



Memorandum

To: Rebecca Barbula, P.E.
Butte District Design Project Manager

From: Patrick S. McCann, P.E. *Pat S. McCann*
Geotechnical Manager – Butte District

Date: July 10, 2023

Subject: IM 90-6(150)319
BOZEMAN HILL - EAST
UPN 9467000
Geotechnical Engineering – Alignment (Activity 464) Report

The Geotechnical Section has completed its analysis for alignment features on the subject project. Please find the following as the Geotechnical Engineering Alignment report for this project, which will complete Activity 464. The report and supporting attachments document the field investigation and apparent subsurface conditions. Recommendations are provided for construction of a proposed cut slope modification on the project to mitigate rockfall issues within the project corridor.

Geotechnical Recommendations Summary

- Excavation is proposed to construct a 2H:1V cut slope From Stations 121+75± to 127+50± to mirror slopes that are east and west of this location adjacent to, and north of, the I-90 WB travel lanes.
- This excavation should be considered Unclassified Excavation.
- Construction of the slope may require the use of explosives in lieu of other techniques such as ripping.
- The inclusion of a bid item for Blasting Consultant is recommended in the event that blasting is needed.
- Blasting, if needed, will require the complete closure of both lanes of Interstate 90 and the adjacent frontage road for a minimum of 30 minutes at a time for blasting.
- A Special Provision for Road Closures for Blasting will be provided and should be included in the special provisions package for the Contract.
- A "dead lane" should be provided from Stations 120+00± to 130+00± to separate traffic from the excavation area.

Project Location and Limits

- Counties: Gallatin and Park
- Route: Interstate 90
- RP's: 320.7± to 320.8± (Specific to this report, not the total project)
- PLSS Information: T02S, R07E, Section 13 (Based on adjacent private ownership)

Intent

Based on information provided in the current PFR/SOW report, dated May 1, 2023, our understanding of the proposed project is as follows:

Overall Project:

The intent of the project is to provide cost-effective surfacing treatment to the travel lanes and address deteriorating shoulder conditions by providing a seal and cover treatment to the driving

lanes and a mill and overlay treatment to the shoulders with spot roadside improvements.

Report Specific Geotechnical Aspects:

The project contains one rock slope (MDT Rock Slope Asset Management Program (RAMP) Section No. 1266 (MP 320.76 to 320.84) which has a Condition State of 3/FAIR and has been identified as a continual maintenance issue. It is proposed to mitigate this slope via excavating the existing rock outcrop to match the adjacent slope cut.

Project Location Map and Aerial Image

A map and aerial image of the proposed rock slope mitigation area are shown in Figures 1 & 2.



Figure 1: Proposed Slope Mitigation Area Map



Figure 2: Slope Mitigation Area Aerial Image

Site Investigation

The MDT Geotechnical site investigation included a review of published data, site reconnaissance, UAV Imagery acquisition, and point cloud model generation for development of project plans and cross sections in the area of the proposed slope mitigation.

Site Description

The site is in rural mountainous terrain. The cut slope in the area of proposed mitigation is approximately 84 feet in height and 420 feet long. The overall slope angle is 55 degrees (approximately 3/4H:1V) with a ditch width of approximately 13 feet and a ditch depth of approximately 1.5 feet. Images of the site are included at the end of this report.

Geologic Setting:

The local surface geology was taken from the Geologic Map of the Livingston 30' x 60' Quadrangle, published by the Montana Bureau of Mines and Geology (Berg, Lopez, and Lonn, MBMG Open File Report 406, 2000). The map describes the surface geology in the project area as predominantly Miner Creek Formation of the Livingston Group (Kmi) with a smaller area of Cokedale Formation of the Livingston Group (Kcd). Miner Creek consists of andesitic siltstone and sandstone with some beds of tuff and bentonite. Cokedale consists of andesitic siltstone and sandstone with claystone, tuff, bentonite, and coal. A portion of the referenced geologic map is shown in Figure 3.

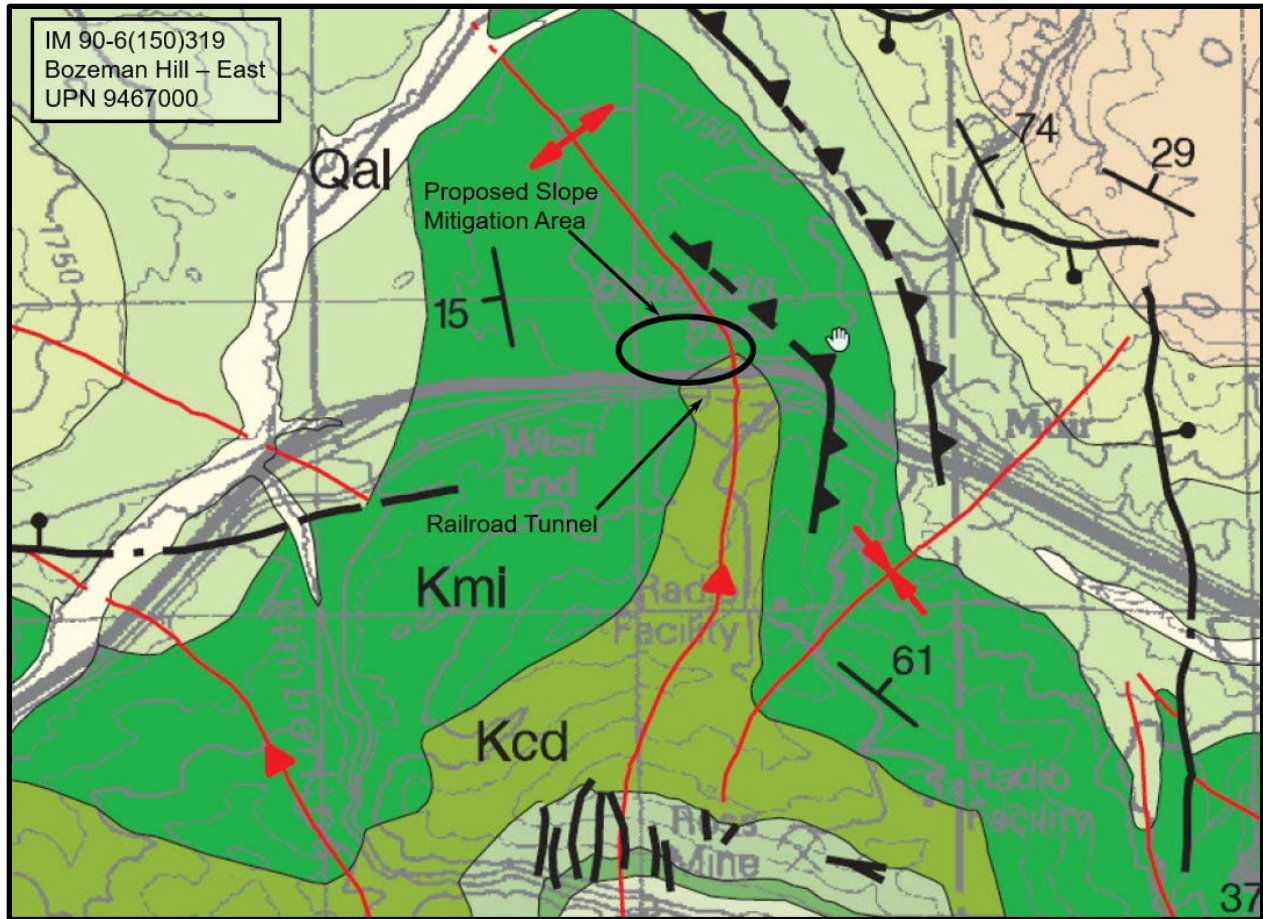


Figure 3: Geology Map Showing Miner Creek (Kmi) and Cokedale (Kcd) Formations

Field Investigation:

MDT Geotechnical conducted a site visit and performed a UAV reconnaissance flight on August 13, 2019. The primary purpose of the site visit was to collect UAV Imagery and data to generate a 3-D point cloud model for the slope to be mitigated. This model was then used to generate cross sections in the plans. No subsurface investigation was performed since the existing slope is exposed and easily observed.

Geotechnical Analysis and Recommendations

Experience with and analyses of similar slope configurations and materials, as well as the historic performance of the adjacent slopes (both east and west of the proposed location), indicate that the slope will likely be stable as designed and shown in the plans. No other features such as embankments or large culvert installations requiring geotechnical input are proposed with the project.

Constructability Elements

The current existing slope was constructed in approximately 1978. This portion of the slope was initially constructed using ripping techniques that proved to be marginal and largely unsuccessful with the available equipment of the time period. The remaining adjacent 2H:1V slopes were constructed utilizing blasting techniques, which proved to be a much more efficient method for excavation. Since initial construction, technological advancements have resulted in earth moving equipment that is significantly larger and more powerful than the previous types and blasting techniques that allow for more efficient and precise excavation. For the purposes of this project, the following are some considerations for inclusion in the Contract.

Excavation Measurement and Payment:

The excavation quantities for the project should be accounted for as Unclassified Excavation irrespective of whether the slope is constructed with earth moving equipment or the use of explosives. Production blasting is incidental to and included in the measurement for Unclassified Excavation in accordance with Section 203.

Blasting Related Considerations:

In anticipation that blasting may be needed for excavation of the proposed slope:

- A bid item for Blasting Consultant should be included in the schedule of items. For the estimate use a quantity of 1 and Lump Sum, with an estimated cost of \$15,000 - \$20,000.
- Blasting will require complete closure of both lanes of I-90 and the adjacent frontage road.
- The minimum closure will be 30 minutes, and this will apply to each blast required to complete the excavation.
- A special provision for Road Closures for Blasting is included at the end of this report and should be included in the special provisions package for the Contract.
- Any other contractual items, including pre- and post-blast surveys and seismic monitoring of the railroad tunnel, related to blasting are covered by Section 204 of the Specifications.

Other Considerations:

Regardless of the excavation technique used, it is strongly recommended that a “dead-lane” closing the driving lane of I-90 WB from project Stations 120+00± to 130+00± is utilized to separate traffic from the area of excavation. This will provide an area for excavated material to descend the slope in a safe manner and also provide an area for Contractors to load trucks and haul the excavated waste materials to an off-site location while maintaining the flow of traffic.

Limitations

This report was prepared by geotechnical engineers and geologists from the Geotechnical Section. It presents professional judgments and recommendations based surface observation, review of published data, and MDT Geotechnical’s experience with subsurface conditions in the general project area. MDT Geotechnical should be contacted if design aspects of this project differ from those assumed in this report, such as alignment, grade, and typical sections. If during construction subsurface conditions vary considerably than otherwise described in this report, MDT Geotechnical should be notified immediately. This report should only be used for the project described herein and should not be used for other purposes.

Questions regarding this project may be directed to Pat McCann, MDT Geotechnical Section, at 444-6277 or via email at pmccann@mt.gov.

Attachments: Site Images
Road Closures for Blasting Special Provision

E-copies: Geno Liva, P.E. - District Administrator
David Gates, P.E. - District Preconstruction Engineer
Kevin Mueller – Acting District Project Supervisor
Dave Cunningham, P.E. – District Construction Engineer
Jeff Harrison – District Construction Operations Engineer
Mike Drew – District Utility Agent
Jeff Jackson, P.E. – Geotechnical and Pavement Bureau
Cameron Kloberdanz, P.E. – Geotechnical and Pavement Bureau
Miles Yerger, P.E. – Surfacing Design
Greg Zeihen, P.E. – Surfacing Design

Deborah Wambach - Environmental Services
Sam Ahlrich P.E. - Projects Development Engineer – Environmental Services
Ryan Wendel – Environmental Services
Mike Walsh – District Materials Supervisor
John MacMillan – Constructability Reviewer
Matt Collingwood – Constructability Reviewer (for D2 Road projects)

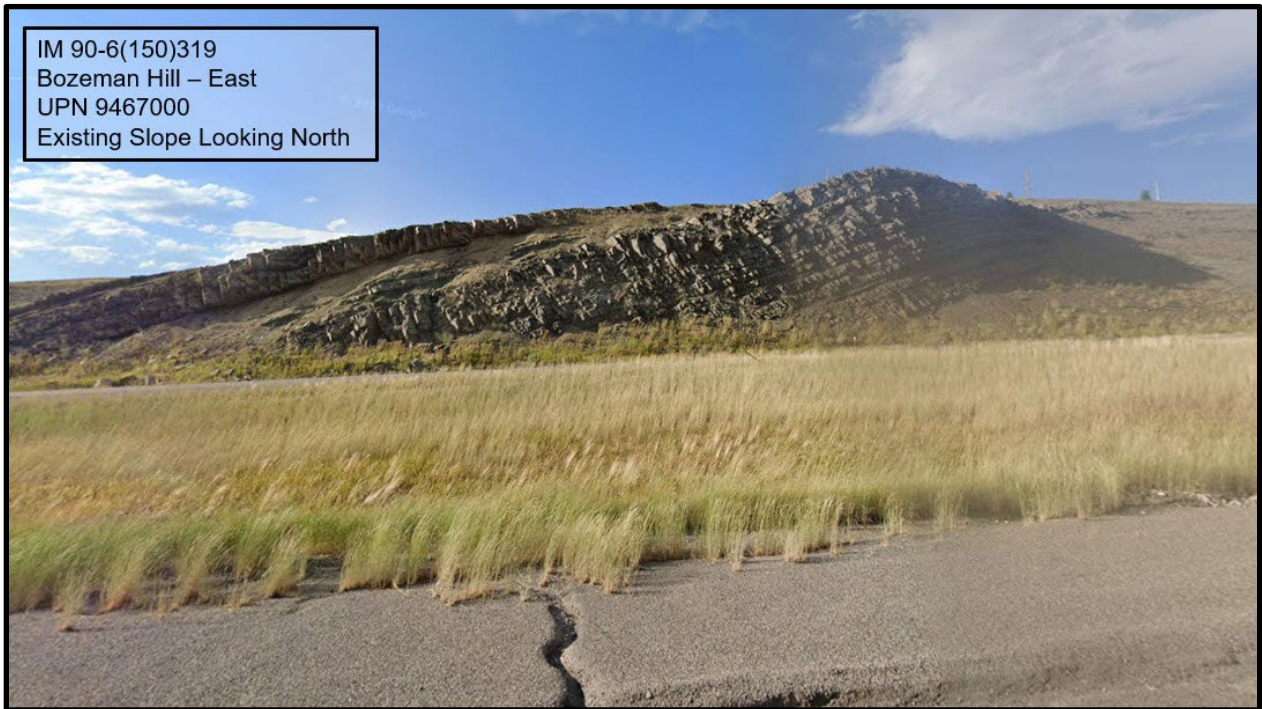
PSM::psm\\S:\PROJECTS\00_ACTIVE\9467000\9467_MEMOS&SPECIALS\464_Materials\9467000gtgdm464.docx

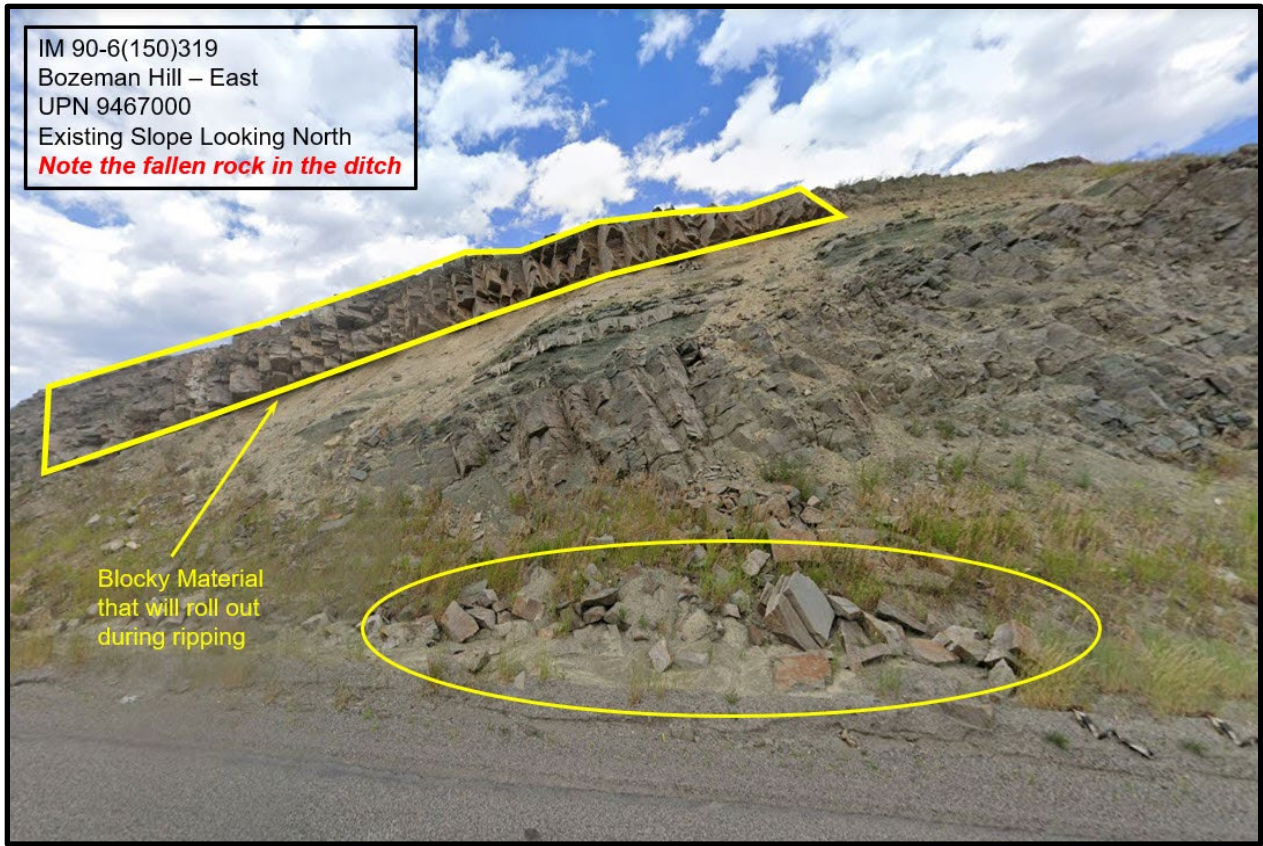
Technical Review

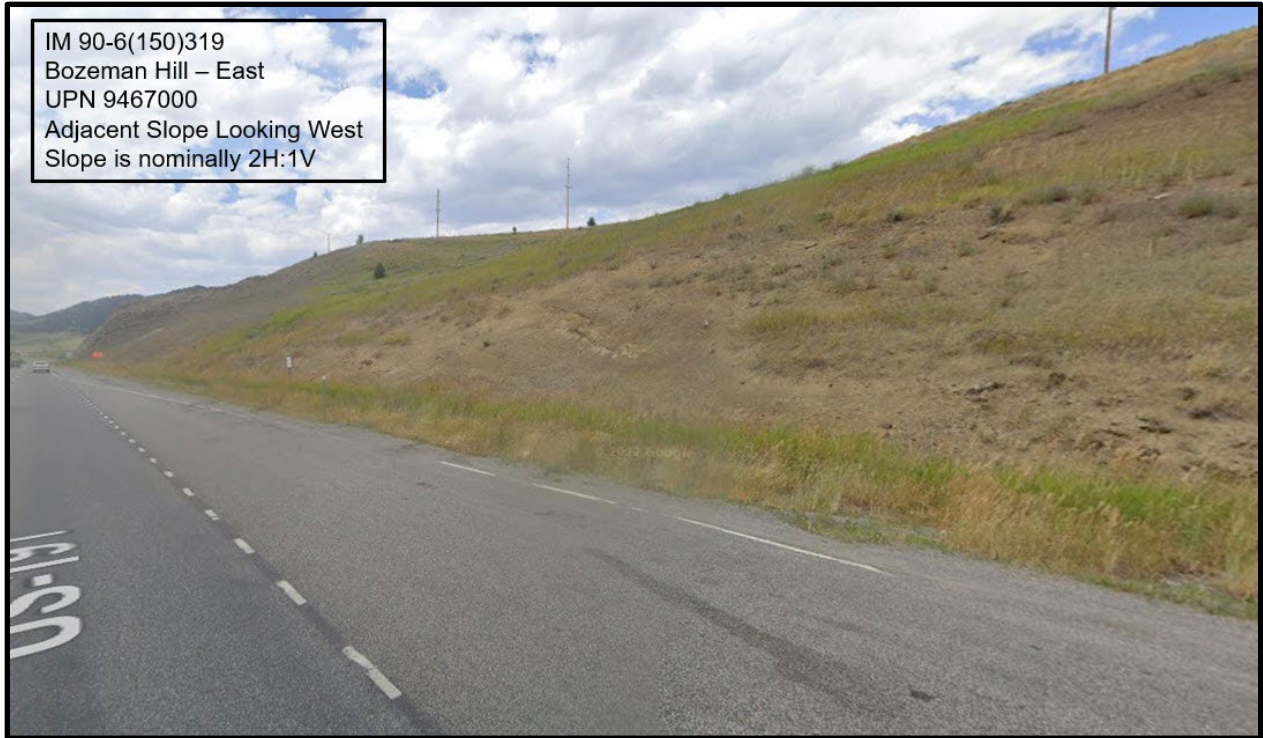
Initials: CMK

Date: 7-10-23

Site Images







1. ROAD CLOSURES FOR BLASTING

A. Description. This work consists of road closure times related to blasting operations only.

B. Construction. The following maximum road closure times are allowed on this project for specific work. Include the proposed road closure times and number in the traffic control plan.

1) Blasting operations. Up to 30 minutes of road closure is allowed for blasting operations including clean-up activities as defined in Section 204. Coordinate road closures with the Project Manager, other requirements of the contract, and local authorities.

2) Do not close the road from 7:30 a.m. to 8:30 a.m., and 4:00 p.m. to 6:00 p.m.

3) Do not close the road starting at 12:00 p.m. (noon) on Friday until 8:30 a.m. the following Monday.

4) All road closure durations and times are at the discretion of the Project Manager. The Project Manager has the authority to adjust these times to better fit field conditions.

C. Method of Measurement and Basis of Payment. No separate measurement will be made for road closure coordination. Include in the cost of other items.