

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 40, Barrier Bluffs Rock Slope
June 2009 Inspection Report**

This letter documents the June 2009 site inspection of the Barrier Bluffs rock slope site on Highway 40, along the east shore of Barrier Lake where the Highway 40 alignment is across the lowermost slopes of Mount Baldy.

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 of AMEC in the company of 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 is a hazard of rockfall debris from the upper rock slope rolling down the unvegetated colluvium slope and impacting upon the highway. Photo 1, attached, illustrates the relative position of the rock slope, colluvium slope and Highway 40.
- It is judged that the essentially all rockfalls from the slope above the highway will come to rest on the slope or be contained within the large ditch between the toe of the colluvium slope and the highway. However, the rockfall hazard to the highway cannot be entirely ruled out.

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.

The June 2009 inspection was recommended to AT as a follow-up to the 2005 inspection, in order to check for additional rockfall debris that had rolled out beyond the toe of the colluvium slope since the 2005 inspection.

SITE OBSERVATIONS

The site conditions appeared unchanged since the 2005 inspection. The numerous large boulders along and slightly out from the toe of the colluvium slope were still present, but it did not appear that there were any new boulders that had rolled out beyond the toe of the slope since the 2005 inspection. Photos 2 and 3 show the debris along the toe of the slope at the time of the June 2009 inspection.

ASSESSMENT

The assessment of the potential rockfall hazard at this site is unchanged from the 2005 inspection. However, the apparent lack of additional boulders rolling beyond the toe of the colluvium slope since the 2005 inspection provides some assurance that the risk of boulder-sized rockfall debris rolling onto the highway is slightly less than assessed based solely on the 2005 inspection.

RISK LEVEL

AMEC recommends the following Risk Level for this site based on AT's rockfall risk matrix:

- Probability Factor of 4, which is mid-way between the values of 3 corresponding to "inactive, fall occurrence improbable" and 5 corresponding to "remote probability of fall occurrence". This is a reduction from the value of 6 recommended after the 2005 inspection.
- Consequence Factor of 3, corresponding to rockfall onto the road that could damage a vehicle and rocks bouncing or rolling onto the road surface but not with a trajectory through the windows or windshield of a passing vehicle. This is a reduction from the value of 4 recommended after the 2005 inspection.

Therefore, the recommended Risk Level is 12. This is a reduction from the value of 24 recommended after the 2005 inspection,.

As noted in the report on the 2005 inspection, the Consequence Factor is likely closer to 1 ("rockfall contained by ditch") but there is not a definitive basis to make that conclusion due to the visual evidence of at least two large boulders rolling out beyond the toe of the colluvium slope and a preliminary estimation of the maximum rockfall reach from the application of the

minimum “rockfall shadow” angle of $27.5^{\circ 2}$ to the estimated slope profile. This could be clarified, and the Risk Level likely lowered, by plotting the “rockfall shadow” on a surveyed slope profile. Please refer to the report on the 2005 inspection for further details.

RECOMMENDATIONS

No further work is recommended for this site.

The occasional site inspections by AT and AMEC personnel as part of AT’s GRMP should be discontinued unless AT or maintenance contractor personnel report rockfall resulting in more boulders rolling out beyond the toe of the colluvium slope.

² Evans, S.G., Hungr, O. 1993. The assessment of rockfall hazard at the base of talus slopes. Canadian Geotechnical Journal, 30, 620-636.

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**

Andrew Bidwell, M.Eng., P.Eng.
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 3

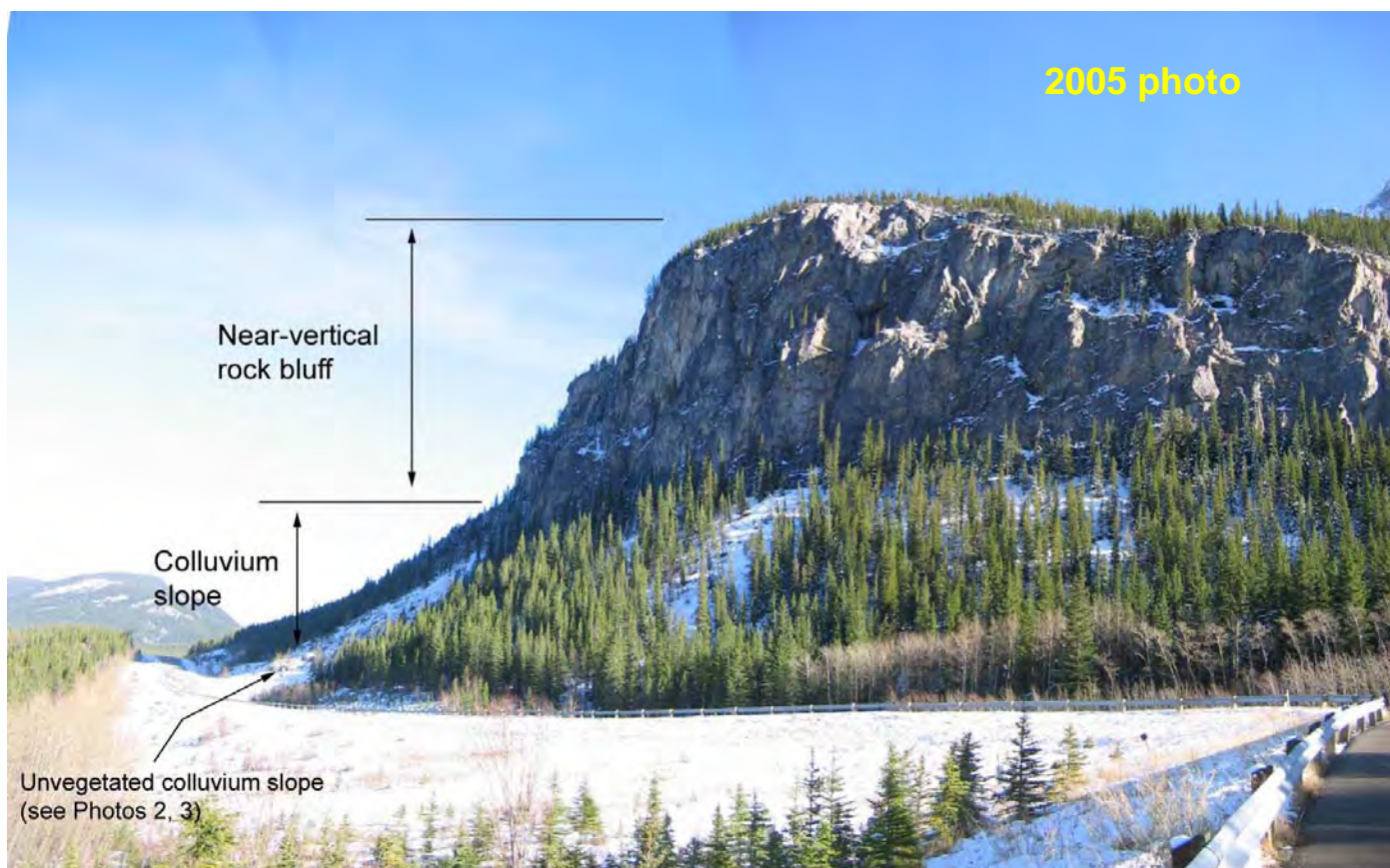


Photo 1 – 2005

General view of the Barrier Bluffs site from the 2005 inspection, illustrating the relative position of the slope (potential rockfall source area) and Highway 40.



Photo 2 (top) – June 2009

Ditch along the toe of the unvegetated colluvium slope. Note the large boulders that have rolled slightly beyond the toe of the cut slope. However, no new boulders were evident in comparison to the photos from the 2005 inspection.



Photo 3 (bottom) – June 2009

Closer view of the toe of the colluvium slope, as seen from the edge of the highway.