



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 S31 – “Mystery Culvert”, Highway 762:02
2011 Annual Inspection Report**

This letter documents the 2011 annual site inspection of Site S31 – “Mystery Culvert” along Highway 762:02, south of Bragg Creek, AB, approximately 4.1 km southbound from the junction between Highway 22 and Highway 762, and roughly 50 to 100 m southbound from the 184 Avenue West turnoff from Highway 762.

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

BACKGROUND

The S31 – Mystery Culvert site was added to the Southern Region Geohazard Assessment Program in 2008 after AT personnel noted ongoing settlement and cracking of the road surface. Documentation in AT’s files refers to a failure in the road at this site in 1987, which was repaired by rebuilding the upper 1.5 m of the road embankment with compacted pit run and installing a trench drain in the upslope ditch. The trench drain was reportedly capped with clay. Please refer to the 2009 inspection report¹ for more details on the site history.

¹ AMEC report “Southern Region Geohazard Assessment Program, Site S31 – “Mystery Culvert”, Highway 762:02, 2009 Annual Inspection Report”, AMEC project number CG25309.B, submitted to AT August 20, 2009.

SITE OBSERVATIONS

Key observations from the June 2011 inspection were as follows:

- An asphalt overlay had been placed across the site recently (Spring 2011), and cracking with approximately 100 mm of down-drop and 50 mm aperture had re-formed through the new overlay (refer to Photo S31-1 and S31-2). The cracking followed a similar pattern as had been observed during past inspections, and was centered over a 600 mm diameter culvert outlet on the slope face below the road. It appeared that the severity of the cracking and the magnitude of settlement were greater than had been observed in the past. Figure 1 illustrates the condition of the site as of June, 2011.
- The upslope ditch was wet and draining slowly to the south due to minimal ditch grade (refer to Photo S31-3). As noted in previous inspections, the culvert inlet was not visible in the upslope ditch and appeared to be buried, and may be connected to an interceptor drainage trench in the south ditch. There was no water discharging from the culvert outlet on slope face to the west of the road.
- The highway embankment slope was observed to be wet at approximately 2 m below the road surface from apparent groundwater seepage. The seepage was above the elevation of the culvert outlet.
- Another area with cracks in the asphalt road surface was noted approximately 500 m to the south of the site. This new site had very similar damage at the road surface, and similar overall site topography as the S31 site, and appears to be a new landslide due to a similar failure mechanism. AT indicated that they will request that AMEC perform a call-out inspection in the future to properly document the site conditions. Figure 2 presents a site survey of this new site, performed in July 2011, at AT's request in advance of potential repair work.
- The cut slope east of the road appeared to be in the same conditions as was observed during the 2009 inspection, with no signs of significant instability or erosion.

AMEC installed a Slope Inclinator (SI) along the downslope shoulder of the road at this site in late June 2009, as per AT's request after the increasing damage to the road surface was noted earlier in 2009. The soil conditions at the SI installation consisted of approximately 3.5 m of clayey fill atop an organic/clay till layer (native ground surface), underlain by extremely weathered shale bedrock. The SI was read last in Spring 2010, and the 2009-2010 data has shown movement in the organic/clay till soil at 3.8 m below the road surface.

ASSESSMENT

The cracking and settlement of the road surface is attributed to relatively shallow landslide movement, as detected by the SI. The landslide movement appears to be due to the low quality fill material used and the presence of the weak native organic/clay till layer that was not stripped prior to construction. Poor drainage along the upslope road ditch (near-standing water due to very low ditch gradient, and lack of drainage through the culvert) is likely also a destabilizing factor.

The damage to the road surface appears to be worsening in recent years, possibly due to the soil embankment becoming weaker due to ongoing slide movement or weathering, or due to wetter than usual weather in recent years. Sufficient information is available to design an excavation/replacement type repair of the road embankment. The instability and settlement in the road embankment does not appear to extend into the backslope.

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 observed active movement with increasing rate of movement, based on observations since 2008.
- Consequence Factor of 2 because the damage to the road surface up to this time has been manageable as a maintenance issue; however, there is possibility that accelerated movement may take the west lane out of service pending backfilling and placement of an additional overlay.

Therefore, the recommended Risk Level is 22, which is an increase from the value of 7 recommended after the 2009 inspection.

RECOMMENDATIONS

Maintenance and Short Term Measures

- AT’s maintenance contractor should continue to crack-seal and apply patches/overlays as required to maintain a trafficable running surface.

Investigation and Long Term Measures

- AMEC has recommended an excavation/replacement type repair be applied at the site, and sufficient information is available to design the repair. A survey of the site was

obtained at AT's request in advance of anticipated repair work in Summer 2011..If requested, AMEC could submit a proposal for the repair design and draft tender package preparation for this work.

- The repair work should include rebuilding the road subgrade with free draining fill to below the depth of slide movement, as well as incorporate improved drainage measures such as trench drains, blanket drains, and culverts.
- The annual site inspections by AT and AMEC personnel should be continued in 2012. The decision on whether or not further annual inspections are necessary can be based on observations from the 2012 site inspection.

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 S31-1 and S31-2
Photos S31-1 to S31-3