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
S38 - Hwy 22:08 – Callum Creek Landslide Site
2011 Annual Inspection Report

This letter documents the 2011 annual site inspection of Site S38 - Callum Creek Landslide Site on Highway 22:08. The site is 11 km north of the Oldman River Bridge and approximately 10 km south of the Highway 22 and Highway 520 junction.

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. Neil Kjelland, P.Eng., and Mr. Ross Dickson of AT.

BACKGROUND

Minor tension cracking and settlement of the road surface at this site were first noted shortly after the 2005 construction of a pile wall repair at another site a few hundred metres northbound from this site. The first inspection of this site under AT's Geohazard Risk Management Program was performed on March 3, 2011, after a member of the public notified AT of worsening conditions at this site. At the time of the site inspection, the road surface was exhibiting arc-shaped cracking and settlement across an approximately 80 to 100 m long segment of the road, which was interpreted to represent a landslide headscarp. The northern end of the affected road segment had a series of tension cracks in the pavement, roughly parallel to the road direction, and possibly indicating future expansion of the arc-shaped cracking. The landsliding did not appear to be linked to the landslide that was the subject of the pile wall repair a short distance northbound from this site. The road at the site has two lanes and appears to be a cut/fill embankment along the natural valley slope. The slope below the road is at an angle of 17 to 18°.

Borehole drilling and instrument installations were recommended in order to investigate the subsurface conditions at this site and to provide a basis for the selection and design of a repair

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for this site. This work was performed in April 2011. Please refer to the Spring/Summer 2011 monitoring report[1] for further information regarding the installations and initial instrument readings.

SITE OBSERVATIONS

Key observations from the June 2011 inspection are summarized as follows:

- The road surface at the site had well developed, arc-shaped cracks, following a similar pattern as was observed during the March 2011 inspection. The cracking was most pronounced at the south end of the site, where the cracks had approximately 100 mm aperture and 300 mm vertical separation.

- The cracking extended from the east edge of the road surface at the south end of the site, to the white line at the west side of the site. The cracking to the north was subtle, but apparently indicated a landslide headscarp, 50 to 80 m long, and encompassing both lanes of the road. Please refer to Photos S38-1 to S38-3.

- The speed limit at the site had been reduced to 70 km/hr due to the uneven road surface.

- There have been multiple overlays and guardrail adjustments since the March 2011 inspection in an attempt to maintain a trafficable road surface and guardrail height.

- The slope below the road was traversed. There were no visible signs of a toe bulge or other features that may have indicated the lower extent of the landsliding.

While on site, AT requested that AMEC obtain an additional set of instrument readings prior to the planned Fall 2011 readings. The instruments were read again on July 14, 2011 and confirmed landslide movement at approximately 9 to 12 m depth below the west shoulder of the road. Of note, as of the July 14, 2011 readings, one of the SI's was found to be pinched off and could no longer be read below 9.4 m from the ground surface because of the accumulated landslide movement since installation in March 2011. Please refer to AMEC's email (copy attached) regarding the July 2011 site conditions sent to AT July 18, 2011 for additional information regarding site observations, instrument data, and recommendations for short and medium/long term actions to manage the risk to the road. It was also noted that the most practical and reliable repair for this site would likely be a pile wall, and that the pros/cons and cost/benefit of this and other repair options could be assessed with the data from the site investigation and instrument monitoring.

[1] AMEC report, "S38 - Hwy 22:08 – Callum Creek Landslide Site 2011 Geotechnical Investigation, Instrument Installations and Initial Readings", submitted to Alberta Transportation, June 2011, AMEC File No. CG25359

ASSESSMENT

This site has active and significant landslide movement, based on the continued settlement and cracking visible in the road surface through recent overlay patches and the instrument data. The depth of the landslide movement corresponds to a layer of higher plasticity clay with possible slickensides that was identified during the instrument installation drilling. The current borehole and instrument data in conjunction with the approximate slope cross-section indicates that the landslide movement may encompass the entire slope below the highway. The toe of the landslide movement is judged to be around or a short distance upslope of the overall slope toe, indicating instability that potentially extends downslope of the fenceline (i.e. outside of the right-of-way). The data from the vibrating wire piezometers indicates that there is water in the upper soil layers (measured at 6 m depth), to within 1.5 m below ground surface. The water pressure is likely a contributing factor to the slope instability.

There is a possibility that additional or accelerated landslide movement could lead to the loss of one or potentially both lanes of the highway. The construction of a temporary detour lane in the upslope road ditch would likely be required.

RISK LEVEL

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

- Probability Factor of 13 based on the active movement, possibly with an increasing trend in movement rates based upon the monitoring to date.

- Consequence Factor of 7 given that the landslide encompasses both lanes of the highway and failure would result in the closure of the road, possibly with a single detour lane in the upslope ditch with alternating one way traffic under a reduced speed limit and timed traffic lights.

Therefore, the current recommended Risk Level for this site is 91.

RECOMMENDATIONS

Maintenance and Short Term Measures

- The road should be maintained by placement of paving overlays and/or milling down the road surface to maintain a trafficable surface through the slide area without accumulating an excessive load from repeated overlays (i.e. avoid loading the upper portion of the landslide area). The adjacent guardrail should be adjusted as necessary to maintain a useful guardrail height through the settled area.

- Signage should be maintained (e.g. “Bump Ahead”, “Slide Area”) along with reduced speed limit as appropriate for the road surface conditions.

Long Term Measures

- Select and design a repair measure for this site based on the information from the borehole drilling and instrument installations. The most practical and reliable repair measure for this site would likely be a pile wall similar to the one constructed at the other landslide area a short distance northbound from this site. Drainage measures (e.g. horizontal drains and/or impermeable lining of the upslope road ditch to reduce water infiltration into the slope) may also be beneficial. The merits of these and other repair options could be assessed with a slope stability analysis. AMEC could provide a cost estimate to perform a repair design and draft tender package preparation at AT’s request.

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

Tyler Clay, B.A.Sc., E.I.T.
Geological Engineer

Bryan Bale, M.Sc., P.Eng.
Geotechnical Engineer

APEGGA Permit to Practice No. P-04546

Reviewed by:

Andrew Bidwell, M.Eng., P.Eng.
Associate Geological Engineer

Attachments: Site Plan
Cross Section
Photos
July 18, 2011 Email