

# IMPROVEMENT OPTIONS

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## TONGUE RIVER ROAD (S-332) – Corridor Planning Study



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*Prepared for:*

**Montana Department of Transportation**

Helena, Montana



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# IMPROVEMENT OPTIONS

## 1.0 INTRODUCTION

This memorandum identifies improvement options for the Secondary Highway 332 (S-332) corridor (locally known as “Tongue River Road”) between Montana Highway 59 (MT-59) south of Miles City and Secondary Highway 447 (S-447) north of Ashland, Montana. The improvement options were identified based on field review, engineering analysis of as-built drawings, crash data analysis, consultation with various resource agencies, and information provided by the general public.

This memorandum provides a brief description of each improvement option, along with planning level cost estimates. A list of areas that do not meet current MDT standards was developed previously in the *Existing and Projected Conditions Report*. Strategies were developed to help address the identified issues and areas of concern. Some of the strategies examined were:

- Expand roadway widths to bring the roadway up to current MDT standards;
- Modify sub-standard vertical curves, and associated vertical grades, to bring vertical curves and grades up to current MDT standards;
- Improve clear zones by flattening slopes or installing guardrail;
- Reconstruct slide areas that were damaged during the 2011 flood events;
- Mill, fill and overlay the existing paved section;
- Place new gravel surfacing on the existing gravel section; Reconstruct and pave S-332 in its entirety, with four new replacement bridges; and
- Modify substandard horizontal curves to current MDT standards.

A fundamental consideration in identifying potential improvement options is the concept of paving S-332 in its entirety. Currently, asphalt surfacing exists between RP 0.00 and RP 17.7. The remaining section of S-332 (RP 17.7 to RP 50.4) contains gravel surfacing of varying widths. Although MDT does not have a defined paving threshold by which a secondary road must be paved, analysis of all state secondary roads in the Glendive District indicates that traffic volumes of approximately 200 vehicles per day (vpd) may be a potential threshold for paving a roadway. Most of the secondary roads in the Glendive District that carry 200 vpd or more are paved. This information is depicted in **Appendix A**.

## 2.0 ESTIMATE OF IMPROVEMENT COSTS

Planning level cost estimates were developed for the improvement options. These costs are for construction costs only and are in year 2012 dollars. The planning level costs do not include right-of-way acquisition, utility relocation, preliminary engineering (PE) or construction engineering (CE).

A number of factors were used to help estimate the planning level costs including as-built drawings, aerial photography, MDT’s average unit costs for materials (see **Table 1**), past projects, local expertise, and engineering judgment. More detail about the planning level cost estimates is provided in the following sections. **Appendix B** contains a detailed summary of the planning level cost estimates.

**Table 1: Estimated Unit Material Costs**

Material	Units	Unit Price
Cold Milling	SQYD	\$1.42
Crushed Aggregate Course <sup>(a)</sup>	CUYD	\$40.00
Cover - Type 1	SQYD	\$0.56
Plant Mix Bit Surf GR S (3/4") <sup>(a)</sup>	TON	\$35.00
Asphalt Cement PG 64-28	TON	\$708.22
Emulsified Asphalt CRS-2P	TON	\$623.57
Aggregate Treatment	SQYD	\$0.42
Excavation - Unclassified Borrow	CUYD	\$5.43
Special Borrow	CUYD	\$15.20
Guardrail – Steel Box Beam	LNFT	\$42.97

(SQYD) square cubic yard; (CUYD) cubic square yard; (TON) ton; (LNFT) linear feet.

<sup>(a)</sup> Planning level unit costs based on communication with MDT Glendive District personnel (Jim Frank, 09/25/2012).

## 2.1. VERTICAL CURVE IMPROVEMENT COSTS

Cost estimates for vertical curve improvements were developed by calculating quantities and resultant costs to bring sub-standard vertical curves up to current standards. The existing vertical curves were drawn using data from as-built drawings provided by MDT. A new curve length designed to meet current MDT standards was then developed and used to estimate excavation (or borrow) quantities. Unit costs listed in **Table 1** were used for the remainder of the items needed for the cost estimate. **Appendix B** contains the assumptions regarding the length of the required curve, and potential construction items necessary for the work.

Vertical curve improvements have been identified in both the paved and graveled sections of the roadway. As these projects are viewed as “stand-alone” spot improvements, the width of the roadway was assumed to be 26 feet for the paved sections and 28 feet for the gravel sections.

Note that as-built drawings were unavailable for some portions along the gravel section of the corridor. For these locations, an average cost was used based on all the calculated vertical curve improvements along the gravel section.

## 2.2. SLIDE AREA COSTS

Planning level cost estimates for slide area repair projects were calculated based on past MDT projects. An average cost per mile was calculated based on MDT slide area project award costs with letting dates between 2011 and 2012. The average cost per mile was multiplied by the estimated length for each improvement option along S-332 as determined based on aerial photography. **Table 2** shows the recent MDT slide repair projects and the associated award costs.

**Table 2: MDT Slide Repair Projects (2011 – 2012)**

Project	County	Letting Date	Length (mi)	Award	Cost per Mile
Clagget Hill Slide	Fergus	2/24/2011	0.19	\$669,003	\$3,532,338
Slide East of Noxon	Sanders	3/10/2011	0.13	\$457,629	\$3,509,329
US 191 Slides - S Mobridge	Fergus	5/26/2011	1.68	\$3,133,525	\$1,869,493
Cut Bank South Slide	Glacier	6/23/2011	0.22	\$365,078	\$1,653,523
E of Winnett - Slide Repair	Petroleum	11/17/2011	0.07	\$525,738	\$7,402,391
S of McLeod Slide Repair	Sweet Grass	11/17/2011	0.34	\$835,658	\$2,451,265
Slide Repair - NE of Glendive	Dawson	7/12/2012	0.11	\$683,132	\$6,011,559
Glasgow Slide Repair	Valley	7/12/2012	0.16	\$482,262	\$2,995,695
Slide Repair - 13 Miles East Glendive	Dawson	8/23/2012	0.12	\$243,070	\$1,974,472
<b>TOTAL</b>			<b>3.03</b>	<b>\$7,395,094</b>	<b>\$2,443,544</b>

Source: MDT Projects Awarded, [http://www3.mdt.mt.gov:7782/mttplc/mttplc.tplk0007.project\\_init](http://www3.mdt.mt.gov:7782/mttplc/mttplc.tplk0007.project_init)

### 2.3. ROADWAY RECONSTRUCTION & WIDENING IMPROVEMENT COSTS

Cost estimates for roadway reconstruction were gathered for both gravel and asphalt surfacing. These planning level costs came from a variety of sources that included the *Winifred to Big Sandy Corridor Study (May 2011)*, the MDT's *US 212 – Ashland East* project, MDT's *Preliminary Estimating Tool Spreadsheet (PET – Revised 09/2011)*, and personal communications with MDT Glendive District personnel. A summary of the estimated costs per square foot for roadway reconstruction are included in **Table 3**.

The recently awarded MDT *US 212 – Ashland East* project in the Glendive District was used to estimate costs associated with asphalt roadway reconstruction. This project includes the reconstruction of 6.5 miles of asphalt roadway to incorporate a 40-foot top width. This project was bid and awarded for approximately \$12.3 million, including a single bridge, which accounted for an estimated cost of \$588,000. The resultant cost for the road reconstruction (not including the bridge) is approximately \$8.55 per square foot.

For gravel roadway reconstruction, costs contained in the *Winifred to Big Sandy Corridor Study* were utilized for cost estimating purposes. A planning level cost estimate of \$559,680 per mile was used for the reconstruction of a 26-foot wide gravel roadway in the *Winifred to Big Sandy Corridor Study*. This cost equates to \$4.08 per square foot.

A planning level cost estimate of \$150 per square foot was used to estimate bridge reconstruction costs. This cost was determined through communications with MDT personnel and through past studies.

**Table 3: Roadway Reconstruction Cost Estimates**

Reconstruction Effort	Estimated Cost (per square foot)	Source
Asphalt Surface	\$8.55	US 212 – Ashland East project
Gravel Surface	\$4.08	Winifred to Big Sandy Corridor Study
Bridge Reconstruction	\$150	MDT Planning

### 3.0 DESCRIPTION AND EVALUATION

Improvement options are described in terms of “concepts” as a way of packaging options together. The concepts identified for potential implementations are described as follows:

- **Concept 1 – Spot Improvements:** This concept resulted in the generation of several individual, geographically distinct spot improvements that could be developed as a stand-alone treatment or a series of treatments. These spot improvements included bringing past slide areas up to standards, fixing sub-standard vertical curves (and associated grades), improving sub-standard horizontal curvature just west of the Tongue River Bridge, and installing guardrail at locations with apparent high, steep fill slopes.
- **Concept 2 – Gravel without Reconstruction (RP 17.7 to RP 50.4):** This concept includes two sub-concepts that consist of a gravel roadway without major reconstruction. One concept includes the placement of new gravel surfacing on the currently graveled portion of S-332 while the other would consist of a double-shot / bitumen surfacing treatment on top of the existing gravel road. Under both concepts, no reconstruction or widening of the roadway would occur.
- **Concept 3 – Reconstruct and Widen Gravel Section (RP 17.7 to RP 50.4):** This concept includes the reconstruction and widening of the existing gravel portion of the roadway to a new 32-foot wide gravel top width, but on a roadway base that would be suitable for a future 36-foot wide top width. Gravel surfacing would be utilized, and three existing bridges would be removed and replaced with new, 40-foot wide bridges.
- **Concept 4 – Rehabilitate with Mill / Fill / Overlay (RP 0.0 to RP 17.7) & Reconstruct and Widen Gravel Section (RP 17.7 to RP 50.4):** This concept includes a mill, fill and overlay of the existing pavement section between RP 0.0 and RP 17.7. It assumes that no improvements to the width of the roadway would be made. The mill, fill and overlay concept is proposed as a method to improve the riding service and extend the life of the existing pavement, but stop short of a full reconstruct to widen the roadway. No modifications to existing widths would occur, nor would any bridge or hydraulic structures be replaced. Also included with this concept is the reconstruction and widening of the existing gravel portion of the roadway (RP 17.7 to RP 50.4) to a new 32-foot wide gravel top width, but on a roadway base that would be suitable for a future 36-foot wide top width. Gravel surfacing would be utilized, and three existing bridges could be removed and replaced with new, 40-foot wide bridges.
- **Concept 5 – Reconstruct with Pavement (RP 0.00 to RP 50.4):** This concept includes a total reconstruction of S-332 from RP 0.0 to RP 50.4. This concept envisions an asphalt surface, although the exact top width would be dependent on future traffic volumes. The four existing bridges could be removed and replaced with new, 40-foot wide bridges.

These concepts are described in more detail in the following sections. It should be recognized that inherent to any improvement concept (or concepts) there will need to be sensitivity to wildlife and aquatic connectivity concerns. Due to the proximity to the Tongue River, implementation of any of the improvement concepts may necessitate close coordination with resource agencies to identify any areas of sensitivity in regards to wildlife and aquatic needs. Additional language concerning this can be found in the study's *Environmental Scan* document.

## CONCEPT 1 - SPOT IMPROVEMENTS

Spot improvements were identified along the corridor that could address specific areas of concern. The description of each spot improvement option is included in this section. The location of each spot improvement is shown graphically in **Figure 1**. Spot improvements generally fall within the following categories:

- Vertical Curve Improvements – Consist of modifications to existing vertical crest and sag curves. Crest vertical curves would be flattened by shaving off the top of the curve to lower the road profile and increase the driver's sight distance. For sag vertical curves, the road profile would be raised by filling in the sag area. In most cases, the vertical curves would also be lengthened. Vertical curve improvements have been identified in both the existing paved and graveled portions of S-332.
- Slide Area Improvements – Numerous slide areas were identified through the field review and discussions with stakeholders and the public. The slide areas were a result of severe flooding during 2011. The slide areas were reconstructed as emergency repairs, under the premise additional work would be needed at a later date.
- Guardrail Installation – There are several areas documented along S-332 that contain steep side slopes and high embankments. MDT's strategy to deal with these hazards is to first remove the hazard. An example would be to flatten a steep side slope by re-grading. The second strategy would then be to consider the installation of barriers, such as guardrail. Spot improvements have been identified where guardrail should be considered for installation to mitigate clear zone concerns.
- Horizontal Curve Improvements – Between RP 39.52 and 40.98 a series of horizontal curves exist that may be a candidate for a roadway alignment modification. Modifications to the existing horizontal curves to improve sight distance and better match driver expectations would be desirable. By increasing the radius of the horizontal curve, the curve would be lengthened so that the change in direction is smoother. In some cases this may be difficult due to physical obstructions such as irrigation pivots or other constraints. In these circumstances, advance warning signs may be utilized to warn the driver of the abrupt shift in alignment.

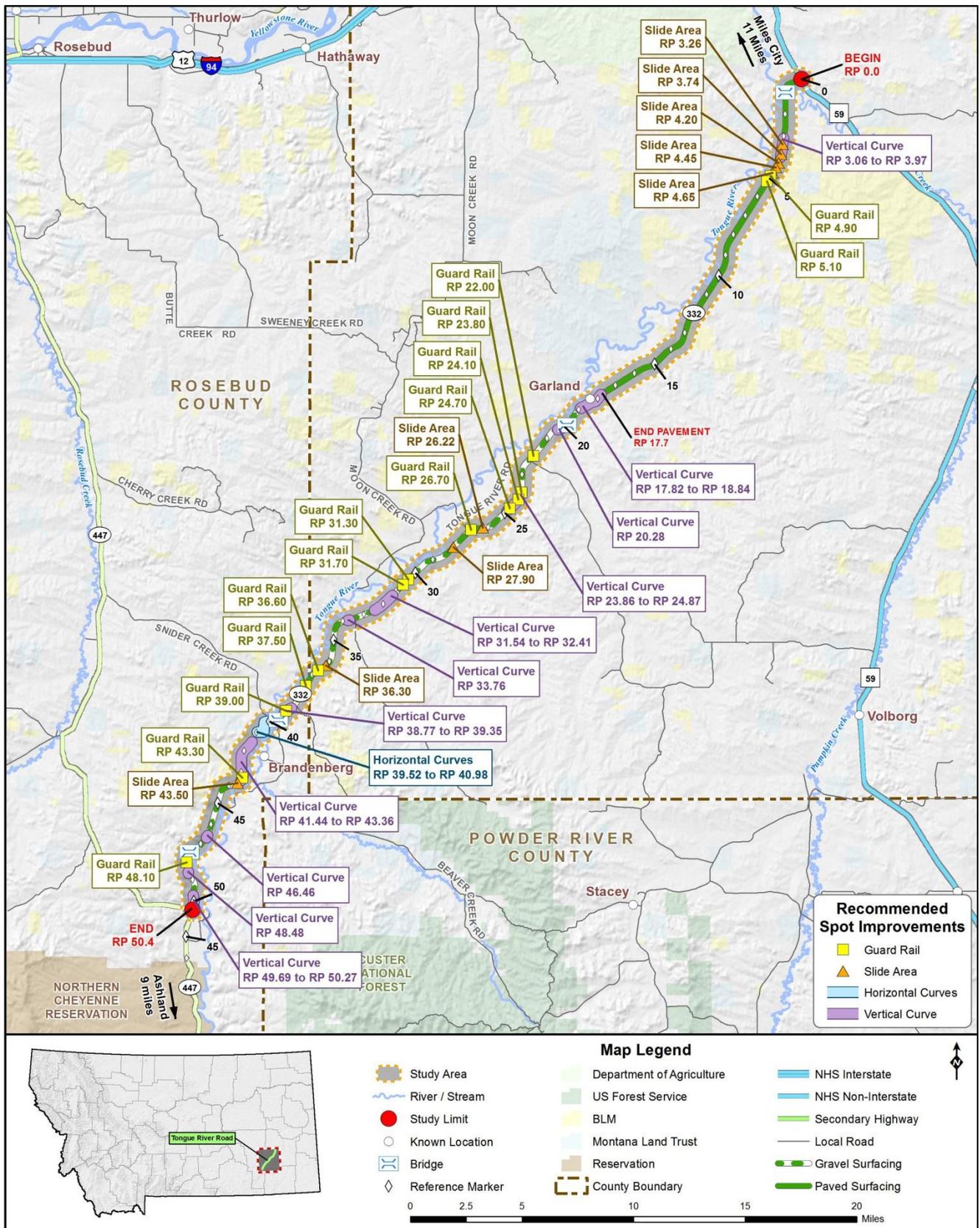


Figure 1: Concept 1 - Spot Improvements

## 1.A – Vertical Curves

### **Description:**

Numerous vertical curves were identified through the analysis of as-built drawings and field review that do not meet current MDT standards. Spot improvements to address the sub-standard curves by modifying them to meet MDT standards are being forwarded for review. This improvement option could be completed on an individual curve basis, or by improving a series of curves adjacent to each other. **Table 4** portrays the vertical curves that are candidates for improvement to bring them up to standards, along with the estimated cost of improvement.

Some vertical curves have been identified that are relatively close to each other. In those cases, it would be possible to improve the curves in close proximity with one project. Crest vertical curves would be flattened by shaving off the top of the curve to lower the road profile and increase the driver's sight distance. The road profile would be raised by filling in the sag area for sag vertical curves.

As seen in **Table 4**, the majority of the identified vertical curves are in the graveled roadway section (i.e. beyond RP 17.7). The curve improvements are envisioned as spot improvements that can be addressed by project sponsors as funding and time allows. Another longer-term strategy that would address these curves would be a total reconstruction of the roadway as described under Concepts 3, 4 and 5.

**Table 4: Vertical Curve Improvements**

Location	Number of Vertical Curves	Estimated Cost
RP 3.06 to RP 3.97	4	\$588,000
RP 17.82 to RP 18.84	3	\$61,000
RP 20.28	1	\$5,000
RP 23.86 to RP 24.87	5	\$81,000
RP 25.53 to RP 29.60	16	\$329,000
RP 31.54 to RP 32.41	2	\$57,000
RP 33.76	1	\$18,000
RP 38.77 to RP 39.35	2	\$13,000
RP 41.44 to RP 43.36 <sup>(a)</sup>	7	\$133,000
RP 46.46 <sup>(a)</sup>	1	\$19,000
RP 48.48 <sup>(a)</sup>	1	\$19,000
RP 49.69 to RP 50.27 <sup>(a)</sup>	3	\$57,000
<b>TOTAL</b>	<b>46</b>	<b>\$1,380,000</b>

<sup>(a)</sup> Cost estimate was based on average cost for vertical curve improvements along the gravel section.



**Photo 1: Representative photograph of a vertical crest curve that does not meet standards (at RP 3.06 in the paved section of the roadway that begins a series of four vertical curves not meeting standards).**

**Benefits:**

- Improves safety by addressing roadway geometrics.

**Impacts:**

- Would require spot roadway reconstruction along S-332.

**Estimated Cost:            \$1,380,000 (Total)**

**1.B – Slide Areas**

**Description:**

Several slides occurred in 2011 due to heavy rainfall and flooding in the area. The slide locations have had minor repair work completed as temporary mitigation. Several of these areas have already begun to deteriorate in terms of slope erosion, pavement settling, and drainage issues. Concepts 3, 4 and 5 present alternatives for the long-term reconstruction of the roadway, however, spot improvements have been identified to rectify the slide areas in a more permanent fashion. Slide area improvements have been identified in both the paved and graveled sections of S-332, and would include drainage culvert(s), embankment material and compaction, base course, and new asphalt. **Table 5** lists all the slide areas identified in the corridor along with the estimated cost of improvement.

**Table 5: Slide Area Improvements**

Location	Number of Slide Areas	Estimated Cost
RP 3.26	1	\$195,000
RP 3.74 to RP 4.65	4	\$1,197,000
RP 26.22	1	\$195,000
RP 27.90	1	\$367,000
RP 36.30	1	\$318,000
RP 43.50	1	\$489,000
<b>TOTAL</b>	<b>9</b>	<b>\$2,761,000</b>



**Photo 2: Representative photograph of a slide area that is deteriorating (at RP 3.74). In this image, note the erosion just off the pavement edge. The asphalt has begun to settle as well, resulting in an uneven driving surface.**

**Benefits:**

- Improve drainage at this location.
- Ensure stability and safety of the roadway.

**Impacts:**

- Would require spot roadway reconstruction along S-332.

**Estimated Cost:**            **\$2,761,000 (Total)**

## 1.C – Guardrail

**Description:**

Multiple areas with steep fill slopes exist between RP 3.74 and RP 50.40. These areas are potential safety hazards due to the steep slopes, as they do not appear to be traversable and/or recoverable. A total reconstruction of the roadway in some of the areas could occur as described under Concepts 3, 4 and 5. However since any reconstruction would be a long-term endeavor, a stand-alone option may be to incorporate guardrail in the areas listed in **Table 6**.

Note that prior to installing guardrail, guardrail warrants would need to be evaluated. Because most of the areas have high embankments, it does not appear feasible to re-work the slopes to provide the proper slope ratio and recovery area that could be developed otherwise with a total reconstruction of the roadway. **Table 6** lists all of the potential guardrail areas that were identified within the corridor. The length of the potential guardrail treatments includes guardrail on both sides of the road, and in most cases traverses the entire length over an existing drainage.

**Table 6: Guardrail Improvement Areas**

Location	Estimated Length of Guardrail Needed (in feet)	Estimated Cost
RP 4.90	1,260	\$54,142
RP 5.10	1,600	\$68,752
RP 22.00	3,700	\$158,989
RP 23.80	1,380	\$59,299
RP 24.10	1,900	\$81,643
RP 24.70	1,600	\$68,752
RP 26.70	4,220	\$181,333
RP 31.30	3,160	\$135,785
RP 31.70	4,760	\$204,537
RP 36.60	2,120	\$91,096
RP 37.50	2,120	\$91,096
RP 39.00	840	\$36,095
RP 43.30	840	\$36,095
RP 48.10	520	\$22,344
<b>TOTAL</b>	<b>30,020</b>	<b>\$1,290,000</b>



**Photo 3: Representative photograph of a steep fill slope that may be a candidate for guardrail. Guardrail warrants should be evaluated prior to programming a project.**

**Benefits:**

- Improve roadside safety.

**Impacts:**

- May cause difficulties with maintenance due to snow removal.
- Does not correct the roadway geometries.

**Estimated Cost:            \$1,290,000 (Total)**

## 1.D – Horizontal Curves (RP 39.52 – RP 40.98)

### **Description:**

This improvement option has been identified between RP 39.52 to 40.98. This area has seven horizontal curves that do not meet current MDT design standards. A long-term improvement option is to reconstruct these horizontal curves to bring the geometrics up to current standards. This would necessitate a shift off of its present alignment. The work would be limited to just west of the Tongue River Bridge, thereby eliminating the need to replace the bridge in the short term. The envisioned project would be complicated by the presence of two irrigation pivot systems that currently irrigate fields that straddle both side of the existing roadway. To improve the sub-standard curves, the alignment shift would be off the present road and would require new right-of-way from adjacent, landowners.



**Photo 4: This horizontal curve at RP 40.7 is in the series of curves that are good candidates for re-alignment.**

### **Benefits:**

- Improve geometrics and safety.

### **Impacts:**

- Additional right-of-way would be required.
- Impacts to existing irrigation pivots and farm fields would be realized.
- Travel speeds may increase due to the elimination of numerous sharp horizontal curves.

**Estimated Cost:**           **\$1,006,000**

## CONCEPT 2 – GRAVEL WITHOUT RECONSTRUCTION (RP 17.7 TO RP 50.4)

This improvement option has been identified between RP 17.7 and RP 50.4. This area of the corridor is currently a gravel roadway. This concept includes two sub-concepts.

### 2.A – Gravel Placement

#### **Description:**

This concept would place a new four-inch gravel layer on the roadway in order to improve the roadway surface. This option does not include widening the roadway or improve any other areas of concern. **Appendix B** contains the assumptions for gravel quantities based on widths of the existing roadway at various locations. Gravel

quantities are represented in cubic yards of gravel and the utilized unit cost (per cubic yard) includes placement and mobilization.

**Benefits:**

- Improve roadway surface.
- Less expensive than a full reconstruction.
- No additional right-of-way required.
- Better surfacing choice than asphalt for movement of livestock on the roadway.

**Impacts:**

- Does not address geometric deficiencies.
- Dust concerns may be elevated.
- More frequent maintenance activities than with a paved surface.
- Travel speeds may increase.

**Estimated Cost:**           **\$2,741,000**

## 2.B – Double Shot / Bitumen Treatment

**Description:**

This concept proposes a double-shot / bitumen surfacing treatment on top of the existing gravel road. This concept would seal the surfacing course which would improve the overall roadway surface condition and help to reduce dust and prove for lower maintenance requirements. Minor grading, elimination of soft spots, and incidental gravel placement prior to application would be included. This concept would be most appropriate for lower traffic volumes and would likely not hold up well under heavy traffic or truck traffic conditions.

**Benefits:**

- Improve roadway surface.
- Less expensive than a full reconstruction.
- No additional right-of-way required.
- Better surfacing choice than asphalt for movement of livestock on the roadway.
- Reduced dust.
- Reduced maintenance costs from a standard gravel roadway.

**Impacts:**

- Does not address geometric deficiencies.
- More frequent maintenance activities than with a paved surface.
- Travel speeds may increase.

**Estimated Cost:**           **\$2,183,000**

## CONCEPT 3 – RECONSTRUCT AND WIDEN GRAVEL SECTION (RP 17.7 TO RP 50.4)

**Description:**

This improvement option has been identified between RP 17.7 and RP 50.4. This area of the corridor is currently a gravel roadway of inconsistent width. Multiple narrow sections are found throughout, especially just west of the Tongue River Bridge.

Narrow roadway widths can be a concern because vehicles may encroach upon the opposite travel lane, thereby creating a potentially unsafe condition. According to projected traffic volumes for the corridor, this area could potentially see an increase in traffic from an average of 110 vpd to 2,056 vpd. MDT standards recommend a roadway width of 28' for an Average Annual Daily Traffic (AADT) of 300 to 999, 32' for an AADT of 1,000 to 1,999, and 36' for an AADT of 2,000 and 3,000. Until which time that the higher traffic volumes are realized, this concept envisions reconstructing the existing gravel portion and placing a 32-foot wide gravel surfacing on top of a roadway base that could accommodate a 36-foot wide top width in the future. For cost estimating purposes, a 36-foot wide gravel roadway was assumed. New right-of-way may be required depending on the public right-of-way available (not included in the cost estimate).

Three new replacement bridges or culverts would be required to meet width requirements. To be conservative in planning level costs estimating, it is assumed that bridges would be required and would be built to a 40' top width, require 12 feet of clearance over existing topography, and utilize 2H:1V sloping abutments. The following bridges would need to be replaced:

- Foster Creek [RP 19.87] – 40' x 50' (Estimated cost = \$300,000)
- Tongue River [RP 39.61] – 40' x 227' (Estimated cost = \$1,362,000)
- Roe and Cooper Creek [RP 47.80] – 40' x 36' (Estimated cost = \$216,000)

Also included in this concept is the extension of the reconstruct and widen gravel section from the end of S-332, along S-447, to the beginning of existing pavement at the Northern Cheyenne Reservation boundary. It may be desirable to reconstruct this segment of S-447 to the same standards as S-332 to ensure continuity of the roadway system.

**Benefits:**

- Improve geometrics and safety.
- Accommodate future traffic volumes.
- Improve roadway surface.

**Impacts:**

- Roadway reconstruction is required.
- Additional right-of-way required.
- Dust concerns may be elevated.
- More frequent maintenance activities than with a paved surface.
- Travel speeds may increase.

**Estimated Cost:**            **\$25,341,000 (Without Bridge Reconstruction)**  
    **\$1,878,000 (Bridge Reconstruction Only)**  
    **\$2,092,000 (Extension on S-447)**

**CONCEPT 4 – REHABILITATE WITH MILL / FILL / OVERLAY (RP 0.0 TO RP 17.7) AND RECONSTRUCT AND WIDEN GRAVEL SECTION (RP 17.7 TO RP 50.4)**

**Description:**

This concept includes a mill, fill and overlay of the existing pavement section between RP 0.0 and RP 17.7. It assumes that no improvements to the width of the roadway would be made along this section. The mill, fill and overlay concept section is proposed as a method to improve the riding service and extend the life of the existing

pavement, but stops short of a full reconstruct to widen the roadway. This section of roadway is in good condition in terms of meeting geometric standards. Accordingly, the mill, fill and overlay would extend the life of the surfacing without a total reconstruct, and would be considered a rehabilitation effort. No modifications to existing widths would occur, nor would any bridge or hydraulic structures be replaced along this section.

Also included in this concept are the improvements described under Concept 3 (i.e. reconstruction and widening of the gravel section between RP 17.7 and RP 50.4, to include three new bridges).

**Benefits:**

- Improve roadway surface.
- Improve geometrics and safety.
- Accommodate future traffic volumes.

**Impacts:**

- Does not address geometric deficiencies (RP 0.0 to RP 17.7).
- The existing widths would be sub-standard if AADT rises above 2,000 vpd in the future (RP 0.0 to RP 17.7).
- Additional right-of-way required (RP 17.0 to RP 50.4).
- Dust concerns may be elevated (RP 17.0 to RP 50.4).
- More frequent maintenance activities than with a paved surface (RP 17.0 to RP 50.4).
- Travel speeds may increase.

**Estimated Cost:**            **\$10,690,000 (Pavement RP 0.0 – RP 17.7)**  
    **\$25,341,000 (Gravel RP 17.7 – RP 50.4, without Bridge Reconstruction)**  
    **\$1,878,000 (Bridge Reconstruction Only RP 17.7 – RP 50.4)**  
    **\$2,092,000 (Extension on S-447)**

**CONCEPT 5 – RECONSTRUCT WITH PAVEMENT (RP 0.00 TO RP 50.4)**

**Description:**

This improvement option has been identified between RP 0.0 and RP 50.4 and would consist of asphalt pavement throughout the entire S-332 corridor. This option would address many of the issues and areas of concern previously identified.

According to projected traffic volumes for the corridor, the roadway could potentially experience an increase in traffic from an average of 110 vpd to 2,056 vpd. MDT standards recommend the following roadway widths based on AADT:

- AADT between 0-299                      24' width
- AADT between 300-999                    28' width
- AADT between 1,000-1,999              32' width
- AADT between 2,000-3,000              36' width
- AADT greater than 3,000                40' width

Ultimately, the required width of the roadway would be determined based on future AADT values. Due to the overall uncertainty of coal development southeast of Ashland and resultant future AADT, cost estimates were provided for a variety of roadway widths.

In addition, four new replacement bridges or culverts would be necessary to meet width requirements. To be conservative in planning level costs estimating, it is assumed that bridges would be required and would be built to a 40' top width, require 12 feet of clearance over existing topography, and utilize 2H:1V sloping abutments. The following bridges would need to be replaces:

- Pumpkin Creek [RP 1.02] – 40' x 152' (Estimated Cost = \$912,000)
- Foster Creek [RP 19.87] – 40' x 50' (Estimated cost = \$300,000)
- Tongue River [RP 39.61] – 40' x 227' (Estimated cost = \$1,362,000)
- Roe and Cooper Creek [RP 47.80] – 40' x 36' (Estimated cost = \$216,000)

Also included in this concept is the extension of the reconstruct with pavement section from the end of S-332, along S-447, to the beginning of existing pavement at the Northern Cheyenne Reservation boundary. It may be desirable to reconstruct this segment of S-447 to the same standards as S-332 to ensure continuity of the roadway system.

**Benefits:**

- Improve geometrics and safety.
- Improve roadway surface.
- Accommodate future traffic volumes.
- Reduces frequency of maintenance activities.
- Eliminates dust issues.

**Impacts:**

- Roadway reconstruction is required.
- Additional right-of-way required.
- Potential impacts to movement of farm animals on and across the roadway.
- Travel speeds may increase.
- Induced growth and associated rise in traffic volumes may occur.

<b><u>Estimated Cost:</u></b>	<b>\$54,614,000 (24' Width without Bridge Reconstruction)</b>
	<b>\$63,716,000 (28' Width without Bridge Reconstruction)</b>
	<b>\$72,819,000 (32' Width without Bridge Reconstruction)</b>
	<b>\$81,921,000 (36' Width without Bridge Reconstruction)</b>
	<b>\$91,023,000 (40' Width without Bridge Reconstruction)</b>
	<b>\$2,790,000 (Bridge Reconstruction Only)</b>
	<b>\$4,389,000 (Extension on S-447)</b>

## 4.0 ADDITIONAL CONSIDERATIONS

This section offers additional considerations regarding the S-332 corridor.

- Because the language authorizing the corridor study was very specific to S-332, the study concludes at the intersection of S-332 and S-447 (i.e. RP 50.4 on S-332). However, south of this intersection there is a two-mile length of roadway (S-447) that is currently gravel until just south of the Northern Cheyenne Indian Reservation’s northern boundary. It is likely if reconstruction occurs along S-332 in the future, construction should be continued over this section of S-447 to ensure continuity of the roadway system. In this case, it would be desirable to reconstruct the stretch of S-447 to the same standard as S-332.

Special infrastructure considerations would be necessary to accommodate travel for the local Amish community in the area. Travel within this community is by horse-and-buggy, horseback, and walking. A separated, gravel surfacing pathway adjacent to the roadway in this area should be considered if and when a project develops, in addition to special speed zone considerations with signing.

- The Tongue River Railroad (TRR) is currently undergoing an Environmental Impact Statement (EIS) to document impacts and mitigation based on a variety of factors, most important of which is the potential impact of the Otter Creek coal tracts. An alignment for the future TRR is not available or known at this time. If and when the TRR is developed, it would be highly desirable to provide grade-separated crossings wherever the proposed railroad would intersect with S-332. Because railroad design standards necessitate a flat, gradual vertical profile, in most cases the roadway would have to cross rail facilities either above or below the rail infrastructure. These are general guidelines, and because of uncertainties regarding the TRR, no cost estimates for grade-separated facilities have been developed.
- The traffic forecasts made in this study's *Existing and Projected Conditions Report* suggest a conservative traffic volume of 2,056 vpd could potentially be realized in the future depending on development activities associated with the Otter Creek coal tracts. There is a concept called "induced demand" that suggests if a reconstructed, paved roadway was in place that additional traffic could be pulled off adjacent roadways and diverted to the newly improved roadway. Adjacent roadways that currently are paved and carry traffic in a general north-south direction are State Route 39 (Lame Deer to Forsyth) and State Route 59 (Broadus to Miles City). It is possible that some travelers between Ashland and Forsyth, or Ashland and Miles City, may currently avoid S-332 due to its gravel surfacing and sub-standard conditions. If the road was improved with pavement, some of these travelers may choose to alter their routes accordingly. B-In this case, S-332 may realize more than 2,056 vpd.

## 5.0 SUMMARY

This memorandum identifies improvement options for S-332 between MT-59 and S-447 using a series of "concepts" for consideration. The improvement options are based on the evaluation of several factors, including, but not limited to, field review, engineering analysis of as-built drawings, crash data analysis, consultation with various resource agencies, and information provided by the general public. Small scale improvement options (i.e. spot improvements) have been identified and may be as simple as installing guardrail. Larger, more complex improvements have also been identified. These include placing new gravel surfacing on the existing gravel roadway, widening the gravel section of the roadway to a consistent width, or paving the gravel portion of S-332.

Wildlife and aquatic concerns are found throughout the entire corridor. The improvement options should be considered with respect to wildlife and aquatic connectivity impacts. These should be more fully explored during project development activities. **Table 7** contains a summary of the potential improvements and their planning level costs.

**Table 7: Improvement Options Summary**

Concept Title	Description	Estimated Cost
<b>CONCEPT 1 – SPOT IMPROVEMENTS</b>		
<i>1.A - Vertical Curves</i>	<ul style="list-style-type: none"> <li>Modify existing vertical curves to increase the driver’s sight distance.</li> <li>Identified in both paved and graveled sections.</li> <li>46 total curves identified.</li> </ul>	\$1,380,000
<i>1.B - Slide Areas</i>	<ul style="list-style-type: none"> <li>Identified in both paved and graveled sections.</li> <li>Nine (9) areas identified.</li> </ul>	\$2,761,000
<i>1.C - Guardrail</i>	<ul style="list-style-type: none"> <li>Protect drivers from potential safety hazards due to the steep slopes.</li> <li>Guardrail warrants to be evaluated prior to installation.</li> <li>Re-work of slopes may not be feasible.</li> </ul>	\$1,290,000
<i>1.D - Horizontal Curves (RP 39.52 – RP 40.98)</i>	<ul style="list-style-type: none"> <li>Improve seven (7) horizontal curves that do not meet current standards.</li> <li>Limited to area just west of the Tongue River Bridge.</li> </ul>	\$1,006,000
<b>CONCEPT 2 – GRAVEL WITHOUT RECONSTRUCTION (RP 17.7 to RP 50.4)</b>		
<i>2.A - Gravel Placement</i>	<ul style="list-style-type: none"> <li>Place new 4” gravel surface on the roadway.</li> <li>No widening of the roadway.</li> <li>No reconstruction to address identified areas of concern.</li> </ul>	\$2,741,000
<i>2.B - Double Shot / Bitumen Treatment</i>	<ul style="list-style-type: none"> <li>Double chip seal coat on top of existing gravel road.</li> <li>No widening of the roadway.</li> <li>No reconstruction to address identified areas of concern.</li> </ul>	\$2,183,000
<b>CONCEPT 3 – RECONSTRUCT AND WIDEN GRAVEL SECTION (RP 17.7 to RP 50.4)</b>		
<i>Reconstruct and Widen Gravel Section</i>	<ul style="list-style-type: none"> <li>Reconstruct gravel portion to a base width of 36’ with a 32’ top surface.</li> <li>May require additional right-of-way (not included in cost estimate).</li> </ul>	\$25,341,000
<i>Bridge Replacement</i>	<ul style="list-style-type: none"> <li>Replace three (3) bridges.</li> </ul>	\$1,878,000
<i>Extension of Reconstruct and Widen Gravel on S-447</i>	<ul style="list-style-type: none"> <li>Continue the reconstruct and widen gravel from S-337 / S-447 intersection to beginning of existing pavement on S-447 (approximately 2.7 miles).</li> </ul>	\$2,092,000
<b>CONCEPT 4 – REHABILITATE WITH MILL / FILL / OVERLAY (RP 0.0 to RP 17.7) AND RECONSTRUCT AND WIDEN GRAVEL SECTION (RP 17.7 to RP 50.4)</b>		
<i>Rehabilitate with Mill / Fill / Overlay (RP 0.0 to RP 17.7)</i>	<ul style="list-style-type: none"> <li>Mill the existing asphalt pavement, fill areas for better drainage (as needed), and place a new asphalt overlay.</li> <li>No modifications to existing road widths.</li> <li>No modifications to existing bridge or hydraulic structures.</li> </ul>	\$10,690,000
<i>Reconstruct &amp; Widen Gravel Section (RP 17.7 to RP 50.4)</i>	<ul style="list-style-type: none"> <li>Reconstruct gravel portion to a base width of 36’ with a 32’ top surface.</li> <li>May require additional right-of-way (not included in cost estimate).</li> </ul>	\$25,341,000
<i>Bridge Replacement</i>	<ul style="list-style-type: none"> <li>Replace three (3) bridges along gravel section.</li> </ul>	\$1,878,000
<i>Extension of Reconstruct and Widen Gravel on S-447</i>	<ul style="list-style-type: none"> <li>Continue the reconstruct and widen gravel from S-337 / S-447 intersection to beginning of existing pavement on S-447 (approximately 2.7 miles)</li> </ul>	\$2,092,000
<b>CONCEPT 5 – RECONSTRUCT WITH PAVEMENT (RP 0.00 to RP 50.4)</b>		
<i>Reconstruct with Pavement (RP 0.0 to RP 50.4)</i>	<ul style="list-style-type: none"> <li>Reconstruct both the paved and gravel section of the roadway to a paved section.</li> <li>Width dependent on AADT</li> <li>May require additional right-of-way (not included in cost estimate).</li> </ul>	\$54,614,000 (24’) \$63,716,000 (28’) \$72,819,000 (32’) \$81,921,000 (36’) \$91,023,000 (40’)
<i>Bridge Replacement</i>	<ul style="list-style-type: none"> <li>Replace one (1) bridge along paved section.</li> <li>Replace three (3) bridges along gravel section.</li> </ul>	\$2,790,000
<i>Extension of Pavement on S-447</i>	<ul style="list-style-type: none"> <li>Continue the reconstruct with pavement from S-332 / S-447 intersection to beginning of existing pavement on S-447 (approximately 2.7 miles).</li> </ul>	\$4,389,000



# APPENDIX A

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## GLENDIVE DISTRICT PAVED/GRAVEL ROAD COMPARISON

**AADT for Secondary Roads in the Glendive District**

Site ID	Route	Description	AADT 2011	Type
42-1-4	S-201	S-201, RP 19, W of S-480	50 (A)	GRAVEL
42-1-1	S-201	S-201, RP 21, .5 mi E of S-480	60 (A)	GRAVEL
28-2-3	S-201	S-201, RP .5, .5 mi E of MT 13	100 (A)	PAVED
42-1-2	S-201	S-201, RP 34, 14 mi SE of S-480	250 (A)	PAVED
42-2-7	S-201	S-201, RP 46, 11.5 mi W of MT 16	550 (A)	PAVED
42-2-15	S-201	S-201, RP 69, W of Dawson Av, Fairview	830 (A)	PAVED
42-2-16	S-201	S-201 (1st), btwn Central & Ellery Avs (Fairv	1030 (A)	PAVED
42-2-9	S-201	S-201, RP 59, 1 mi E of MT 16	1110 (A)	PAVED
42-2-8	S-201	S-201, RP 57, 1 mi W of MT 16	1200 (A)	PAVED
42-2-10	S-201	S-201, RP 63.5, 5.5 mi E of MT 16	1220 (A)	PAVED
17-3-2	S-245	S-245, RP 37, 37 mi NW of Jordan	80 (E)	GRAVEL
17-3-1	S-245	S-245, RP 22, 22 mi NW of Jordan	90 (E)	GRAVEL
17-4-6	S-245	S-245, RP 6, 6 mi NW of Jordan	190 (A)	PAVED
17-4-14	S-245	S-245, W of MT 200 (Jordan)	200 (A)	PAVED
17-4-15	S-245	S-245, W of Purcell Av (Jordan)	300 (A)	PAVED
17-4-17	S-245	S-245, btwn Leavitt Av & Jordan Av (Jordan)	330 (A)	PAVED
53-4-14	S-246	S-246, RP 11, .5 mi SE of Tampico	110 (A)	GRAVEL
53-4-13	S-246	S-246, RP 4, S of Paisley	180 (A)	PAVED
53-4-27	S-246	S-246 (2nd Av S), W of 13th St S, Glasgow	520 (A)	PAVED
53-4-26	S-246	S-246 (2nd Av S), btwn S 7th & 8th Sts, Glasgow	2350 (A)	PAVED
53-4-25	S-246	S-246 (S 6th St), btwn 1st & 2nd Av S, Glasgow	5360 (E)	PAVED
43-1-3	S-250	S-250, RP 37, 12.5 mi NW of MT 13	20 (A)	GRAVEL
43-1-2	S-250	S-250, RP 26, 26 mi N of US 2	170 (A)	GRAVEL
43-1-4	S-250	S-250, RP 48.5, 1 mi W of MT 13	30 (A)	PAVED
43-3-13	S-250	S-250, RP 13, 13 mi N of US 2	300 (A)	PAVED
43-3-12	S-250	S-250, RP 1, 1 mi N of US 2	350 (A)	PAVED
28-3-3	S-252	S-252, RP 23.3, .5 mi E of Weldom	30 (A)	GRAVEL
28-3-2	S-252	S-252, RP 23.3, 12.5 mi NW of MT 200 (Circle)	70 (E)	GRAVEL
28-4-9	S-252	S-252, RP 7, 7.5 mi NW of MT 200 in Circle	140 (E)	PAVED
28-4-17	S-252	S-252, RP .5, at W city limits of Circle	290 (A)	PAVED
28-4-16	S-252	S-252 (10th St), btwn C & D Avs (Circle)	740 (E)	PAVED
28-4-7	S-254	S-254, RP 68.5, .5 mi E of MT 13	40 (A)	GRAVEL
11-1-6	S-254	S-254, RP 50.5, 6.5 mi NW of Richey	80 (A)	GRAVEL
11-1-5	S-254	S-254, RP 46, 2 mi NW of Richey	90 (A)	GRAVEL

Site ID	Route	Description	AADT 2011	Type
11-1-7	S-254	S-254, W of 2nd Av (Richey)	140 (A)	PAVED
11-2-7	S-254	S-254, RP 23, .5 mi S of Bloomfield	240 (A)	PAVED
11-1-9	S-254	S-254, W of MT 200 (Richey)	290 (A)	PAVED
11-1-8	S-254	S-254, btwn 2nd & 3rd St S (Richey)	340 (A)	PAVED
11-5A-27	S-254	S-254, W of MT 16	350 (A)	PAVED
11-2-6	S-254	S-254, RP 11, 11 mi NW of P-20	360 (A)	PAVED
11-1-4	S-254	S-254, RP 34, 9 mi SE of MT 200	370 (A)	PAVED
11-2-8	S-254	S-254, RP 24, .5 mi N of Bloomfield	410 (A)	PAVED
11-1-3	S-254	S-254, RP 42, 1 mi E of MT 200	450 (A)	PAVED
13-2-5	S-322	S-322, RP 25.5, 1.5 mi E of MT 7	40 (A)	GRAVEL
13-2-4	S-322	FAS 322, RP 16.5, .5 mi N of Webster	70 (A)	GRAVEL
13-2-3	S-322	S-322, RP .5, .5 mi SE of MT 7	340 (A)	PAVED
43-5-7	S-327	S-327, RP 4.5, 4.5 mi SE of US 2 (Bainville)	140 (A)	GRAVEL
43-5-9	S-327	S-327, RP 13, 1 mi SE of S-469	260 (A)	GRAVEL
43-5-34	S-327	FAS 327 (5th Av), E of Duval (Bainville)	290 (A)	PAVED
43-5-33	S-327	S-327, btwn Clark & Flynn Avs (Bainville)	600 (A)	PAVED
43-5-32	S-327	S-327, S of US 2	1130 (A)	PAVED
44-7-5	S-332	S-332, RP 39.5, 2 mi SW of Custer Co line	50 (E)	GRAVEL
44-8-4	S-332	S-332, RP 49.5, .5 mi N of S-447	50 (E)	GRAVEL
9-4-4	S-332	S-332, RP 26.5, 6 mi SW of Garland	80 (A)	GRAVEL
9-4-3	S-332	S-332, RP 11, 11 mi SW of MT 59	100 (A)	PAVED
9-2-9	S-332	S-332, RP 1, 1 mi SW of MT 59	280 (E)	PAVED
11-5-2	S-335	S-335, RP 8, 7.5 mi S of P-57	100 (A)	GRAVEL
11-5A-29	S-335	S-335, RP 2, 2 mi S of W Towne St	350 (A)	PAVED
11-5A-28	S-335	S-335, S of Clough St, Glendive	620 (A)	PAVED
11-5A-42	S-335	Merrill Av, S of Douglas St	670 (A)	PAVED
11-5A-41	S-335	Merrill Av (S-335), S of Towne	5480 (A)	PAVED
40-2-6	S-340	S-340, MP 8, .5 mi S of S-504, SE of Fallon	60 (E)	GRAVEL
40-2-5	S-340	S-340, MP 1.5, 1 mi SE of Fallon Intch	240 (E)	PAVED
40-2-9	S-340	S-340, SE of Fallon Int	460 (E)	PAVED
36-3-7	S-363	S-363, RP .3, S of US 2	130 (E)	GRAVEL
36-3-8	S-363	S-363, RP 2.5, 2.5 mi S of US 2	140 (E)	GRAVEL
36-3-9	S-363	S-363, RP 11, .5 mi NW of US 191	380 (A)	PAVED
38-5-4	S-391	S-391, RP 10, 10 mi SW of US 212	30 (E)	GRAVEL
38-2-8	S-391	S-391, RP 3.5, 3.5 mi SW of US 212	100 (A)	GRAVEL

Site ID	Route	Description	AADT 2011	Type
38-2-7	S-391	S-391, btwn 4th & 5th Sts, S of US 212, Brdus	170 (E)	PAVED
43-5-10	S-405	S-405, RP .5, .5 mi N of US 2 (Bainville)	50 (A)	GRAVEL
43-5-11	S-405	S-405, RP 6, 6 mi NE of US 2 (Bainville)	80 (A)	GRAVEL
43-5-12	S-405	S-405, RP 18, 10.5 mi E of MT 16 (Froid)	160 (A)	GRAVEL
43-5-13	S-405	S-405, RP 27, 1.5 mi NE of MT 16 (Froid)	260 (A)	PAVED
43-5-18	S-405	S-405, Main St, SW of BNRR (Froid)	460 (A)	PAVED
43-5-17	S-405	S-405, Main St, btwn 2nd & 3rd Avs (Froid)	730 (A)	PAVED
53-2-8	S-438	S-438, RP 53.5, 1 mi S of S-248 in Glentana	40 (A)	GRAVEL
53-2-7	S-438	S-438, RP 32, 12.5 mi S of Glentana	70 (A)	PAVED
53-5-2	S-438	S-438, RP 21, 21.5 mi N of US 2	90 (A)	PAVED
53-5-1	S-438	S-438, RP 10, 9.5 mi N of US 2	250 (A)	PAVED
53-8-6	S-438	S-438, RP 1, 1 mi N of US 2	280 (A)	PAVED
44-7-4	S-447	S-447, RP 34.5, 11 mi NW of S-332	40 (E)	GRAVEL
44-7-3	S-447	S-447, RP 25, 18.5 mi NW of S-332	50 (E)	GRAVEL
44-8-5	S-447	S-447, RP 46, S of S-332	150 (E)	PAVED
44-6-4	S-447	S-447, RP 1, 1 mi S of W Rosebud Int	160 (A)	PAVED
44-8-6	S-447	S-447, RP 51, 2 mi NW of US 212	540 (A)	PAVED
44-8-17	S-447	S-447, N of US 212, Ashland	1550 (E)	PAVED
38-4-5	S-484	S-484, S of Taylor Creek Rd	40 (A)	GRAVEL
38-4-6	S-484	S-484 (Tooley Ck Rd), W of Otter Ck Rd	40 (E)	GRAVEL
38-1-5	S-484	S-484, RP 9, 9 mi SE of US 212	120 (E)	PAVED
38-1-4	S-484	S-484, RP .5, .5 mi S of US 212	180 (A)	PAVED
13-2-6	S-494	FAS 494, RP 16, 7 mi W of MT 7, Willard	30 (A)	GRAVEL
13-2-7	S-494	S-494, RP 22.5, 1 mi W of MT 7	110 (A)	GRAVEL
13-1-13	S-494	S-494, RP 1, S of S Fk Sandstone Crk bridge	120 (E)	PAVED
13-1-28	S-494	S-494, S of US 12 (Plevna)	130 (E)	PAVED

Source: MDT Data and Statistics Bureau, Traffic Data Collection Section, 2012

(A) Actual

(E) Estimated



# APPENDIX B

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## COST ESTIMATES

**S-332 IMPROVEMENT OPTIONS - PLANNING LEVEL COST ESTIMATES**

**CONCEPT 1 - SPOT IMPROVEMENTS**

**1.A VERTICAL CURVES** **\$ 1,380,000 TOT**

*\*Unit costs based on communication with MDT Glendive District (Jim Frank, 09/25/2012)*

<b>ASPHALT SURFACE</b>				<b>WIDTH (FT)</b>	<b>26</b>
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>	
Cold Milling	SQYD	\$ 1.42	288.9	\$ 21,660	
Crushed Aggregate Course - 8"*	CUYD	\$ 40.00	87.1	\$ 183,955	
Cover - Type 1	SQYD	\$ 0.56	289	\$ 8,545	
Plant Mix Bit Surf Gr S (3/4") - 4"*	TON	\$ 35.00	67.3	\$ 124,370	
Asphalt Cement PG 64-28	TON	\$ 708.22	3.63	\$ 135,740	
Emulsified Asphalt CRS-2P	TON	\$ 623.57	0.52	\$ 17,121	
Aggregate Treatment	SQYD	\$ 0.42	340	\$ 7,540	
	Subtotal			\$ 498,931	

<b>GRAVEL SURFACE</b>				<b>WIDTH (FT)</b>	<b>28</b>
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>	
Crushed Aggregate Course - 4"*	CUYD	\$ 40.00	34.6	\$ 73,075	
Aggregate Treatment	SQYD	\$ 0.42	311	\$ 6,897	
	Subtotal			\$ 73,075	

**VERTICAL CURVES (RP 3.06 - RP 3.97)** **\$ 588,000 TOT**

**VERTICAL CURVE (RP 3.06)** **\$ 72,039 EA**

	<b>WIDTH (FT)</b>	<b>DEPTH (FT)</b>	<b>LENGTH (FT)</b>	<b>LENGTH (MI)</b>
CREST	26	0.16	660	0.13

<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>
Asphalt Surfacing				\$ 498,931
Excavation - Unclassified Borrow	CUYD	\$ 5.43	7.70	\$ 2,209
Special Borrow	CUYD	\$ 15.20	0.00	\$ -
	Subtotal			\$ 501,140
	Contingency	15%		\$ 75,171
	Total			\$ 576,311

**VERTICAL CURVE (RP 3.20)** **\$ 141,400 EA**

	<b>WIDTH (FT)</b>	<b>DEPTH (FT)</b>	<b>LENGTH (FT)</b>	<b>LENGTH (MI)</b>
SAG	26	1.8	1142	0.22

<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>
Asphalt Surfacing				\$ 498,931
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	86.67	\$ 69,555
	Subtotal			\$ 568,487
	Contingency	15%		\$ 85,273
	Total			\$ 653,760

**VERTICAL CURVE (RP 3.42)** **\$ 152,287 EA**

	<b>WIDTH (FT)</b>	<b>DEPTH (FT)</b>	<b>LENGTH (FT)</b>	<b>LENGTH (MI)</b>
CREST	26	0.01	1401	0.27

<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>
Asphalt Surfacing				\$ 498,931
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.48	\$ 138
Special Borrow	CUYD	\$ 15.20	0.00	\$ -
	Subtotal			\$ 499,069
	Contingency	15%		\$ 74,860
	Total			\$ 573,930

**VERTICAL CURVE (RP 3.66)** **\$ 222,446 EA**

	<b>WIDTH (FT)</b>	<b>DEPTH (FT)</b>	<b>LENGTH (FT)</b>	<b>LENGTH (MI)</b>
SAG	26	4.02	1561	0.30

<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>
Asphalt Surfacing				\$ 498,931
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	193.56	\$ 155,340
	Subtotal			\$ 654,271
	Contingency	15%		\$ 98,141
	Total			\$ 752,412

VERTICAL CURVES (RP 17.82 - RP 18.84)					\$	61,000	TOT
VERTICAL CURVE (RP 17.82)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	32,067	EA
CREST	28	3.6	1163	0.22			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>			
Gravel Surfacing				\$ 73,075			
Excavation - Unclassified Borrow	CUYD	\$ 5.43	186.67	\$ 53,518			
Special Borrow	CUYD	\$ 15.20	0.00	\$ -			
	Subtotal			\$ 126,593			
	Contingency	15%		\$ 18,989			
	Total			\$ 145,582			
VERTICAL CURVE (RP 17.97)					\$	21,830	EA
SAG	28	1.32	783	0.15			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>			
Gravel Surfacing				\$ 73,075			
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -			
Special Borrow	CUYD	\$ 15.20	68.44	\$ 54,931			
	Subtotal			\$ 128,006			
	Contingency	15%		\$ 19,201			
	Total			\$ 147,207			
VERTICAL CURVE (RP 18.84)					\$	6,913	EA
CREST	28	0.05	430	0.08			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>			
Gravel Surfacing				\$ 73,075			
Excavation - Unclassified Borrow	CUYD	\$ 5.43	2.59	\$ 743			
Special Borrow	CUYD	\$ 15.20	0.00	\$ -			
	Subtotal			\$ 73,819			
	Contingency	15%		\$ 11,073			
	Total			\$ 84,891			
VERTICAL CURVE (RP 20.28)					\$	5,000	TOT
VERTICAL CURVE (RP 20.28)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	4,568	TOT
SAG	28	0.09	273	0.05			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>			
Gravel Surfacing				\$ 73,075			
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -			
Special Borrow	CUYD	\$ 15.20	4.67	\$ 3,745			
	Subtotal			\$ 76,820			
	Contingency	15%		\$ 11,523			
	Total			\$ 88,344			
VERTICAL CURVES (RP 23.86 - RP 24.87)					\$	81,000	TOT
VERTICAL CURVE (RP 23.86)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	8,919	EA
SAG	28	0.22	498	0.09			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>			
Gravel Surfacing				\$ 73,075			
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -			
Special Borrow	CUYD	\$ 15.20	11.41	\$ 9,155			
	Subtotal			\$ 82,230			
	Contingency	15%		\$ 12,335			
	Total			\$ 94,565			
VERTICAL CURVE (RP 24.01)					\$	13,602	EA
CREST	28	0.54	770	0.15			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>			
Gravel Surfacing				\$ 73,075			
Excavation - Unclassified Borrow	CUYD	\$ 5.43	28.00	\$ 8,028			
Special Borrow	CUYD	\$ 15.20	0.00	\$ -			
	Subtotal			\$ 81,103			
	Contingency	15%		\$ 12,165			
	Total			\$ 93,268			

VERTICAL CURVE (RP 24.50)		WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	19,497	EA
CREST		28	1.82	894	0.17			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>				
Gravel Surfacing				\$ 73,075				
Excavation - Unclassified Borrow	CUYD	\$ 5.43	94.37	\$ 27,056				
Special Borrow	CUYD	\$ 15.20	0.00	\$ -				
	Subtotal			\$ 100,132				
	Contingency	15%		\$ 15,020				
	Total			\$ 115,151				
VERTICAL CURVE (RP 24.73)		WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	23,523	EA
SAG		28	1.48	802	0.15			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>				
Gravel Surfacing				\$ 73,075				
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -				
Special Borrow	CUYD	\$ 15.20	76.74	\$ 61,589				
	Subtotal			\$ 134,664				
	Contingency	15%		\$ 20,200				
	Total			\$ 154,864				
VERTICAL CURVE (RP 24.87)		WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	15,454	EA
SAG		28	0.77	675	0.13			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>				
Gravel Surfacing				\$ 73,075				
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -				
Special Borrow	CUYD	\$ 15.20	39.93	\$ 32,043				
	Subtotal			\$ 105,118				
	Contingency	15%		\$ 15,768				
	Total			\$ 120,886				
VERTICAL CURVES (RP 25.53 - RP 29.60)						\$	329,000	TOT
VERTICAL CURVE (RP 25.53)		WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	7,646	EA
CREST		28	0.13	468	0.09			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>				
Gravel Surfacing				\$ 73,075				
Excavation - Unclassified Borrow	CUYD	\$ 5.43	6.74	\$ 1,933				
Special Borrow	CUYD	\$ 15.20	0.00	\$ -				
	Subtotal			\$ 75,008				
	Contingency	15%		\$ 11,251				
	Total			\$ 86,259				
VERTICAL CURVE (RP 25.89)		WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	46,684	EA
CREST		28	5.31	1410	0.27			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>				
Gravel Surfacing				\$ 73,075				
Excavation - Unclassified Borrow	CUYD	\$ 5.43	275.33	\$ 78,939				
Special Borrow	CUYD	\$ 15.20	0.00	\$ -				
	Subtotal			\$ 152,014				
	Contingency	15%		\$ 22,802				
	Total			\$ 174,817				
VERTICAL CURVE (RP 26.04)		WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	14,773	EA
SAG		28	0.74	653	0.12			
<b>TYPE</b>	<b>UNITS</b>	<b>UNIT PRICE</b>	<b>QUANTITY / STA</b>	<b>COST / MI</b>				
Gravel Surfacing				\$ 73,075				
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -				
Special Borrow	CUYD	\$ 15.20	38.37	\$ 30,795				
	Subtotal			\$ 103,870				
	Contingency	15%		\$ 15,580				
	Total			\$ 119,450				

VERTICAL CURVE (RP 26.53)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	29,980	EA
CREST	28	1.47	1450	0.27			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	76.22	\$ 21,853
Special Borrow	CUYD	\$ 15.20	0.00	\$ -
Subtotal				\$ 94,928
Contingency		15%		\$ 14,239
Total				\$ 109,168

VERTICAL CURVE (RP 26.72)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	39,742	EA
SAG	28	2.62	1002	0.19			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	135.85	\$ 109,029
Subtotal				\$ 182,104
Contingency		15%		\$ 27,316
Total				\$ 209,420

VERTICAL CURVE (RP 27.09)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	11,305	EA
CREST	28	0.6	633	0.12			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	31.11	\$ 8,920
Special Borrow	CUYD	\$ 15.20	0.00	\$ -
Subtotal				\$ 81,995
Contingency		15%		\$ 12,299
Total				\$ 94,294

VERTICAL CURVE (RP 27.27)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	11,033	EA
SAG	28	0.41	562	0.11			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	21.26	\$ 17,062
Subtotal				\$ 90,137
Contingency		15%		\$ 13,521
Total				\$ 103,658

VERTICAL CURVE (RP 27.95)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	7,462	EA
SAG	28	0.09	446	0.08			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	4.67	\$ 3,745
Subtotal				\$ 76,820
Contingency		15%		\$ 11,523
Total				\$ 88,344

VERTICAL CURVE (RP 28.05)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	33,737	EA
CREST	28	3.4	1253	0.24			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	176.30	\$ 50,545
Special Borrow	CUYD	\$ 15.20	0.00	\$ -
Subtotal				\$ 123,620
Contingency		15%		\$ 18,543
Total				\$ 142,163

VERTICAL CURVE (RP 28.16)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	37,506	EA
SAG	28	2.51	970	0.18			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	130.15	\$ 104,452
Subtotal				\$ 177,527
Contingency		15%		\$ 26,629
Total				\$ 204,156

VERTICAL CURVE (RP 28.26)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	22,476	EA
CREST	28	2.04	998	0.19			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	105.78	\$ 30,327
Special Borrow	CUYD	\$ 15.20	0.00	\$ -
Subtotal				\$ 103,402
Contingency		15%		\$ 15,510
Total				\$ 118,912

VERTICAL CURVE (RP 28.58)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	16,399	EA
SAG	28	0.87	689	0.13			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	45.11	\$ 36,204
Subtotal				\$ 109,280
Contingency		15%		\$ 16,392
Total				\$ 125,672

VERTICAL CURVE (RP 28.78)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	10,365	EA
SAG	28	0.35	543	0.10			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	18.15	\$ 14,565
Subtotal				\$ 87,640
Contingency		15%		\$ 13,146
Total				\$ 100,786

VERTICAL CURVE (RP 29.03)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	24,029	EA
CREST	28	1.6	1139	0.22			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	82.96	\$ 23,786
Special Borrow	CUYD	\$ 15.20	0.00	\$ -
Subtotal				\$ 96,861
Contingency		15%		\$ 14,529
Total				\$ 111,390

VERTICAL CURVE (RP 29.24)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	10,384	EA
SAG	28	0.35	544	0.10			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	18.15	\$ 14,565
Subtotal				\$ 87,640
Contingency		15%		\$ 13,146
Total				\$ 100,786

VERTICAL CURVE (RP 29.60)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	5,307	EA
SAG	28	0.04	326	0.06			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	2.07	\$ 1,665
Subtotal				\$ 74,740
Contingency		15%		\$ 11,211
Total				\$ 85,951

VERTICAL CURVES (RP 31.54 - RP 32.41)	\$	57,000	TOT
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VERTICAL CURVE (RP 31.54)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	29,312	EA
SAG	28	0.98	1182	0.22			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	50.81	\$ 40,782
Subtotal				\$ 113,857
Contingency		15%		\$ 17,079
Total				\$ 130,936

VERTICAL CURVE (RP 32.41)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	27,276	EA
CREST	28	0.45	1570	0.30			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	23.33	\$ 6,690
Special Borrow	CUYD	\$ 15.20	0.00	\$ -
Subtotal				\$ 79,765
Contingency		15%		\$ 11,965
Total				\$ 91,730

VERTICAL CURVE (RP 33.76)	\$	18,000	TOT
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VERTICAL CURVE (RP 33.76)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	17,506	TOT
SAG	28	0.84	744	0.14			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	43.56	\$ 34,956
Subtotal				\$ 108,031
Contingency		15%		\$ 16,205
Total				\$ 124,236

VERTICAL CURVES (RP 38.77 - RP 39.35)	\$	13,000	TOT
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VERTICAL CURVE (RP 38.77)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	12,951	TOT
SAG	28	0.3	695	0.13			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	15.56	\$ 12,484
Subtotal				\$ 85,559
Contingency		15%		\$ 12,834
Total				\$ 98,393

VERTICAL CURVE (RP 39.35)	WIDTH (FT)	DEPTH (FT)	LENGTH (FT)	LENGTH (MI)	\$	6,467	TOT
SAG	28	0.01	404	0.08			

TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Gravel Surfacing				\$ 73,075
Excavation - Unclassified Borrow	CUYD	\$ 5.43	0.00	\$ -
Special Borrow	CUYD	\$ 15.20	0.52	\$ 416
Subtotal				\$ 73,491
Contingency		15%		\$ 11,024
Total				\$ 84,515

<b>VERTICAL CURVES (RP 41.44 - RP 43.36)</b>		<b>\$ 133,000 TOT</b>
Cost Per Curve - Gravel Surfacing	\$ 18,957 EA	
Number of Curves	7	
<b>VERTICAL CURVE (RP 46.46)</b>		<b>\$ 19,000 TOT</b>
Cost Per Curve - Gravel Surfacing	\$ 18,957 EA	
Number of Curves	1	
<b>VERTICAL CURVE (RP 48.48)</b>		<b>\$ 19,000 TOT</b>
Cost Per Curve - Gravel Surfacing	\$ 18,957 EA	
Number of Curves	1	
<b>VERTICAL CURVE (RP 49.69 - RP 50.27)</b>		<b>\$ 57,000 TOT</b>
Cost Per Curve - Gravel Surfacing	\$ 18,957 EA	
Number of Curves	3	

**1.B SLIDE AREAS \$ 2,761,000 TOT**

**MDT SLIDE AREA PROJECTS (2011 - 2012)**

NAME	LOCATION	LETTING DATE	LENGTH (FT)	LENGTH (MI)	COST	COST / MI
Clagget Hill Slide	Fergus	2/24/2011	1,000	0.19	\$ 669,003	\$ 3,532,338
Slide East of Noxon	Sanders	3/10/2011	689	0.13	\$ 457,629	\$ 4,017,125
US 191 Slides - S Mobridge	Fergus	5/26/2011	8,850	1.68	\$ 3,133,525	\$ 1,926,536
Cut Bank South Slide	Glacier	6/23/2011	1,166	0.22	\$ 365,078	\$ 2,013,385
E of Winnett - Slide Repair	Petroleum	11/17/2011	375	0.07	\$ 525,738	\$ 9,706,063
S of McLeod Slide Repair	Sweet Grass	11/17/2011	1,800	0.34	\$ 835,658	\$ 2,829,313
Slide Repair - NE of Glendive	Dawson	7/12/2012	600	0.11	\$ 683,132	\$ 6,810,883
Glasgow Slide Repair	Valley	7/12/2012	850	0.16	\$ 482,262	\$ 3,580,929
Slide Repair - 13 Miles East Glendive	Dawson	8/23/2012	650	0.12	\$ 243,070	\$ 1,636,703
Total			15,979	3.03	\$ 7,395,094	\$ 2,443,544

SLIDE AREA (RP 3.26)	LENGTH (MI)	0.08	\$ 195,000 TOT
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SLIDE AREAS (RP 3.74 - RP 4.65)	\$ 1,197,000 TOT
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RP 3.74	LENGTH (MI)	0.09	\$ 219,919 EA
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RP 4.20	LENGTH (MI)	0.2	\$ 488,709 EA
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RP 4.45	LENGTH (MI)	0.1	\$ 244,354 EA
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RP 4.65	LENGTH (MI)	0.1	\$ 244,354 EA
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SLIDE AREA (RP 26.22)	LENGTH (MI)	0.08	\$ 195,000 TOT
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SLIDE AREA (RP 27.90)	LENGTH (MI)	0.15	\$ 367,000 TOT
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SLIDE AREA (RP 36.30)	LENGTH (MI)	0.13	\$ 318,000 TOT
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SLIDE AREA (RP 43.50)	LENGTH (MI)	0.2	\$ 489,000 TOT
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**1.C GUARDRAIL \$ 1,290,000 TOT**

TYPE	UNITS	UNIT PRICE
Guard Rail - Steel Box Beam	LNFT	\$ 42.97

STEEP FILL SLOPE (RP 4.90)	LENGTH (FT)	1,260	\$ 54,142 EA
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STEEP FILL SLOPE (RP 5.10)	LENGTH (FT)	1,600	\$ 68,752 EA
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STEEP FILL SLOPE (RP 22.00)	LENGTH (FT)	3,700	\$ 158,989 EA
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STEEP FILL SLOPE (RP 23.80)	LENGTH (FT)	1,380	\$ 59,299 EA
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STEEP FILL SLOPE (RP 24.10)	LENGTH (FT)	1,900	\$ 81,643 EA
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STEEP FILL SLOPE (RP 24.70)	LENGTH (FT)	1,600	\$ 68,752 EA
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STEEP FILL SLOPE (RP 26.70)	LENGTH (FT)	4,220	\$	181,333	EA
STEEP FILL SLOPE (RP 31.30)	LENGTH (FT)	3,160	\$	135,785	EA
STEEP FILL SLOPE (RP 31.70)	LENGTH (FT)	4,760	\$	204,537	EA
STEEP FILL SLOPE (RP 36.60)	LENGTH (FT)	2,120	\$	91,096	EA
STEEP FILL SLOPE (RP 37.50)	LENGTH (FT)	2,120	\$	91,096	EA
STEEP FILL SLOPE (RP 39.00)	LENGTH (FT)	840	\$	36,095	EA
STEEP FILL SLOPE (RP 43.30)	LENGTH (FT)	840	\$	36,095	EA
STEEP FILL SLOPE (RP 48.10)	LENGTH (FT)	520	\$	22,344	EA

<b>1.D</b>	<b>HORIZONTAL CURVES (RP 39.52 - RP 40.98)</b>	<b>WIDTH (FT)</b>	<b>LENGTH (MI)</b>	<b>\$</b>	<b>1,006,000</b>	<b>TOT</b>
		32	1.46			

*\*Costs from Winifred to Big Sandy Corridor Study (May 2011)*

Cost / mi*	\$	559,680
Width (ft)		26
Cost / sqft	\$	4.08

**CONCEPT 2 - GRAVEL WITHOUT RECONSTRUCTION (RP 17.7 - RP 50.4)**

**2.A GRAVEL PLACEMENT \$ 2,741,000 TOT**

*\*Unit costs based on communication with MDT Glendive District (Jim Frank, 09/25/2012)*

GRAVEL SURFACING			WIDTH (FT)		24
TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI	
Crushed Aggregate Course - 4"*	CUYD	\$ 40.00	29.6	\$ 62,515	
Aggregate Treatment	SQYD	\$ 0.42	267	\$ 5,921	
	Contingency	15%		\$ 10,265.43	
	Total			\$ 78,702	

GRAVEL SURFACING			WIDTH (FT)		26
TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI	
Crushed Aggregate Course - 4"*	CUYD	\$ 40.00	32.1	\$ 67,795	
Aggregate Treatment	SQYD	\$ 0.42	289	\$ 6,409	
	Contingency	15%		\$ 11,130.61	
	Total			\$ 85,335	

GRAVEL SURFACING			WIDTH (FT)		28
TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI	
Crushed Aggregate Course - 4"*	CUYD	\$ 40.00	34.6	\$ 73,075	
Aggregate Treatment	SQYD	\$ 0.42	311	\$ 6,897	
	Contingency	15%		\$ 11,995.79	
	Total			\$ 91,968	

GRAVEL SURFACING			WIDTH (FT)		32
TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI	
Crushed Aggregate Course - 4"*	CUYD	\$ 40.00	39.5	\$ 83,424	
Aggregate Treatment	SQYD	\$ 0.42	356	\$ 7,895	
	Contingency	15%		\$ 13,697.80	
	Total			\$ 105,016	

GRAVEL SURFACE (RP 17.7 - RP 20.0)	WIDTH (FT)	LENGTH (MI)	\$	211,526	TOT
	28	2.3			

GRAVEL SURFACE (RP 20.0 - RP 39.6)	WIDTH (FT)	LENGTH (MI)	\$	1,542,552	TOT
	24	19.6			

GRAVEL SURFACE (RP 39.6 - RP 41.0)	WIDTH (FT)	LENGTH (MI)	\$	147,023	TOT
	32	1.4			

GRAVEL SURFACE (RP 41.0 - RP 44.7)	WIDTH (FT)	LENGTH (MI)	\$	315,738	TOT
	26	3.7			

GRAVEL SURFACE (RP 44.7 - RP 50.4)	WIDTH (FT)	LENGTH (MI)	\$	524,216	TOT
	28	5.7			

**2.B DOUBLE SHOT / BITUMEN TREATMENT \$ 2,183,000 TOT**

*\*Unit costs from "Ashland - East" project (July 2012)*

DOUBLE SHOT / BITUMEN TREATMENT			WIDTH (FT)		24
TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI	
Emuls Asphalt CRS-2P*	TON	\$ 726.15	0.95	\$ 36,500	
Cover - Type 1*	SQYD	\$ 0.64	533	\$ 18,022	
	Contingency	15%		\$ 8,178.41	
	Total			\$ 62,701	

DOUBLE SHOT / BITUMEN TREATMENT			WIDTH (FT)		26
TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI	
Emuls Asphalt CRS-2P*	TON	\$ 726.15	1.03	\$ 39,542	
Cover - Type 1*	SQYD	\$ 0.64	578	\$ 19,524	
	Contingency	15%		\$ 8,859.95	
	Total			\$ 67,926	

DOUBLE SHOT / BITUMEN TREATMENT			WIDTH (FT)	28
TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Emuls Asphalt CRS-2P*	TON	\$ 726.15	1.11	\$ 42,584
Cover - Type 1*	SQYD	\$ 0.64	622	\$ 21,026
	Contingency	15%		\$ 9,541.48
	Total			\$ 73,151

DOUBLE SHOT / BITUMEN TREATMENT			WIDTH (FT)	32
TYPE	UNITS	UNIT PRICE	QUANTITY / STA	COST / MI
Emuls Asphalt CRS-2P*	TON	\$ 726.15	1.27	\$ 48,667
Cover - Type 1*	SQYD	\$ 0.64	711	\$ 24,030
	Contingency	15%		\$ 10,904.55
	Total			\$ 83,602

GRAVEL SURFACE W/ DOUBLE SHOT (RP 17.7 - RP 20.0)	WIDTH (FT)	LENGTH (MI)	\$	168,248	TOT
	28	2.3			

GRAVEL SURFACE W/ DOUBLE SHOT (RP 20.0 - RP 39.6)	WIDTH (FT)	LENGTH (MI)	\$	1,228,943	TOT
	24	19.6			

GRAVEL SURFACE W/ DOUBLE SHOT (RP 39.6 - RP 41.0)	WIDTH (FT)	LENGTH (MI)	\$	117,042	TOT
	32	1.4			

GRAVEL SURFACE W/ DOUBLE SHOT (RP 41.0 - RP 44.7)	WIDTH (FT)	LENGTH (MI)	\$	251,327	TOT
	26	3.7			

GRAVEL SURFACE W/ DOUBLE SHOT (RP 44.7 - RP 50.4)	WIDTH (FT)	LENGTH (MI)	\$	416,963	TOT
	28	5.7			

**CONCEPT 3 - RECONSTRUCT AND WIDEN GRAVEL SECTION (RP 17.7 - RP 50.4)**

*Costs from Winifred to Big Sandy Corridor Study (May 2011)	Cost / mi*	\$	559,680
	Width (ft)		26
	Cost / sqft	\$	4.08

<b>RECONSTRUCT AND WIDEN GRAVEL SECTION (RP 17.7 - RP 50.4)</b>	<b>WIDTH (FT)*</b>	<b>LENGTH (MI)</b>	<b>\$</b>	<b>25,341,000</b>	<b>TOT</b>
	36	32.7			

\*36-foot base width was assumed for cost estimating purposes.

<b>BRIDGE COST ESTIMATES*</b>	<b>COST / SQFT</b>	<b>\$</b>	<b>150</b>	<b>\$</b>	<b>1,878,000</b>	<b>TOT</b>
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\*Planning level cost estimate from Toston Bridge Corridor Study, confirmed with MDT Glendive District Staff

Foster Creek - RP 19.87	Length (ft)	Width (ft)	Cost
	50	40	\$ 300,000
Tongue River - RP 39.61	Length (ft)	Width (ft)	Cost
	227	40	\$ 1,362,000
Roe and Cooper Creek - RP 47.80	Length (ft)	Width (ft)	Cost
	36	40	\$ 216,000

<b>EXTENSION OF RECONSTRUCT AND WIDEN GRAVEL SECTION ON S-447</b>	<b>WIDTH (FT)</b>	<b>LENGTH (MI)</b>	<b>\$</b>	<b>2,092,000</b>	<b>TOT</b>
RP 43.72 - RP 46.42	36	2.7			



**CONCEPT 5 - RECONSTRUCT WITH PAVEMENT (RP 0.0 - RP 50.4)**

\*Cost from US 212 - Ashland East Project (July 2012)  
 \*\*Based on \$150 / sqft cost

\*Cost \$ 12,326,887  
 \*\*Bridge \$ 587,760 Estimate 97.96 LENGTH (FT)  
 Length 6.50  
 Width (ft) 40  
 Cost / sqft \$ 8.55

<b>RECONSTRUCT WITH PAVEMENT (RP 0.0 - RP 50.4)</b>	<b>WIDTH (FT)</b>	<b>LENGTH (MI)</b>	<b>\$</b>	<b>54,614,000</b>	<b>TOT</b>
	24	50.4			
<b>RECONSTRUCT WITH PAVEMENT (RP 0.0 - RP 50.4)</b>	<b>WIDTH (FT)</b>	<b>LENGTH (MI)</b>	<b>\$</b>	<b>63,716,000</b>	<b>TOT</b>
	28	50.4			
<b>RECONSTRUCT WITH PAVEMENT (RP 0.0 - RP 50.4)</b>	<b>WIDTH (FT)</b>	<b>LENGTH (MI)</b>	<b>\$</b>	<b>72,819,000</b>	<b>TOT</b>
	32	50.4			
<b>RECONSTRUCT WITH PAVEMENT (RP 0.0 - RP 50.4)</b>	<b>WIDTH (FT)</b>	<b>LENGTH (MI)</b>	<b>\$</b>	<b>81,921,000</b>	<b>TOT</b>
	36	50.4			
<b>RECONSTRUCT WITH PAVEMENT (RP 0.0 - RP 50.4)</b>	<b>WIDTH (FT)</b>	<b>LENGTH (MI)</b>	<b>\$</b>	<b>91,023,000</b>	<b>TOT</b>
	40	50.4			
<b>BRIDGE COST ESTIMATES</b>	<b>COST / SQFT</b>	<b>\$</b>	<b>150</b>	<b>\$</b>	<b>2,790,000</b>
Pumpkin Creek - RP 1.02	Length (ft)	Width (ft)	Cost		
	152	40	\$ 912,000		
Bridge Replacement along Gravel Section			Cost		
			\$ 1,878,000		
<b>EXTENSION OF RECONSTRUCT WITH PAVEMENT ON S-447</b>	<b>WIDTH (FT)</b>	<b>LENGTH (MI)</b>	<b>\$</b>	<b>4,389,000</b>	<b>TOT</b>
RP 43.72 - RP 46.42	36	2.7			