

November 2012

CG25399

Alberta Transportation
2nd 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 S32: Highway 56, Bow River Upstream of Crowfoot Ferry**

This letter documents the 2012 annual site inspection of Site S32 – Bow River Upstream of Crowfoot Ferry, along Highway 56 and approximately 4.4 km southbound from the intersection between Highway 56 and Highway 1.

AMEC Environment & 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

This site was inspected for the first time under AT's Geohazard Risk Management Program in June 2008 after AT personnel noted active erosion and slope instability along the left (east) bank of the Bow River adjacent to the highway. Please refer to the report on the June 2008 inspection¹ for a description of the site layout and landslide conditions.

The assessment from the June 2009/2010 inspection recommended:

- A hydrotechnical review of the site to assess if the erosion induced instability along the east bank will continue or change in the near future.
- Continuation of the inspections in order to check the site conditions and the position of the landslide headscarp relative to the fenceline west of the highway.

¹ AMEC report "Southern Region Geohazard Assessment Program, Site S32 – Bow River Upstream Of Crowfoot Ferry, Highway 56, 2008 Annual Inspection Report", submitted to AT on September 8, 2008, AT consulting services agreement no. CE061/08, AMEC project no. CG25277.B.

2.0 SITE OBSERVATIONS

Key observations from the June 2012 inspection were as follows:

- Bank retrogression at the south ferry guide wire support tower appeared to be unchanged from the last inspection report (refer to Photo S32-1). Some fresh retrogression was noted a short distance upslope of the crossing and approximately 3 m of retrogression was observed just south of the ferry sign (refer to Photo S32-2).
- Slump blocks have continued to develop and slide down the slope at the main slide area along the left (east) bank of the river since the June 2010 inspection. Photo S32-3 shows a general view of the landslide area, and Figures S32-1 and S32-2 present plan views of the site area. The minimum offset between the scarp of the landsliding and the fence line along the west side of the road was approximately 1.7 m, which is the same as was measured in 2010. The slide remains active but no significant retrogression has occurred towards the road.

3.0 ASSESSMENT

The site conditions have not changed significantly since the June 2010 inspection. The landsliding adjacent to the highway continues but without significant retrogression. The bank between the main slide area and the ferry ramp has retrogressed at some locations. The banks in the area of the ferry ramp appear unchanged.

Retrogression of the scarp at the main slide area, as well as the banks between the slide area and the ferry crossing, is expected to continue. The over-steepened upper portion of the landslide area will retrogress back to a 15 to 20° inclination similar to the existing slope in the lower portion of the landslide area. An approximately 50 to 70 m long segment of the highway may become directly undermined by the landsliding. The risk of this occurring over the short term is judged to be low, and bi-annual inspections should provide sufficient warning.

The landslide risk to the highway could be mitigated with one of the strategies discussed in the 2008 annual inspection report. Erosion protection along the east bank or relocation of the highway are likely the most applicable options. Further study would be required.

Although bank erosion towards near the ferry ramp has not been observed, it will likely occur and could damage the ferry infrastructure. A hydrotechnical study would be required to determine this risk.

4.0 RISK LEVEL

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

- Probability Factor of 6 based on the active but slow rate of slope crest retrogression towards the highway.
- Consequence Factor of 4 to account for the potential for at least a partial closure of the existing road could be required if an increment of landslide movement in the near-future retrogresses eastwards through the fenceline and undermines the west shoulder of the road.

Therefore, the recommended Risk Level is 24, which remains unchanged from the 2010 assessment.

5.0 RECOMMENDATIONS

The hydrotechnical review of this site recommended in the previous annual inspection reports should be performed in order to clarify the risk level for this site. The scope of a hydrotechnical review would include:

- A review of site airphotos, available river flow data and the information from the June 2008 inspection should be performed by a hydrotechnical engineer.
- Assess if the current pattern and intensity of erosion along the east bank will continue or change in the near future, and from that interpret whether or not the active landsliding will continue.
- Such a review should also provide a basis to confirm the length of the highway segment that should be shifted eastward, if necessary.
- Such a review could also consider potential long-term issues at the ferry crossing downstream of the landslide area due to bank erosion/channel shifting.

AMEC can provide a proposed scope and cost estimate for this task to AT upon request.

If the hydrotechnical review confirms that the landsliding will continue then AT should review the concept of an eastwards relocation of the highway by 10 to 15 m. The cost and issues associated with right-of-way acquisition vs. bank protection and slope stabilization measures to preserve the existing highway could then be considered well in advance of needing to do either.

AMEC also recommends that a site survey of the ferry ramp and landslide crests be performed to allow accurate measurements of changed site conditions in the future. AMEC will provide a scope and cost estimate for the site survey.



The site inspections should be performed bi-annually.

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 20, 2012

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Reviewed by:

APEGA Permit to Practice No. P-04546

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