

August 28, 2009

CG25309.B

Alberta Transportation
2nd Floor, 803 Manning Road NE
Calgary, AB T2E 7M8

Attn: Mr. Ross Dickson

**Re: Southern Region Geohazard Assessment Program
Highway 541:02, East Of Fir Creek Rock Cut Site
June 2009 Inspection Report**

This letter documents the June 2009 site inspection of the East Of Fir Creek Rock Cut site on Highway 541:02, along the north side of the highway approximately 7 km eastbound along the highway from the junction between Highways 40, 541 and 940 at Highwood House.

AMEC Earth & Environmental (AMEC), a division of AMEC Americas Limited, performed this inspection in partial fulfillment of the scope of work for the supply of geotechnical services for Alberta Transportation's (AT's) Southern Region (AT contract CE061/08).

The site inspection was performed on June 10, 2009 by Mr. Andrew Bidwell, P.Eng., and Mr. Bryan Bale, EIT of AMEC in the company of Mr. Ross Dickson, Mr. Rick Nash and Mr. Neil Kjelland, P.Eng. of AT.

BACKGROUND

The only previous assessment of this site under AT's Geohazard Risk Management Program (GRMP) was during 2005 as part of the Highway 40/Highway 541 corridor review. Please refer to the report on the corridor review¹ for further details. In summary:

- There was an accumulation of gravel to boulder sized rockfall debris that had significantly reduced the effective width and depth of the ditch in several locations to less than the dimensions recommended by the "Ritchie chart" ditch sizing criteria.

¹ AMEC report "Geohazards Review, Highway 40/Highway 541 Corridor, Southwestern Alberta", submitted to AT on April 10, 2006, AT contract number CE044/2004, AMEC project number CG25211.

- A rough check of the actual effectiveness of the ditch in containing rockfall debris was performed by dropping two cobble-sized rocks from the crest of the cut slope. Both rocks landed in the ditch and did not roll onto the road.
- It was recommended that the accumulated rockfall debris be cleaned out from the ditch by the spring of 2006 and that a follow-up site inspection be performed by a geotechnical engineer during 2006 in order to estimate if further measures (such as draped netting/mesh) would be warranted to further manage the rockfall risk at this site.

The June 2009 inspection was recommended to AT as a follow-up to the 2005 inspection, due to the recommended Risk Level of 30 being relatively high amongst the other Southern Region sites within AT's GRMP.

SITE OBSERVATIONS

Key observations from the June 2009 inspection were as follows:

- Overall, there was little to no change in the appearance of the cut slope since the 2005 inspection. The distribution and accumulation of rockfall debris along the ditch was similar to that noted in 2005, including a large debris cone below a chute eroded along a weak bed exposed in the cut slope. Photo 1 shows a general view of the cut slope with the location of the large debris cone highlighted. Photo 2 shows a closer view of the eroded chute and debris cone.
- When compared with the photos from the 2005 inspection, the June 2009 debris cone appeared to be slightly larger than in 2005. However, it is not known how much time was required for the June 2009 debris cone to accumulate, how many times since 2005 the rockfall debris from the ditch had been cleaned out, or what volume of rockfall debris had been removed since 2005.
- Aside from the debris cone, there was gravel to cobble sized rockfall debris scattered throughout the ditch and up to the north edge of the pavement (see Photo 3).
- A boulder was present near the crest of the cut slope as shown in Photo 4. It appeared that if this boulder was essentially perched on the slope, and if it were to come loose in the future it could roll onto the highway and/or impact the ditch and break up, with debris spilling onto the highway. Such a rockfall is not necessarily imminent, but illustrates the potential hazard at this site.

ASSESSMENT

The ongoing rockfall appears to pose relatively little risk to the highway, given that there was limited to no evidence of debris spilling onto the highway despite the ditch being relatively undersized. However, there remains a hazard of some rockfall debris, and possibly boulder-sized rocks such as the one shown in Photo 4, reaching the highway in the future.

RISK LEVEL

The recommended Risk Level for this site, based on AT's rockfall geohazard risk matrix, is unchanged from the 2005 site inspection and is summarized as follows:

- Probability Factor of 15 based on the appearance of the slope and debris that suggests that there is ongoing rockfall at this site.
- Consequence Factor of 2 because if the typically gravel to cobble sized rockfall debris were to spill onto the pavement, it could be removed by maintenance crews by hand or with shovels without road closure. A higher Consequence Factor would be applicable to the possible, but less likely, rockfall of a boulder from near the crest of the slope. However, the Consequence Factor of 2 is likely conservative for the typical case of rockfalls being entirely contained by the ditch without any debris spilling onto the highway.

Therefore, the recommended Risk Level for this site is 30, which is unchanged from the 2005 assessment.

RECOMMENDATIONS

Maintenance and Short Term Measures

The accumulated rockfall debris should be cleaned out from the ditch in order to restore the ditch to near-maximum capacity, and in future years the debris should be cleaned out as required in order to maintain the ditch reasonably close to full capacity. The rate of rockfall debris accumulation at this site is not clear based on the 2005 and 2009 inspections only, therefore the optimum frequency and timing for ditch cleaning is not known but is likely in the order of once every one to two years.

Long Term Measures

The annual site inspections by AT and AMEC personnel should be discontinued. Future inspections can be performed if AT personnel or the maintenance contractor report significant rockfall or changes to the site conditions.

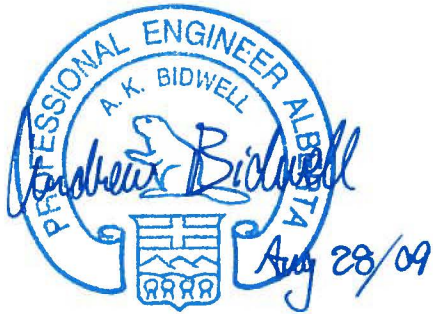
CLOSURE

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 Earth & Environmental, a division of AMEC 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 Earth & Environmental,
a division of AMEC Americas Limited**



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Associate Geological Engineer

APEGGA Permit to Practice No. P-04546

Reviewed by:

Pete Barlow, M.Sc., P.Eng.
Principal Geotechnical Engineer

Attachments: Photos 1 to 4



Photo 1 (top) – June 2009

Facing across the highway towards the cut slope. Overall, little to no change in the cut slope appearance since the 2005 inspection. The talus cone of accumulated rockfall debris below the central portion of the cut slope was slightly larger than observed during 2005. It is not known how many times the rockfall debris in the ditch was cleaned out between the 2005 and 2009 inspections, nor how long it has taken for the debris cone visible in June 2009 to accumulate.



Photo 2 (bottom) – June 2009

Closer view of the debris cone below the eroded chute in the central portion of the cut slope.



Photo 3 (top) – June 2009
Facing eastbound along the north ditch, showing the accumulation of rockfall debris along the ditch.



Photo 4 (bottom) – June 2009
Another view of the cut slope. Note the boulder perched near the crest of the slope. If this boulder eventually comes loose from the slope it may roll onto the highway and/or break up upon impacting the ditch with debris spilling onto the highway.