



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 S31 – “Mystery Culvert”, Highway 762:02
2009 Annual Inspection Report**

This letter documents the 2009 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 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 of AMEC in the company of Mr. Ross Dickson and Mr. Neil Kjelland, P.Eng., of AT.

BACKGROUND

The June 2009 site inspection by AT and AMEC personnel was the first follow-up inspection of this site under the Southern Region Geohazard Assessment Program since the site was added to the inspection list in 2008 after AT personnel had noted ongoing settlement and cracking of the road surface. Documentation in AT’s file from 1987 refers to a failure in the road. The 1987 failure was repaired by rebuilding the upper 1.5 m of the road 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 2008 inspection report for more details on the site history¹.

¹ AMEC report “Southern Region Geohazard Assessment Program, Site S31 – “Mystery Culvert”, Highway 762:02, 2008 Annual Inspection Report”, AMEC project number CG25277.B, submitted to AT on September 8, 2008.

SITE OBSERVATIONS

Key observations from the June 2009 inspection were as follows:

- Multiple overlays from previous years remained visible along an approximately 70 to 90 m long segment of the highway and roughly centered around a 600 mm diameter culvert outlet in the slope face below the road. The attached site plan shows the approximate extent of the overlays relative to the culvert outlet, and they are also visible in Photo S31-1. It did not appear that any overlays had been placed since the June 2008 inspection, however the site was marked for another overlay with paint on the road.
- The cracking on the road surface was considerably worse than was observed during the 2008 inspection, with the cracking now forming a continuous arc across the west lane. The cracks had a maximum aperture of 20 to 30 mm and some minor dropdown. The cracking followed the same pattern noted in 2008. Refer to Photos S31-2 and S31-3.
- The culvert outlet visible on the embankment slope face below the highway had negligible flow at the time of the inspection, however it appeared that the culvert had recently been carrying water. The culvert inlet was not visible in the upslope ditch (same condition as during the 2008 inspection). Refer to Photo S31-4.
- The upslope ditch above the site was wet, with water ponding in tire tracks, as shown in Photo S31-5.
- The slopes adjacent to the road appeared to be in the same conditions as was observed during the 2008 inspection. A cross-section of the site is attached.

AMEC installed an 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. Soil conditions included fill atop an organic layer, underlain by weathered bedrock. Details of this installation will be reported following the initial readings of the instrument.

ASSESSMENT

Overall, the assessment of this site has not changed since the 2008 inspection. In summary:

- The multiple overlays and pattern of visible cracking in the road surface suggest that there is ongoing settlement and possibly rotational landsliding in the road fill embankment and roughly centered around the culvert. The 1987 assessment documented in AT's files – that native organic and compressible soils underlying the embankment and groundwater seepage into and through the embankment are the driving forces for the settlement and/or landsliding – remains valid. The apparent

instability and settlement in the road embankment does not appear to extend into the backslope.

- It appears that the damage to the road surface has been easily manageable as a maintenance issue in recent years. It is possible that the drainage measures installed in 1987 are becoming less effective over time, resulting in increased cracking and settlement of the road surface in recent years.

The SI that was installed at this site in late June 2009 is intended to confirm the depth of movement that is causing the ongoing damage to the road surface. The data from this borehole and SI could be used as a basis to select and design appropriate repair work. and will provide a basis for possible repair work.

RISK LEVEL

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

- Probability Factor of 7 based on the perceptibly active movement based on the worsened condition from the 2008 inspection. This is an increase from the value of 5 recommended in 2008 based on the continued cracking in the road.
- Consequence Factor of 1 because it appears that the damage to the road surface is easily manageable as a maintenance issue for the time being.

Therefore, the recommended Risk Level is 7. This is an increase from the 2008 recommendation, but it is judged that the Risk Level at this site is currently very low.

RECOMMENDATIONS

Maintenance and Short Term Measures

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

Investigation and Long Term Measures

- New trench drains could be installed to drain the upslope ditch to attempt to improve the drainage conditions that may have degraded since the 1987 repair. The consequence of not doing this would be ongoing maintenance, likely similar amounts as in the past 2 to 3 years. This would likely be a more reliable solution than attempting to locate, expose and clear the culvert inlet that may or may not be at depth within the 1987 trench drain.
- An additional culvert could be installed to drain the ponding water in the ditch and prevent this water from percolating into the road fill.
- The borehole drilled for the new SI installation noted organic layers between 2.3 to 3.6 m depth. It would be possible to excavate the road fill to below the organic layers and rebuild the road with granular fill, however this would significantly disrupt local traffic during the work.
- The annual site inspections by AT and AMEC personnel should be continued in 2010. The decision on whether or not further annual inspections are necessary can be based on observations from the 2010 site inspection and from the new SI readings. Selection of a repair option should be delayed until the new SI readings indicate the depth of landslide movement.

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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APEGGA Permit to Practice No. P-04546

Reviewed by:

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Attachments: Site Plan
Cross-Section
Photos