SEEDBED SURFACE	0.45	ACRE	\$61.48	\$28.00	\$70.00	\$32.00
RIGHT OF WAY ¹⁰	0.6	ACRE		\$0.00	\$30,000.00	\$18,000.00
RP 22.73 (PRIVATE APPROACH) SUBTOTAL				\$9,434.00		\$53,912
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					25%	\$13,500
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					15%	\$8,100
SUBTOTAL 2						\$76,000
PRELIMINARY ENGINEERING					10%	\$7,600
CONSTRUCTION ENGINEERING					10%	\$7,600
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$7,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$120,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$128,000
AVERAGE APPROACH - SUBTOTAL 1						\$69,757.00
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					25%	\$17,400
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					15%	\$10,500
SUBTOTAL 2						\$98,000
PRELIMINARY ENGINEERING					10%	\$9,800
CONSTRUCTION ENGINEERING					10%	\$9,800
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$9,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$960,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$1,119,000

¹ Average MDT bid prices provided for the period July 2013 to July 2014.

² Cost estimates are provided in 2014 dollars. All dollar amounts are rounded for planning purposes.

³ Assume topsoil depth of 1'.

⁴ Assume an excavation depth of 3 ft for all locations except Brackett Creek (RP 18.75), with an assumed excavation depth of 4 ft.

⁵ The Miscellaneous category is estimated at 25 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁶ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁷ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁸ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁹ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.



Option 4.b - RP 18.74 to RP 18.77 (BRACKETT CREEK) INTERSECTION REALIGNMENT
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
BRACKETT CREEK (RP 18.74 TO 18.77)						
COMMERCIAL MIX PG 64-28 ³	320	TON	\$96.99	\$31,037.00	\$125.00	\$40,000.00
EMULSIFIED ASPHALT CRS-2P	2.9	TON	\$613.48	\$1,785.00	\$650.00	\$1,891.00
COVER-TYPE 1	1,230	SQYD	\$0.54	\$664.00	\$1.00	\$1,230.00
CRUSHED AGGREGATE COURSE ³	1,248	CUYD	\$22.16	\$27,661.00	\$30.00	\$37,447.00
SPECIAL BORROW ³	600	CUYD		\$0.00	\$25.00	\$15,000.00
EXCAVATION-UNCLASSIFIED BORROW ⁴	5,000	CUYD	\$11.36	\$56,800.00	\$12.00	\$60,000.00
EXCAVATION-UNCLASSIFIED ⁴	2,300	CUYD	\$4.24	\$9,752.00	\$6.00	\$13,800.00
ROADWAY OBLITERATION	7	STA	\$257.59	\$1,764.00	\$350.00	\$2,398.00
BOX CULVERT	1	EACH		\$0.00	\$20,000.00	\$20,000.00
GUARD RAIL-STEEL	250	LNFT	\$15.97	\$3,993.00	\$20.00	\$5,000.00
REMOVE GUARD RAIL	60	LNFT	\$1.60	\$96.00	\$3.00	\$180.00
REVEGETATION	0.1	ACRE	\$509.90	\$51.00	\$1,000.00	\$100.00
CHEVRON SIGN PANEL 24X30	8	EACH		\$0.00	\$250.00	\$2,000.00
RIGHT OF WAY ⁴	0.6	ACRE		\$0.00	\$30,000.00	\$18,000.00
MUDDY CREEK ROAD (RP 28.78) SUBTOTAL 1						\$155,925
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					25%	\$39,000
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					10%	\$15,600
SUBTOTAL 2						\$211,000
PRELIMINARY ENGINEERING					15%	\$31,650
CONSTRUCTION ENGINEERING					10%	\$21,100
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$19,300
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$340,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$370,000

¹ Average MDT bid prices provided for the period July 2013 to July 2014.

² Cost estimates are provided in 2014 dollars. All dollar amounts are rounded for planning purposes.

³ Gravel road typical section includes a top width of 24 ft and 2 ft of crushed aggregate course. Paved road typical section includes a top width of 36 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁴ 6 ft average cut depth is assumed.

⁵ The Miscellaneous category is estimated at 25 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁶ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁷ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁸ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁹ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.



Option 4.b - RP 28.78 (MUDDY CREEK ROAD) INTERSECTION REALIGNMENT
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
MUDDY CREEK ROAD (RP 28.78)						
COMMERCIAL MIX PG 64-28 ³	940	TON	\$96.99	\$91,171.00	\$125.00	\$117,500.00
EMULSIFIED ASPHALT CRS-2P	8.5	TON	\$613.48	\$5,242.00	\$650.00	\$5,555.00
COVER-TYPE 1	3,653	SQYD	\$0.54	\$1,972.00	\$1.00	\$3,653.00
CRUSHED AGGREGATE COURSE ³	1,790	CUYD	\$22.16	\$39,662.00	\$30.00	\$53,693.00
SPECIAL BORROW ³	1,462	CUYD		\$0.00	\$20.00	\$29,234.00
EMBANKMENT IN PLACE ⁴	12,000	CUYD	\$11.36	\$136,320.00	\$12.00	\$144,000.00
ROADWAY OBLITERATION	10	STA	\$257.59	\$2,568.00	\$300.00	\$2,991.00
FARM FENCE	1,500	LNFT	\$1.91	\$2,865.00	\$2.00	\$3,000.00
STRIPING - WHITE EPOXY	15	GAL	\$64.78	\$972.00	\$100.00	\$1,500.00
STRIPING - YELLOW EPOXY	15	GAL	\$67.39	\$1,011.00	\$100.00	\$1,500.00
RIGHT OF WAY ¹⁰	2.3	ACRE		\$0.00	\$20,000.00	\$46,000.00
MUDDY CREEK ROAD (RP 28.78) SUBTOTAL 1						\$362,626
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					20%	\$72,500
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					10%	\$36,300
SUBTOTAL 2						\$471,000
PRELIMINARY ENGINEERING					10%	\$47,100
CONSTRUCTION ENGINEERING					10%	\$47,100
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$43,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}						\$730,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}						\$790,000

¹ Average MDT bid prices provided for the period July 2013 to July 2014.

² Cost estimates are provided in 2014 dollars. All dollar amounts are rounded for planning purposes.

³ Gravel road typical section includes a top width of 24 ft and 2 ft of crushed aggregate course. Paved road typical section includes a top width of 36 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow.

⁴ 10 ft average fill depth is assumed.

⁵ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁶ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁷ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁸ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁹ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.



Option 4.c - TURN LANES
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ²		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ³
			Dollars	Dollars	Dollars	Dollars
TURN LANE (45 MPH DESIGN SPEED)¹						
EXCAVATION - UNCLASSIFIED ⁵	2,000	CUYD	\$4.24	\$8,480.00	\$4.50	\$9,000.00
EXCAVATION-UNCLASSIFIED BORROW ⁵	2,909	CUYD	\$11.36	\$33,045.00	\$12.00	\$34,907.00
COMMERCIAL MIX PG 64-28 ⁴	1,980	TON	\$96.99	\$192,040.00	\$115.00	\$227,700.00
EMULSIFIED ASPHALT CRS-2P	18.0	TON	\$613.48	\$11,043.00	\$650.00	\$11,700.00
COVER-TYPE 1	9,520	SQYD	\$0.54	\$5,141.00	\$0.60	\$5,712.00
CRUSHED AGGREGATE COURSE ⁴	1,322	CUYD	\$22.16	\$29,300.00	\$25.00	\$33,056.00
SPECIAL BORROW ⁴	1,900	CUYD		\$0.00	\$16.00	\$30,401.00
STRIPING - WHITE EPOXY	10	GAL	\$64.78	\$648.00	\$75.00	\$750.00
STRIPING - YELLOW EPOXY	15	GAL	\$67.39	\$1,011.00	\$75.00	\$1,125.00
RIGHT OF WAY ¹¹	0.8	ACRE		\$0.00	\$46,000.00	\$36,800.00
TURN LANE (45 MPH DESIGN SPEED) SUBTOTAL						\$391,151
TURN LANE (55 MPH DESIGN SPEED)¹						
EXCAVATION - UNCLASSIFIED ⁵	3,000	CUYD	\$4.24	\$12,720.00	\$4.50	\$13,500.00
EXCAVATION-UNCLASSIFIED BORROW ⁵	3,611	CUYD	\$11.36	\$41,024.00	\$12.00	\$43,335.00
COMMERCIAL MIX PG 64-28 ⁴	2,450	TON	\$96.99	\$237,626.00	\$115.00	\$281,750.00
EMULSIFIED ASPHALT CRS-2P	22.3	TON	\$613.48	\$13,664.00	\$650.00	\$14,477.00
COVER-TYPE 1	11,819	SQYD	\$0.54	\$6,382.00	\$0.60	\$7,091.00
CRUSHED AGGREGATE COURSE ⁴	4,924	CUYD	\$22.16	\$109,126.00	\$25.00	\$123,111.00
SPECIAL BORROW ⁴	2,224	CUYD		\$0.00	\$16.00	\$35,588.00
STRIPING - WHITE EPOXY	15	GAL	\$64.78	\$972.00	\$75.00	\$1,125.00
STRIPING - YELLOW EPOXY	20	GAL	\$67.39	\$1,348.00	\$75.00	\$1,500.00
RIGHT OF WAY ¹¹	1.0	ACRE		\$0.00	\$46,000.00	\$46,000.00
TURN LANE (55 MPH DESIGN SPEED) SUBTOTAL						\$567,477
AVERAGE TURN LANE COST - SUBTOTAL 1						\$479,000
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁶					15%	\$71,900
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁷					10%	\$47,900
SUBTOTAL 2						\$598,800
PRELIMINARY ENGINEERING					10%	\$59,880
CONSTRUCTION ENGINEERING					10%	\$59,880
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁸					9.13%	\$55,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{9,10}						\$900,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{9,10}						\$1,100,000

¹ For 45 mph design speed, the turn lane has a stopping distance of 385 ft (per Figure 28.4H MDT traffic engineering manual) and a 10:1 taper (per Figure 28.4G MDT traffic engineering manual)

For 55 mph design speed, the turn lane has a stopping distance of 480 ft (per Figure 28.4H MDT traffic engineering manual) and a 18:1 taper (per Figure 28.4G MDT traffic engineering manual)

² Average MDT bid prices provided for the period July 2013 to July 2014.

³ Cost estimates are provided in 2014 dollars. All dollar amounts are rounded for planning purposes.

⁴ Gravel road typical section includes a top width of 24 ft and 2 ft of crushed aggregate course. Paved road typical section includes a top width of 36 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow. Overlay includes 0.2 ft depth of plant mix surfacing. Top width at turn lanes is 48 ft.

⁵ 1 ft average cut depth (below subgrade) is assumed throughout the corridor.

⁶ The Miscellaneous category is estimated at 15 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁷ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁸ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁹ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

¹⁰ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

¹¹ Right of way costs estimated from anticipated impacted area.



Option 5.b - RP 4.4 ROCKFALL HAZARD MITIGATION AND MAINTENANCE
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
RP 4.4						
EXCAVATION - UNCLASSIFIED ⁴	2,222	CUYD	\$4.24	\$9,422.00	\$5.00	\$11,111.00
BLASTING CONSULTANT	1	LS	\$17,750.00	\$17,750.00	\$30,000.00	\$30,000.00
ROCKFALL NETTING ³	20,000	SQFT	\$0.00	\$0.00	\$10.00	\$200,000.00
DSN, CNST GRAVITY RET WALL	133	SQYD	\$0.00	\$0.00	\$600.00	\$79,998.00
RIGHT OF WAY ¹¹	0.7	ACRE	\$0.00	\$0.00	\$46,000.00	\$32,200.00
SUBTOTAL 1					\$353,309	
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1 ⁵					20%	\$71,000
MOBILIZATION @ 10% OF SUBTOTAL 1 ⁶					10%	\$35,300
SUBTOTAL 2					\$460,000	
PRELIMINARY ENGINEERING					15%	\$69,000
CONSTRUCTION ENGINEERING					10%	\$46,000
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2 ⁷					9.13%	\$42,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY ^{8,9}					\$740,000	
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY ^{8,9}					\$800,000	

¹ Average MDT bid prices provided for the period July 2013 to July 2014.

² Cost estimates are provided in 2014 dollars. All dollar amounts are rounded for planning purposes.

³ Rockfall net dimensions are assumed to be 200 ft x 100 ft.

⁴ 6 ft average cut depth for catchment basin. Catchment basin dimensions are assumed to be 200 ft x 50 ft x 6 ft.

⁵ The Miscellaneous category is estimated at 20 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁶ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁷ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁸ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁹ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.



Option 5.c - PULLOUTS
Planning-level Estimate of Costs

Item Description	Approx. Quantity	Unit	Average MDT Bid Prices ¹		Adjusted Unit Prices	
			Unit Price	Amount	Unit Price	Amount ²
			Dollars	Dollars	Dollars	Dollars
RP 7.5						
EXCAVATION-UNCLASSIFIED BORROW	462	CUYD	\$11.36	\$5,244.00	\$12.00	\$5,539.00
COMMERCIAL MIX PG 64-28 ³	300	TON	\$96.99	\$29,097.00	\$115.00	\$34,500.00
EMULSIFIED ASPHALT CRS-2P	2.7	TON	\$613.48	\$1,673.00	\$650.00	\$1,773.00
COVER-TYPE 1	1,167	SQYD	\$0.54	\$630.00	\$0.60	\$700.00
CRUSHED AGGREGATE COURSE ³	233	CUYD	\$22.16	\$5,171.00	\$25.00	\$5,833.00
SPECIAL BORROW ³	389	CUYD		\$0.00	\$16.00	\$6,222.00
STRIPING - WHITE EPOXY	2	GAL	\$64.78	\$130.00	\$75.00	\$150.00
RP 7.5 SUBTOTAL						\$54,717
RP 8.5						
EXCAVATION-UNCLASSIFIED BORROW	769	CUYD	\$11.36	\$8,739.00	\$12.00	\$9,232.00
COMMERCIAL MIX PG 64-28 ³	300	TON	\$96.99	\$29,097.00	\$115.00	\$34,500.00
EMULSIFIED ASPHALT CRS-2P	2.7	TON	\$613.48	\$1,673.00	\$650.00	\$1,773.00
COVER-TYPE 1	1,167	SQYD	\$0.54	\$630.00	\$0.60	\$700.00
CRUSHED AGGREGATE COURSE ³	233	CUYD	\$22.16	\$5,171.00	\$25.00	\$5,833.00
SPECIAL BORROW ³	389	CUYD		\$0.00	\$16.00	\$6,222.00
STRIPING - WHITE EPOXY	2	GAL	\$64.78	\$130.00	\$75.00	\$150.00
RIGHT OF WAY ⁹	0.8	ACRE		\$0.00	\$46,000.00	\$36,800.00
RP 8.5 SUBTOTAL						\$95,210
RP 11.9						
EXCAVATION - UNCLASSIFIED	96	CUYD	\$4.24	\$409.00	\$4.50	\$434.00
EXCAVATION-UNCLASSIFIED BORROW	413	CUYD	\$11.36	\$4,695.00	\$12.00	\$4,960.00
COMMERCIAL MIX PG 64-28 ³	300	TON	\$96.99	\$29,097.00	\$115.00	\$34,500.00
EMULSIFIED ASPHALT CRS-2P	2.7	TON	\$613.48	\$1,673.00	\$650.00	\$1,773.00
COVER-TYPE 1	1,167	SQYD	\$0.54	\$630.00	\$0.60	\$700.00
CRUSHED AGGREGATE COURSE ³	233	CUYD	\$22.16	\$5,171.00	\$25.00	\$5,833.00
SPECIAL BORROW ³	389	CUYD		\$0.00	\$16.00	\$6,222.00
STRIPING - WHITE EPOXY	2	GAL	\$64.78	\$130.00	\$75.00	\$150.00
RIGHT OF WAY ⁹	0.8	ACRE		\$0.00	\$46,000.00	\$36,800.00
RP 11.9 SUBTOTAL						\$91,372
RP 15.3						
EXCAVATION-UNCLASSIFIED BORROW	769	CUYD	\$11.36	\$8,739.00	\$12.00	\$9,232.00
COMMERCIAL MIX PG 64-28 ³	300	TON	\$96.99	\$29,097.00	\$115.00	\$34,500.00
EMULSIFIED ASPHALT CRS-2P	2.7	TON	\$613.48	\$1,673.00	\$650.00	\$1,773.00
COVER-TYPE 1	1,167	SQYD	\$0.54	\$630.00	\$0.60	\$700.00
CRUSHED AGGREGATE COURSE ³	233	CUYD	\$22.16	\$5,171.00	\$25.00	\$5,833.00
SPECIAL BORROW ³	389	CUYD		\$0.00	\$16.00	\$6,222.00
STRIPING - WHITE EPOXY	2	GAL	\$64.78	\$130.00	\$75.00	\$150.00
RP 15.3 SUBTOTAL						\$58,410
AVERAGE PULLOUT COST - SUBTOTAL 1					\$74,927	
ADDITIONAL COSTS						
MISCELLANEOUS ITEMS SUBTOTAL 1⁴					15%	\$11,200
MOBILIZATION @ 10% OF SUBTOTAL 1⁵					10%	\$7,500
SUBTOTAL 2						\$93,600
PRELIMINARY ENGINEERING					10%	\$9,360
CONSTRUCTION ENGINEERING					10%	\$9,360
INDIRECT COST (IDC) - CONSTRUCTION @ 9.13% OF SUBTOTAL 2⁶					9.13%	\$9,000
TOTAL IMPROVEMENT OPTION COST @ 20% CONTINGENCY^{7,8}						\$150,000
TOTAL IMPROVEMENT OPTION COST @ 30% CONTINGENCY^{7,8}						\$160,000

¹ Average MDT bid prices provided for the period July 2013 to July 2014.

² Cost estimates are provided in 2014 dollars. All dollar amounts are rounded for planning purposes.

³ Gravel road typical section includes a top width of 24 ft and 2 ft of crushed aggregate course. Paved road typical section includes a top width of 36 ft, 0.4 ft of plant mix, 0.6 ft of crushed aggregate course, and 1 ft of special borrow. Overlay includes 0.2 ft depth of plant mix surfacing. Top width at turn lanes is 48 ft.

⁴ The Miscellaneous category is estimated at 15 percent due to unknown factors including but not limited to excavation, embankment, topsoil, guardrail, BMPs, utilities, traffic control, noxious weeds, slope treatments, ditch or channel excavation, incidental pavement transitional areas, temporary striping, temporary water pollution/erosion control measures and public relations.

⁵ The Mobilization category includes all costs incurred in assembling and transporting materials to the work site.

⁶ Indirect costs are costs not directly associated with the construction of a project, but incurred during the construction processes. IDC percentage is subject to change.

⁷ A contingency range of 20 to 30 percent was used due to the high degree of unknown factors over the planning horizon.

⁸ The Total Improvement Option Cost reflects an estimate of potential construction costs based on planning-level estimates, and should not be considered an actual cost or encompassing all scenarios and circumstances.

⁹ Right of way costs estimated from anticipated impacted area.