



September 29, 2008

CG25277.B

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  
Site S2 – Priddis, Highway 22:14  
2008 Annual Inspection Report**

This letter documents the 2008 annual site inspection of Site S2 – Priddis, on Highway 22:14, approximately 11 km west of the Priddis turnoff from Highway 22 and approximately 10 km southeast of Bragg Creek, AB. This site is located on the west slope of the Priddis Creek valley where Highway 22 climbs westbound out of the valley. The slope below the highway is underlain by a landslide that is encroaching into the downslope (north) edge of the highway.

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 19, 2008 by Mr. Andrew Bidwell, P.Eng., and Mr. Bryan Bale, EIT of AMEC in the company of Mr. Ross Dickson and Mr. Roger Skirrow of AT.

## **BACKGROUND**

A general description of the geohazard conditions at this site along with the site geological setting and chronology of previous events, investigations, monitoring and repair work were provided in the Geotechnical File Review (Section A of binder) and summarized in previous annual inspection reports<sup>1</sup>.

This site has been monitored by AT and their consultants since the early 1990's. A pile wall was installed along the downslope (north) side of the highway in 1992 in order to stabilize the highway against ongoing landslide movement. No other repairs aside from ongoing maintenance (patching, crack sealing, overlays, raising guardrail) of the slide damaged area have been performed since that time.

---

<sup>1</sup> AMEC report "Southern Region Geohazard Assessment, Annual Assessment Report, 2007", project number CG25263, submitted to AT on November 6, 2007.

## **SITE OBSERVATIONS**

Key observations regarding changes in the site conditions since the 2007 inspection are summarized as follows:

- There were no significant changes in the visual appearance of the highway surface or the adjacent slope since the 2007 inspection.
- The settlement and cracking of the road surface along the downslope (north) shoulder of the highway is ongoing. Photos S2-1 to S2-3 show the damaged segment of the road surface. There were otherwise no significant cracks or downdrops noted in the highway surface adjacent to the landslide area. The open cracks and vertical settlement along the north shoulder were the order of 10's of millimetres visible at the time of the site inspection. As noted in previous assessments, the pattern and distribution of the cracking appears to delineate the existing pile wall (see Photos S2-2 and S2-3).
- The east flank of the landslide scarp, near and downslope of SI #4, remained visible with up to approximately 2 m of vertical displacement, however there were no open tension cracks or visible signs of recent or rapid displacement. Photo S2-4 shows a view of the east flank and its location is illustrated on the site plan.
- The groundwater pumps installed below the south shoulder of the highway were heard to switch on during the site inspection, and the discharge into the upslope ditch (flowing away from the site) was visible.

Also, the readings of the functioning instrumentation at this site in May 2008 showed that landslide movement is continuing in the slope below the highway, however the slope inclinometers installed along the north side of the highway and upslope of the existing pile wall have not shown any movement beneath the highway surface itself.

## **ASSESSMENT**

The ongoing landslide movement in the slope below the highway continues to cause significant cracking and settlement of the north edge of the road surface between the white line and the guardrail. In recent years the damage has been restricted to the portion of the road surface between the guardrail and the apparent location of the existing pile wall slightly upslope of the guardrail. This damage to the road surface has been treated as a maintenance issue for many years now, with numerous asphalt patches applied and the guardrail raised back up to the required height relative to the road surface.

The instrument data and visual observations of the site suggest that the landslide movement is not directly undermining the traffic lanes of the highway. It is inferred that the existing pile wall

is helping to stabilize the highway. However, as noted in previous reports, the degree to which the pile wall increases the Factor of Safety for the highway cannot be quantified because no documentation of the design basis or as-built details for the pile wall has been located during the file reviews to date for this site. The ability of the existing pile wall to provide sufficient support to the highway if the landsliding encroaching on the north side of the highway worsens is not known.

Also, as noted in previous reports, relatively few of the geotechnical instruments installed at this site are still functioning. As discussed on site, replacement slope inclinometers are not considered to be a high priority because it is judged that the landslide conditions at this site have been relatively well characterized and concept-level repair measures have already been determined. Ongoing data regarding the rate and magnitude of landslide movement would likely not provide significant additional insight to the landslide conditions nor bring forward more effective repair options. However, replacements for the non-functioning and/or questionable piezometers in the south shoulder of the highway are considered to be worthwhile because that would help to confirm that the groundwater pumps are working as intended and if additional drainage would be worthwhile.

## **RISK LEVEL**

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

- Probability Factor of 9 based on the ongoing slope movement at this site.
- Consequence Factor of 5 given that the design basis/capacity of the pile wall relative to the current landslide movement is unconfirmed and it is considered possible that a large increment of landslide movement could occur and closure of the westbound lane may be required (notwithstanding the existing pile wall).

Therefore, the current recommended Risk Level for this site is 45, which is unchanged since the 2002 assessment.

## **RECOMMENDATIONS**

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

- AT's maintenance contractor personnel should continue to patch and regrade the settlement along the north edge of the highway, including resetting the guardrail as necessary to maintain its elevation relative to the highway surface.
- Replacement piezometers should be installed adjacent to the existing piezometers on the south shoulder. Please refer to the text under "Investigation" for further details.
- The paved-over SI's #10 and AMEC BH#1 along the north edge of the road should be recovered, and the collars of the casing protectors over all of the functioning instruments along the north edge of the road should be extended and properly aligned to ensure future access to the instruments. Please refer to the instrument repair recommendations in the Spring 2008 monitoring report for this site for further details.

### **Long Term Measures**

- The semi-annual readings of the functioning instruments should be continued.
- The annual site inspections should be continued.

The following options have been discussed for longer term or more permanent repairs to the highway at this site:

- Shifting the highway upslope, at least enough to move the north guardrail to the upslope side of the existing pile wall and thereby having the ongoing cracking and settlement of the road surface outside of the guardrail. This will reduce the reliance on timely patching of the settlement and cracking area and the possibility (albeit low at present) that a vehicle travelling at highway speed could be damaged if it strayed onto the north shoulder and drove over the cracking and settlement area. It may be possible to do this without significant realignment of the adjacent segments of the highway, however this would need to be checked against the required road geometry.
- Retrofitting the existing pile wall with a waler beam, tied-back into the bedrock underlying the highway. AMEC recommends further work to investigate the possibility of retrofitting the pile wall with a waler beam and anchors. Please see the following section for further information on the recommended investigation work.

It is understood that this segment of Highway 22 may be twinned at some point in the future. If the highway is twinned, the new lanes would be constructed on the upslope side of the existing highway.

### **Investigation**

AMEC recommends the following investigation work for this site:

- Installation of new piezometers near the existing piezometers 34396, 34397, 34398, and 34399. The purpose of the new piezometers would be to replace the existing piezometers which are providing questionable data and provide monitoring of the piezometric pressures around the pumping well(s). As discussed on site, the new piezometers would be installed with flush-mounted casing protectors in order to protect them and provide for a long and reliable service life. The possibility of using vibrating wire piezometers with a temporary datalogger to provide continuous monitoring in order to attempt to observe short-term reaction to the pumping well(s) switching on and off was discussed on site during the inspection.
- In conjunction with the borehole drilling for piezometer installation, drilling two boreholes in the road in order to confirm the bedrock surface elevation and bedrock composition/characteristics in the area where tie-back anchors would be required for a waler beam added to the existing pile wall.

The ballpark cost to perform the recommended investigation work is \$20,000. AMEC will submit a proposed scope and estimated costs for this work to AT under separate cover.

## **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**

Andrew Bidwell, M.Eng., P.Eng.  
Associate Geological Engineer

APEGGA Permit to Practice No. P-04546

Reviewed by:

Pete Barlow, M.Sc., P.Eng.  
Principal Geotechnical Engineer

Attachments: Site Plan  
Photos