November 2013

CG25399

Alberta Transportation
2nd Floor, 803 Manning Road NE
Calgary, AB T2E 7M8

Attention: Mr. Ross Dickson

Dear Ross:

Re: Southern Region Geohazard Assessment
2013 Annual Inspection Report
Site S39: Highway 3, West Brocket Hill Slide

This report documents the 2013 annual site inspection of the West Brocket Hill Slide site, on Highway 3, approximately 1 km westbound along Highway 3 from the junction between Highway 3 and Range Road 284 at Brocket, AB, and approximately 30 km westbound from the junction between Highway 3 and Highway 2 near Fort Macleod, AB.

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 Bryan Bale P.Eng., Hui Wang, P.Eng, and Tyler Clay, E.I.T., of AMEC; and Roger Skirrow, P.Eng., and Ross Dickson, of AT during the 2013 Annual Tour.

1.0 SUMMARY

The site conditions remained similar to the June 2012 inspections. The landslide encroaching onto the road surface is continuing and will likely undermine the west-bound lane in the near future if mitigations are not completed. A proposal has already been submitted by AMEC to conduct a geotechnical investigation to determine suitable mitigation options. The site should be monitored in 2014.

2.0 BACKGROUND

This site was inspected in 2011 as part of AT's Geohazard Risk Management Program following the initial call-out inspection in June 2011. Please refer to the report on the June 1, 2011 inspection[1] and the 2011 annual inspection report[2] for further details.

[1] AMEC Environment & Infrastructure, *Highway 3 – West Brocket Hill - June 1, 2011 Site Inspection*, CG25352.400, June 9, 2011.

[2] AMEC Environment & Infrastructure, *Southern Region Geohazard Assessment Program, West Brocket Hill Slide, Highway 3*, 2011 Annual Inspection Report, CG25352.200, October 28, 2011.

At the site location, Highway 3 is a paved, three-lane undivided roadway with two eastbound lanes ascending towards Brocket, AB and a single westbound lane descending towards a bridge that crosses Pincher Creek approximately 1 km westbound from the site. The highway is oriented roughly east/west, with the south slope of the Oldman River valley immediately north/downslope of the highway.

3.0 SITE OBSERVATIONS

Key observations of the site conditions from the May 28, 2013 site inspection are as follows:

- Overall, the landslide conditions and risk to the highway had not changed significantly since the last annual inspection on June 20, 2012.

- Cracks noted previously in the pavement surface approximately 1 m from the guardrail at the north side of the highway were in approximately the same condition as was observed in 2012. The extent of the cracking had appeared similar to the previous inspection. The cracks within the westbound lane which had been previously sealed had re-opened. The cracks in the shoulder had approximately 50 mm vertical displacement and 50 mm aperture. A slight vertical deflection of the guardrail was also noted in this area. Refer to Photos S39-1 and S39-2 for a comparison from the 2011 inspection.

- The asphalt berm, constructed on the north edge of the highway shoulder to prevent runoff from flowing into the headscarp area, was no longer effective due to settlement of the road surface. Water was observed to be ponding at the road edge.

- The soil was noted to be wet on the lower half of the slide mass below the ground surface. The headscarp appeared to be active in the last 5 years but was not very active as shrubs and grass had overgrown on the feature.

- The condition of the landslide on the slope below the highway was relatively unchanged from the 2011 inspection conditions. Refer to Photos S39-3 and S39-4.

The offset from the main landslide headscarp to the north road shoulder was measured from the “Do Not Pass” sign to the west as a starting chainage point and is summarized below for future measurement and reference:

TABLE 1: OFFSET FROM MAIN HEADSCARP TO NORTH ROAD SHOULDER

Chainage (West from Sign) (m)	Offset (May 2013) (m)	Offset (June 2012) (m)
8	7.3 m	7.2 m
16	7.3 m	7.0
24	1.7 m	1.8
29	0 m (1.4 m wide crack)	0 m (1.2 m wide crack)
35	4.1 m	4.3 m
43	6.9 m	7.6 m

Please refer to the previous inspection reports for more details of the site conditions.

4.0 ASSESSMENT

The landsliding that is encroaching into the road surface at this site is naturally occurring in the valley slope below the highway. Surface runoff is a probable contributing factor in the slide development. Due to settlement, the asphalt berm constructed on the north road shoulder is ineffective for diverting surface runoff water from entering the headscarp near the top of the road. Settlement of the shoulder has resulted in water ponding and the berm may be overtopped.

It is judged that the landslide movement will continue in the future and that the westbound lane of the highway is at risk of becoming significantly undermined in the next several years. Without subsurface investigation of the site and landslide conditions, it is not clear if the overall headscarp of the landsliding will eventually retrogress into the eastbound lanes as well. It would be prudent to consider both the westbound and eastbound lanes as being at risk from the landsliding unless mitigative measures are applied.

5.0 RISK LEVEL

AMEC recommends the following Risk Level for this site, based on AT's general geohazard risk matrix:

- Probability Factor of 9, based on the active slide movement with a moderate steady or decreasing rate of movement.

- Consequence Factor of 4, reflecting the potential for closure of the westbound lane of the highway if the cracking and settlement along the north shoulder worsens.

Therefore, the recommended Risk Level is 36, which is unchanged from the 2012 Risk Level assessment, as the site conditions appear similar to the June 2012 tour. The Risk Level is expected to gradually increase in the future as the landsliding continues and the potential for undermining of the eastbound lanes increases. In the short term, the risk to the westbound lane

may be somewhat mitigated by the option to temporarily maintain two-way traffic using the two eastbound lanes.

6.0 RECOMMENDATIONS

6.1 Maintenance and Short Term Measures

- The maintenance contractor should seal the existing cracks and promptly seal any new cracks that form.

- The asphalt berm should be maintained as required in order to prevent runoff from the road surface from flowing onto the slope below the guardrail. This may include cleaning any build-up of sediment and road debris and maintaining a necessary gradient to prevent pooling.

- A geosynthetic reinforced wall system could be considered to provide temporary support of the road at the headscarp location.

AMEC has recommended a geotechnical investigation to determine potential repair options for the site. Please refer to the June 1, 2011 call-out report, and the May 8, 2013 proposal for geotechnical investigation[3]. More detailed recommendations on repair options can be provided after completing the geotechnical investigation and monitoring of the recommendation instrumentation.

[3] AMEC Earth & Environmental, *Proposal and Cost Estimate for Geotechnical Investigation, West Brocket Hill Slide, Highway 3*, Project No. CG25352.400, submitted to AT September 6, 2011.

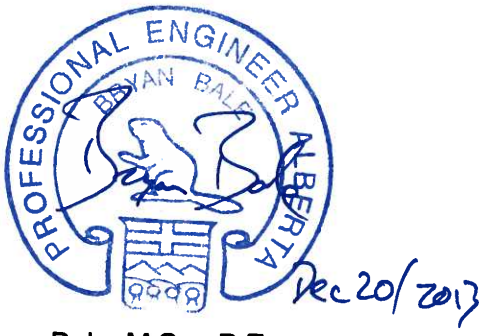
7.0 CLOSURE

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



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APEGA Permit to Practice No. P-04546

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