



August 20, 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
Site S10(A) – Archery Range, Highway 762:02
2009 Annual Inspection Report**

This letter documents the 2009 annual site inspection of Site S10(A) – Archery Range on Highway 762:02, approximately 12 km southbound of the junction between Highway 762 and Highway 22.

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 12, 2009 by Mr. Andrew Bidwell, P.Eng., and Mr. Bryan Bale, EIT of AMEC in the company of Mr. Ross Dickson and Mr. Neil Kjelland, P.Eng. of AT.

BACKGROUND

There is limited background information available regarding this site prior to the start of annual assessments by AT and AMEC personnel in the spring of 2000. It is understood that there was a failure at this site (either a failure of the road subgrade and/or slope instability in the underlying native soil and the slope face downslope (west) of the road) in the mid-1990's. This instability required temporary closure of at least the southbound lane of the road prior to repair. There are no details currently available on the associated investigation and repair aside from that the road was reconstructed with granular fill.

Settlement and cracking of an approximately 30 m long segment of the southbound lane at this site has been ongoing since approximately 2000. The semi-circular pattern of the cracking suggests a slump failure down towards the west. Asphalt overlays have been placed at this site at least annually since 2002.

AMEC and AT personnel have performed annual inspections of this site since 2000. The following site investigation, monitoring and assessment work has also been performed:

- Drilling a series of boreholes with the installation of two slope inclinometers (SI's) and two pneumatic piezometers in March 2007¹. The data from these boreholes and instrumentation monitoring up to early 2008 was used to develop a list of repair options and consider the advantages and disadvantages of each².
- A third SI was installed adjacent to the toe of the road embankment slope west of the highway in early 2009 in order to further define the landslide movement surface geometry and provide a basis to select the most appropriate repair measure for this site³. This SI was read in February, April and May 2009.

SITE OBSERVATIONS

Key observations from the June 2009 inspection were as follows:

- There was minor cracking in the current asphalt overlay at the site. The extent and pattern of the cracking was similar to that noted in previous inspections. Photo S10(A)-1 shows the road surface at the time of the June 2009 inspection.
- The AMEC personnel read SI 2009-1 at the toe of the road embankment slope (see Figures S10-1 and S10-2 for the location). The data showed continued movement around 4 to 5 m depth (988 to 989 m elevation) since the previous reading in May 2009. See Figure S10-3 for an updated displacement vs. time plot for the ground movement zones in the SI's at this site.
- The toe thrust in the treed area a short distance further downslope from SI 2009-1 was still evident (Photo S10(A)-3, location also marked on Figure S10-1).

¹ AMEC report "Highway 762, Borehole Drilling And Instrumentation For S8 – Fisher Creek, S-Curve Site, S10 – Site A", submitted to AT on July 30, 2007, AMEC project number CG25260.

² AMEC report "Highway 762, Site S10(A) Archery Range Site, Assessment of Landslide Conditions and Repair Options", submitted to AT on March 25, 2008, AMEC project no. CG25260.

³ AMEC report "Site S10(A) – Hwy 762:02 – Archery Range, 2009 Geotechnical Investigation, Instrument Installations And Readings", submitted to AT on May 28, 2009, AMEC project number CG25305.

ASSESSMENT

The ongoing landslide movement below the southbound lane of the highway presents a significant, ongoing maintenance issue that has required one to two asphalt overlays per year for the last several years.

The data from the SI's installed in 2007 and 2009 have confirmed the depth of active ground movement below the southbound lane and around the toe of the road embankment slope. These movement zones along with the position of the cracking in the road surface and the toe bulge a short distance downslope of SI 2009-1 align along a rotational or possibly rotational/translational failure surface, as shown on the cross-section on Figure S10-2. A toe buttress would likely be a suitable repair method.

RISK LEVEL

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

- Probability Factor of 11 based on the ongoing movement measured in the SI's.
- Consequence Factor of 4 based on the potential for the southbound lane of the highway to be taken out of service if overlays to mitigate the ongoing settlement of the road surface are not applied promptly. This is also consistent with the damage reported from the mid-1990's failure at this site where at least one lane of the road was temporarily closed until repairs could be completed.

Therefore, the current recommended Risk Level for this site is 44, which is unchanged since the 2005 assessment.

RECOMMENDATIONS

Maintenance and Short Term Measures

- AT's maintenance contractor personnel should continue to patch and regrade the settlement in the southbound lane of the highway as necessary.

Long Term Measures

- The available SI data should be used to confirm a suitable repair method, likely a toe buttress, and proceed with the design and draft tender package preparation for the repair as per AMEC's proposed scope of work that was approved by AT earlier in 2009. A key factor for a toe buttress repair will be securing construction access to the affected

area outside of AT's right-of-way and landowner agreement to the construction of a buttress fill extending onto their property. AMEC will discuss this issue with AT while getting underway with the design work.

- The semi-annual readings of the functioning instruments should be continued.
- The annual site inspections should be continued.

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:

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Associate Geotechnical Engineer

Attachments: Figures S10-1 to S10-3
Photos S10(A)-1 to S10(A)-3