



October 28, 2011

CG25352.200

Alberta Transportation  
2<sup>nd</sup> Floor, 803 Manning Road NE  
Calgary, AB T2E 7M8

Attn: Mr. Ross Dickson

**Re: Southern Region Geohazard Assessment Program  
West Bocket Hill Slide, Highway 3  
2011 Annual Inspection Report**

This report documents the 2011 annual site inspection of the West Bocket Hill Slide site, on Highway 3, approximately 1 km westbound along Highway 3 from the junction between Highway 3 and Range Road 284 at Bocket, AB, and approximately 30 km westbound from the junction between Highway 3 and Highway 2 near Fort Macleod, AB.

AMEC Environment & 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 21, 2011 by Mr. Bryan Bale, P.Eng., Mr. Andrew Bidwell, 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 only previous inspection of this site under AT's Geohazard Risk Management Program was a call-out site inspection by AMEC on June 1, 2011. This call-out inspection was performed at the request of AT, after AT personnel reported cracking of the pavement at the site in the spring of 2011. Please refer to the report on the June 1, 2011 inspection<sup>1</sup> for further details.

At the site location, Highway 3 is a paved, three lane undivided roadway with two eastbound lanes ascending towards Bocket, 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

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<sup>1</sup> AMEC report "Highway 3 – West Bocket Hill - June 1, 2011 Site Inspection", project number CG25352.400, submitted to AT on June 9, 2011.

north/downslope of the highway. Please refer to Figure 1 for a site plan sketch showing the general layout and orientation of the site.

## **SITE OBSERVATIONS**

Key observations of the site conditions from the June 21, 2011 site inspection are as follows:

- Overall, the landslide conditions and risk to the highway had not changed significantly since the June 1, 2011 site inspection.
- Cracks were noted in the pavement surface approximately 1 m from the guardrail at the north side of the highway, and extending for approximately 12 m (refer to Figure S39-1). The position and extent of cracking were essentially unchanged from the June 1, 2011 call-out inspection.
- A large landslide was present in the valley slope below the highway at this location. The slide was well developed and appears to have been present for many years. Signs of recent (e.g. likely 2010 and 2011) slide activity were noted in the form of fresh soil exposed at scarps along the headscarp, flanks, and within the slide mass. The slide had likely been active within one to two months of the time of the inspection. Photos S39-2 to S39-5 illustrates the recent slide activity, and Photo S39-6 presents a view of the entire landslide. It appears that recent slide movement or headwards retrogression of the landslide has caused the cracking of the road surface. Figure S39-1 and S39-2 illustrate the key features of the landslide.
- The landsliding appeared to consist of a series of rotational failures (slumps) seated in the lower and middle portion of the valley slope and with headscarps extending upslope to the highway.
- The lower slide mass was wet, with seepage noted at the recent scarps.

Please refer to the report on the June 1, 2011 call-out site inspection for further details of the site conditions.

## **ASSESSMENT**

The landsliding that is beginning to damage the road surface at this site is naturally occurring in the valley slope below the highway. However, surface runoff from the paved road surface that has flowed into the upper portion of the overall landslide mass appears to have at least partially contributed towards recent landslide movements in the upper slope that are beginning to undermine the westbound lane of the highway.

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 one to two 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.

## **RISK LEVEL**

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

- Probability Factor of 10, based on the evidence of active movement in the spring of 2011, and possibly an increasing rate of movement since 2010.
- 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 40 (i.e.  $10 \times 4$ ). 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.

## **RECOMMENDATIONS**

### **Maintenance and Short Term Measures**

- The maintenance contractor should seal the existing cracks and promptly seal any new cracks that form.
- Construct an asphalt berm along the north edge of the pavement surface in order to prevent runoff from the road surface from flowing onto the slope below the guardrail. The asphalt berm should be used to direct surface runoff downhill along the road to the west, where it can be allowed to discharge onto the small upland area below the highway and above the valley slope crest which is offset further north from the highway in that area. This will be beneficial as a short term measure, but the surface runoff should not be permanently redirected in this way as it could begin to erode and destabilize the valley slope west of the current landslide area.

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 September 6, 2011

proposal for geotechnical investigation<sup>2</sup>. More detailed recommendations on repair options can be provided after completing the geotechnical investigation and monitoring of the recommendation instrumentation.

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<sup>2</sup> AMEC report, "Proposal and Cost Estimate for Geotechnical Investigation, West Brocket Hill Slide, Highway 3", submitted to AT on September 6, 2011, AMEC File No. CG25352.400.

## **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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APEGGA Permit to Practice No. P-04546

Reviewed by:

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Attachments: Figures S39-1 to S39-2  
Photos S39-1 to S39-6