

December 2013

CG25399

Alberta Transportation  
2<sup>nd</sup> 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 S2: Highway 22:14, Priddis**

This report documents the 2013 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, Alberta. 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 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 Bryan Bale, P.Eng., Hugh Wang, P.Eng., and Tyler Clay, E.I.T., of AMEC; and Roger Skirrow, P.Eng., and Ross Dickson of AT during the May 2013 Annual Tour.

## **1.0 SUMMARY**

The site condition is relatively unchanged from the 2012 inspection. The risk level is unchanged since the 2002 assessment. Cracking was observed in similar shape and extent from previous inspections. The maintenance contractor should continue to patch and regrade the damaged areas and maintain the guardrail height. Access to the instruments should be maintained and instrument maintenance is recommended. Long term options include shifting the highway upslope or retrofitting the existing pile wall. The semi-annual readings should continue and the site should be inspected next in 2014.

## **2.0 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

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

### 3.0 SITE OBSERVATIONS

Key observations regarding changes in the site conditions since the June 2012 inspection are summarized as follows, and illustrated on Figure 1 and Photos S2-1 to S2-4:

- Cracking was observed in the pavement along the edge of the guardrail (north road shoulder) in an arc pattern that was similar in shape and extent from previous inspections. There was up to approximately 50 mm of settlement around the areas affected by cracking. Refer to Photo S2-1.
- No deflection of the guardrail was apparent, and it appeared that the guardrail was replaced in 2012. Refer to Photo S2-2.
- No open tension cracks or signs of recent or rapid slope movement were visible throughout the landslide mass. Refer to Photo S2-3 and S2-4.
- The outlets of the groundwater pumps (installed below the south shoulder of the highway) had signs of previous flow and were observed to be actively working during the inspection.
- There were no other significant changes in the visual appearance of the highway surface or the adjacent slope since the 2012 inspection.

The instrumentation on the slope below the highway has shown active, ongoing landslide movement for many years. As of October 2013 there was only one functioning slope inclinometer (SI #4) downslope of the highway and the existing pile wall, and this SI is located outside of the landslide area. The SI in this area showed movement in the upper 2.0 m since 2009; however, it was thought to be a result of localized downslope movement and settlement and not related to the stability of the roadway and pile wall. The SIs installed along the north/downslope shoulder of the highway and upslope of the existing pile wall continued to show no confirmed active movement beneath the highway surface itself. The SI data was compromised in the last several years due to instrument damage and difficulty obtaining

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<sup>1</sup> AMEC Environment & Infrastructure, 2011. *Southern Region Geohazard Assessment Program, Site S2 – Priddis, Highway 22:14, 2011 Annual Inspection Report*, Project Number CG25352.200, Report submitted to AT October 28, 2011.

readings due to road settlement. The settlement gauge that was recovered in 2009 indicated that settlement of the road fill occurred since the initial readings in 2001. The settlement gauge was found sheared/destroyed near the surface during the Spring 2011 readings and is no longer functional.

#### **4.0 ASSESSMENT**

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

- The ongoing landslide movement of 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. It is possible that the cracking in the pavement surface is due to localized soil movements between the piles. 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.
- Very few of the geotechnical instruments installed at this site are still functioning at full capacity and there are no functioning slope inclinometers within the landslide area. As discussed during recent annual site inspections, replacement SIs 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. However, the current instrumentation restored to full capacity would still provide effective monitoring of potential undermining of the road and provide earlier indication of worsening conditions.

## **5.0 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 or settlement at this site.
- Consequence Factor of 5 given that the design 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.

## **6.0 RECOMMENDATIONS**

### **6.1 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. Access to the SIs should be maintained during paving. SI #10 was found paved over during the Fall 2013 readings and needs to be recovered.

### **6.2 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 patching of the settlement and cracking area and the possibility that a vehicle could be damaged by driving 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 whaler 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 should be constructed on the upslope side of the existing highway.

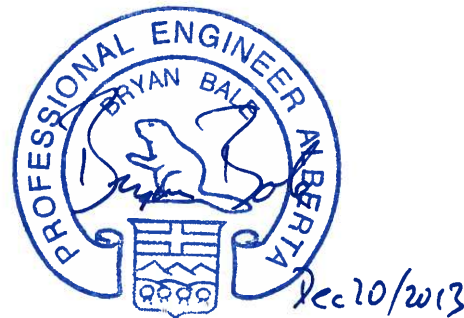
## 7.0 CLOSURE

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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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