



October 14, 2010

CG25332.200

Alberta Transportation
2nd 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
2010 Annual Inspection Report**

This letter documents the 2010 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 21, 2010 by Mr. Bryan Bale, P.Eng., and Mr. Andrew Bidwell, P.Eng., of AMEC in the company of Mr. Ross Dickson, Mr. Neil Kjelland, P.Eng., and Mr. Roger Skirrow, P.Eng., 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 reports¹.

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

¹ AMEC report "Southern Region Geohazard Assessment, Annual Assessment Report, 2008", project number CG25277, submitted to AT on September 8, 2008.

maintenance (patching, crack sealing, overlays, raising guardrail) of the slide damaged area have been performed since that time.

SITE OBSERVATIONS

Key observations regarding changes in the site conditions since the 2009 inspection are summarized as follows, and illustrated on Figure 1:

- There were no significant changes in the visual appearance of the highway surface or the adjacent slope since the 2009 inspection.
- The settlement and cracking of the road surface along the downslope (north) shoulder of the highway, which had been patched in 2009, appeared to have redeveloped in the same pattern and extent as was observed in the past. This cracking had coincided with the pattern and distribution of the pile wall. Photos S2-1 and S2-2 show the road along the pile wall.
- The guardrail had settled along the area of cracking in the road surface described above and as shown in Photo S2-3. The extent and magnitude of guardrail settlement was similar to that noted in past years each time after the guardrail had been re-set by the maintenance contractor.
- 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. The location of the east flank is illustrated on the site plan, and appears in Photo S2-4.
- The groundwater pumps installed below the south shoulder of the highway were noted to be discharging into the south ditch during the inspection.

The instrumentation on the slope below the highway has shown active, ongoing landslide movement for many years. As of 2010 there is only one functioning slope inclinometer (SI) downslope of the highway and the existing pile wall – SI #4 which is outside of the landslide area. The SI's installed along the north/downslope shoulder of the highway and upslope of the existing pile wall continue to show no active movement beneath the highway surface itself. The settlement gauge that was recovered in 2009 indicates that settlement of the road fill has occurred since the initial readings in 2001, however the available data from 2001 to 2003, and since May 2010 does not show a clear settlement trend. The planned Fall 2010 and spring/fall 2011 readings should help to clarify the settlement conditions.

ASSESSMENT

The assessment of the hazard conditions at this site has not changed in recent years. In summary:

- 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 repeatedly raised and adjusted 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.
- Relatively few of the geotechnical instruments installed at this site are still functioning. As discussed during recent annual site inspections, replacement SI's 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 conceptual-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.

In addition, a geotechnical investigation was performed at this site in the spring of 2009 and new piezometers were installed in the upslope road shoulder to monitor the water pressure within the slope and to try to verify that the dewatering pumps remain operational. The paved-over instruments at BH #1 and SI #10 were also recovered at that time.

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.

Long Term Measures

Based upon on-site discussions with AT during the past few annual site inspections, the current path forward for geotechnical work at this site is as follows:

- The semi-annual readings of the functioning instruments should be continued.
- The annual site inspections should be continued in order to check for changes to the extent and magnitude of the settlement and damage to the road surface that may indicate that the landsliding is accelerating and the risk to the road is increasing. The visual inspections will also be useful to check for signs of the landsliding expanding beyond the area covered by the remaining instruments.

Also, the following options have been discussed for longer term 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 so that the ongoing settlement area will be outside of the westbound lane. 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 assessed with respect to the required road geometry. AMEC could perform this assessment upon request by AT.

- Retrofitting the existing pile wall with a waler beam, tied-back into the bedrock underlying the highway. This option has been discussed, but further assessment of whether or not it would be practical has been deferred until if and when it becomes necessary to assess additional repair work for this site.

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.



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**

ORIGINAL SIGNED
OCTOBER 14, 2010

Bryan Bale, M.Sc, P.Eng.
Geotechnical Engineer

APEGGA Permit to Practice No. P-04546

Reviewed by:

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

Attachments: Site Plan
Photos S2-1 to S2-4