



**HIGHWAY 505 – BULLRUSH HILL
CALL-OUT REPORT**

Submitted to:
Alberta Transportation
Calgary, Alberta

Submitted by:
Amec Foster Wheeler Environment & Infrastructure
Calgary, Alberta

March 2016

CG25399.400

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1.0 INTRODUCTION

AMEC Foster Wheeler Environment & Infrastructure, a division of AMEC Foster Wheeler Americas Limited (AMEC), attended a call-out request to the Bullrush Hill site on Highway 505, 600m west of Spring Coulee, Alberta and 400m west of the Highway 5 intersection. The call-out request was made by Mr. Ross Dickson of Alberta Transportation (AT). The site inspection was performed by Bryan Bale, P.Eng., and Tyler Clay, P.Eng., of AmecFW on 26 May 2015.

The purpose of the site inspection was to:

- ▶ Assess potential damage and risk to the highway.
- ▶ Provide recommendations for potential monitoring work, mitigative measures and any potential geotechnical investigations.

The call-out site inspection was authorized under AT Consulting Services Agreement CON0013506.

2.0 SITE LOCATION AND BACKGROUND

This site is located along Highway 505, 600m west of Spring Coulee, Alberta and approximately 400m west of the Highway 5 intersection. It is also 5.5km east of the St. Mary Reservoir. The site includes a slide located on the south east slope that crosses both lanes of Highway 505.

The published surficial geology of the site consists of till with occasional lenses of silt and sand¹. The bedrock geology of the site area is within a region mapped predominantly as the Upper Cretaceous St. Mary River Formation however it lies very close to the contact with the Upper Cretaceous and Paleogene Willow Creek Formation². Both formations are non-marine mudstone with interbedded siltstone and sandstones.

There were no previous records or reports located for this site during a file review. This site was identified as a hazard by Alberta Transportation and was visited during the 2015 Southern Region Geohazard Monitoring Annual Inspections tour.

¹ Shetsen, I., (1981): Surficial Geology, Lethbridge, Alberta. A.R.C. Drafting Services. Scale 1:250,000.

² Prior, G.J., Hathway, B., Glombick, P.M., Pana, D.I., Banks, C.J., Hay, D.C., Schneider, C.L., Grobe, M., Elgr, R. and Weiss, J.A., (2013): Bedrock Geology of Alberta; Alberta Energy Regulator, AER/AGS Map 600, scale 1:1,000,000.

3.0 ANNUAL INSPECTION OBSERVATIONS

A summary of observations and discussions on site with the AT personnel from the May 2015 inspection is presented below:

- ▶ The highway was aligned East-West and passed through a coulee at this site. Refer to Figure 1.
- ▶ A 60m stretch of highway has been damaged and recently patched. Refer to Photo 1. A possible old road was observed south of the current highway on the midslope bend.
- ▶ The valley was broad with a meandering stream. An old meander was observed at the toe of the slide south of the damaged area at a slightly higher elevation than the current channel. The slide along the older riverbank was still active even though the creek has shifted position. Refer to Photo 2.
- ▶ The highway was a cut and fill through the valley. The backslope was stable and the backslope ditch was dry. A marshy ditch to the west and north of the slide indicates higher moisture content which could indicate potential springs.
- ▶ The upper ditch was dry however water was noted on the shoulder along the main scarp area. In the upslope ditch, a 150mm pipe was observed approximately 2m deep and is suspected to be a french drain.
- ▶ A marshy area was observed north of the highway with flowing water. Vegetation including cat tails indicated consistent higher moisture. Refer to Photo 3 and Figure 1. This area smelled like sewage which could be related to a septic system at the house to the north of the site.
- ▶ At the west end of the overlay, slight deflection of the road was observed when vehicles were passing at this location, but no obvious cracks were observed. Refer to Figure 1.
- ▶ The scarp was observed across the road that had recently been patched. There was 300mm settlement noted, but no distinct cracks due to the recent patch work. The scarp aligned with the main scarp in the natural slope to the south.
- ▶ The main scarp on the hillside has soil exposure indicating soil is likely a clay till (Cl-CH). Slide movement appeared to be to the south with potential compression to the west. Refer to Photos 4, 5 and 6. No additional cracks or toe bulge were observed on the slope.
- ▶ The slope below the highway to the creek was estimated to be 18°.
- ▶ There was a gully on the slope below the highway that starts mid-way down, suspected to be an old culvert outlet location prior to raising the road grade.

4.0 DISCUSSION AND ASSESSMENT

There is risk to both lanes of the highway at this site based on the ongoing cracking and settlement observed in the road surface. This damage appears to be due to an active landslide located on the south slope and crossing the highway. The extent and depth of sliding at this location is unknown however it is suspected to be a deep-seated landslide after the field visit.

The cause of this slide is likely caused by groundwater seepage within the slope. The creek at the base of the slope currently makes a sharp westerly bend at the base of the slope area resulting in continued erosion of the toe and is contributing to the instability. An abandoned channel is visible both in the field and on aerial images meandering directly at the base of the slope on in which the slide is occurring. Refer to Figure 1 for a site plan. The slide at the old channel bank is still active even though the creek has shifted.

The presence of both flowing and ponded water on the slope north of the highway is suspected to be a result of springs in the area. Vegetation indicates water is accumulating on the north slope and that the soil may not be able to effectively drain.

Recent repairs to the highway surface appear effective to prevent damage to vehicle traffic at this time, however it is anticipated that slide activity will continue resulting in regular road maintenance being required.

Further investigation would be useful to determine the extent and rate of slide movement at this site. The addition of slope inclinometers and piezometers to this site would provide monitoring of slope movement and increase the knowledge of slide mechanisms, rates and groundwater conditions. Borehole completed at the time of installation would allow a better understanding of the bedrock and surficial geology at this site.

Slide conditions should be considered during the planning of any future repairs. This site should be added to the Southern Region Geohazard Monitoring Program and re-inspected in 2016.

5.0 RISK LEVEL

The current recommended Risk Level for this site, based on AT's general geohazard risk matrix, is as follows:

- ▶ Probability Factor of 8 in order to reflect the active, steady slope movement observed in the area.
- ▶ Consequence Factor of 6 based on the magnitude of damage to both lanes in recent years that has been managed as a maintenance issue.

Therefore, the current recommended Risk Level for this site is 48 (i.e. 8 x 6). The damage observed to the highway is seen as a cumulative effect of the suspected deep movement in the last several years and is expected to continue. Further investigation into the slide area is required.

6.0 RECOMMENDATIONS

6.1 Maintenance and Short Term Measures

- ▶ The MCI should continue road surface patching and overlays as required to mitigate the settlement and cracking along the shoulder and both the north and southbound lanes.
- ▶ Signage should be installed that indicates "slide area" and speed reductions should be considered to protect vehicles from potential road damage.
- ▶ This site should be added to the Southern Region Geohazard Monitoring Program for follow-up inspections.
- ▶ Slope inclinometers and piezometers should be installed to investigate ground movement and water levels in the slide area and on both sides of the highway. Borehole logs should be completed at the time of installation. Amec Foster Wheeler would be pleased to provide a cost estimate for this work.

6.2 Long Term Measures

Air photo review, including a comparison of old and new photos, should be completed to document changes to the highway and surrounding slopes over time.

Further repair work may be required at this site following investigation. Instrumentation should be installed to better understand slide and water movement at this site.

7.0 CLOSURE

This report has been prepared for the exclusive use of Alberta Transportation for the specific project described herein. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it are the responsibility of such third parties. Amec Foster Wheeler Environment & Infrastructure, a division of Amec Foster Wheeler Americas Limited, cannot accept responsibility for such damages, if any, suffered by any third party as a result of decisions made or actions based on this report. This report has been prepared in accordance with accepted geotechnical engineering practices. No other warranty, expressed or implied, is made.

We trust that this meets your needs at this time. Please contact the undersigned if you have any questions or require any further information.

Respectfully Submitted,

**Amec Foster Wheeler Environment & Infrastructure
a Division of AMEC Foster Wheeler Americas Limited**

Original stamped and signed March 29, 2016

Ryan Mateff, B.A.Sc., P.Eng.,
Geotechnical Engineer

Stephanie Weckman, B.Sc., G.I.T.,
Geologist-in-Training

APEGA Permit No. 04546

Reviewed by:
Mickey Davachi, Ph.D., P.Eng.,
Principle Geotechnical Engineer

Appendix A

Site Photographs



Photo 1 - (May 2015) –
Site overview. Facing east
towards site. Main headscarp
marked with red dashed line.



Photo 2 - (May 2015) –
On north slope facing south.
Abandoned creek channel
indicated with white dashed line.



Photo 3 - (May 2015) –
Facing east towards area of moist ground on north shoulder of Highway 505 indicated by cat tail vegetation.



Photo 4 - (May 2015) –
On north slope facing southeast towards headscarp and road damage. Extent of headscarp indicated by red dashed line.



Photo 5 - (May 2015) –
In valley south of highway facing
upslope (east) towards
headscarp exposure, marked
with dashed line.



Photo 6 - (May 2015) –
Facing east towards damaged
portion of highway.