October 28, 2011

CG25352.200

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
2011 Annual Inspection Report

This letter documents the 2011 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 Environment and Infrastructure (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 20, 2011 by Mr. Bryan Bale, P.Eng., and Mr. Tyler Clay, E.I.T., of AMEC in the company of Mr. Ross Dickson, 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 except 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, and instrument monitoring findings, suggest a rotational slump failure towards the west. Asphalt overlays have been placed at this site at least annually since 2002.

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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 2007[1]. The data from these boreholes and instrumentation monitoring up to early 2008 were used to develop a list of repair options and consider the advantages and disadvantages of each[2].

- 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 site[3].

SITE OBSERVATIONS

A summary of the key observations from the June 2011 inspection is provided in the following bullets:

- There has been increased slide movement in 2011 as evidenced by the damage to the road surface. The condition of the road surface at the time of the June 2011 inspection was significantly worse than has been observed during past inspections. The cracks in the road surface have approximately 150 mm vertical displacement and 70 mm aperture. The arc-shaped pattern of cracking encompasses the entire southbound lane in the same pattern as noted during previous inspections. Please refer to Photo S10A-1.

- The repeated overlays across the damaged segment of the road have created a steep drop below the downslope edge of the road and there is currently no effective shoulder width in that area.

[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 assessment of the geohazard conditions at this site is unchanged from the previous annual inspections. In summary:

- 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.

- As discussed in previous reports, 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. The movement rates since 2007 have indicated episodic movement, likely corresponding to periods of peak precipitation or wetter than normal years.

AMEC has submitted a preliminary repair design report outlining several repair options and their associated costs, as well as a right-of-way plan showing the land required to undertake a repair. AMEC can finalize the repair design and prepare a draft tender package for the repair work upon AT's selection of a 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 and current active slide conditions.

- Consequence Factor of 5 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 55, which is the same as the 2010 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.

- Signs should be setup to reduce traffic speed for both north and south bound traffic when the road surface is damaged due to landslide movement.

- A guardrail or jersey barrier is required along the west edge of the road where the shoulder drops off steeply, according to AT's highway design requirements.

Long Term Measures

- A longer-term repair should be constructed at this site. AT should select one of the repair options presented in AMEC's January 2010 report[4] and authorize the final design and draft tender package preparation for the repair.

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

- The annual inspections of this site should be continued, as it is understood that this site will likely be repaired in the near future. The inspections will be useful to inspect the pre and post-repair conditions.

[4] AMEC Report "S10(A) – Hwy 762:02 – Archery Range, Recommended Repair Option", CG25305, January 28, 2010.

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 Environment & Infrastructure, 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 Environment & Infrastructure,
a division of AMEC Americas Limited

ORIGINAL SIGNED
OCTOBER 28, 2011

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Reviewed by:

APEGGA Permit to Practice No. P-04546

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Attachments: Figures S10-1 and S10-2
Photo S10(A)-1