

November 2012

CG25399

Alberta Transportation  
2<sup>nd</sup> Floor, 803 Manning Road NE  
Calgary, AB T2E 7M8

**Attention: Mr. Ross Dickson**

Dear Ross:

**Re: Southern Region Geohazard Assessment  
2012 Annual Inspection Report  
Site S10A: Highway 762:02, Archery Range**

This letter documents the 2012 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 fulfilment of the scope of work for the supply of geotechnical services for Alberta Transportation's (AT's) Southern Region (AT contract CON0013506).

The site inspection was performed by Georgina Griffin, P.Eng., Bryan Bale, P.Eng., and Tyler Clay, E.I.T., of AMEC; and Roger Skirrow, P.Eng., Ross Dickson, and Nathan Madigan, E.I.T. of AT during the 2012 Annual Tour.

## **1.0 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<sup>1</sup>. The data from these boreholes and instrumentation monitoring up to early 2008 was used to develop a list of potential repair options<sup>2</sup>.
- 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<sup>3</sup>.

## 2.0 SITE OBSERVATIONS

A summary of the key observations from the June 2012 inspection is as follows:

- An asphalt overlay was placed in late 2011 and extended through the entire site area.
- Subtle settlement was noted along the road surface, within the previously observed cracking pattern. There was also some minor cracking of the road shoulder. Refer to Photo S10A-1.
- There are no operational instruments at the site due to landslide damage and/or road construction work.
- 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.
- Stands for temporary traffic control lights are now setup at the site.

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<sup>1</sup> AMEC Earth & Environmental, 2007. *Highway 762, Borehole Drilling And Instrumentation For S8 – Fisher Creek, S-Curve Site, S10 – Site A*, Project Number CG25260, report submitted to AT July 30, 2007.

<sup>2</sup> AMEC Earth & Environmental, 2008. *Highway 762, Site S10(A) Archery Range Site, Assessment of Landslide Conditions and Repair Options*, Project Number CG25260, report submitted to AT March 25, 2008.

<sup>3</sup> AMEC Earth & Environmental, 2009. *Site S10(A) – Hwy 762:02 – Archery Range, 2009 Geotechnical Investigation, Instrument Installations and Readings*, Project Number CG25305, report submitted to AT May 28, 2009.

### **3.0 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.
- A large increment of movement occurred in 2011 causing significant dropdown and cracking within the southbound lane, and creating a safety hazard. The lane was temporarily closed and traffic controlled with signal lights while repairs were performed. Major increments of movement are expected to continue, especially during years with greater precipitation amounts or rapid snow-melt. Overlays will likely be required annually. In addition, increments of rapid slide movement, as observed in 2011, present a significant hazard to road users.
- 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 in 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 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.

### **4.0 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 8 based on the rapid increments of movement to date and the potential for similar movements in the future that could cause sudden and significant changes to the pavement elevation and/or crack development in this segment of the highway that pose consequence of extended road closure and/or severe injury or risk to life to motorists.

Therefore, the current recommended Risk Level for this site is 88, which is increased from the 2010 Risk Level assessment of 55.

## **5.0 RECOMMENDATIONS**

### **5.1 Maintenance and Short Term Measures**

- AT's maintenance contractor personnel should continue to patch and re-grade 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. "Slide Area" signs should also be posted year-round.
- 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.
- Replacement monitoring instruments are not recommended, as the slide mechanism is understood.

### **5.2 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<sup>4</sup> and authorize the final design and draft tender package preparation for the repair.
- The current annual inspections should be discontinued until a repair is carried out so post repair conditions can be monitored.

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<sup>4</sup> AMEC Earth & Environmental, 2010. *S10(A) – Hwy 762:02 – Archery Range, Recommended Repair Option*, Project Number CG25305, report submitted to AT January 28, 2010.

## 6.0 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 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 AND STAMPED NOVEMBER 19, 2012**

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Reviewed by:

APEGA Permit to Practice No. P-04546

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