



August 25, 2009

CG25309.B

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

Attn: Mr. Ross Dickson

**Re: Southern Region Geohazard Assessment Program
Site S5 – Chin Coulee, Highway 36:02
2009 Annual Inspection Report**

This letter documents the 2009 annual site inspection of Site S5 – Chin Coulee on Highway 36:02, approximately 20 km south of Taber, AB and on the north approach slope to the highway bridge across the Chin Coulee Reservoir. This site is located on the upper portion of the north slope above the Chin Coulee Reservoir, where the highway is oriented cross-slope as it descends to the bridge across the reservoir.

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 8, 2009 by Mr. Andrew Bidwell and Mr. Bryan Bale of AMEC, in the company of Mr. Ross Dickson and Mr. Neil Kjelland 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.

Landslide movement undermining the downslope shoulder of the highway was first noted by AT in the fall of 1978 and was reported to have occurred again in the spring of 1997. The landsliding consists of deep-seated instability (apparently inactive to intermittently active) in the north valley slope along with relatively shallower movements in the fill embankment immediately downslope of the affected segment of the highway. Geotechnical instrumentation was installed

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

at this site in 1998 and the site has been monitored by AT and consultant personnel since that time.

Launched soil nails and a small retaining wall (“GCS wall” – supplier’s product name of Geosynthetically Confined Soils) were installed in May 2008 in order to reinforce the headscarp of the shallower, fill embankment landsliding where it had undermined a segment of the guardrail. Please refer to AMEC’s report to AT on observations from site visits during the soil nailing and wall construction² for further details.

SITE OBSERVATIONS

Key observations regarding changes in the site conditions since the 2008 inspection are summarized as follows:

- The retaining wall has developed cracking in the footing towards the west end of the wall where erosion has undermined the footing around a drain. A stake was placed below the footing in this area during the June 2009 inspection to enable future measurements of settlement. Cracking was also noted between the wall blocks over the undermined area with crack separation of 32 mm measured at a location marked with paint on the wall. The wall has settled in the middle with approximately 15 cm of differential settlement evidenced by the visible deflection of the rows of wall blocks. The fill behind the wall has also settled by up to 30 cm adjacent to the road surface, with tension cracks along the back edge of the fill and parallel to the guardrail open to approximately 300 to 600 mm depth. Refer to Photographs S5-1 to S5-3. These changes in the condition of the retaining wall have developed since the June 2008 inspection.
- Two guardrail posts supported by the retaining wall fill are becoming unsupported due to the settlement of the wall backfill. Refer to Photograph S5-4 and S5-5. The guardrail was also noted to be shifted slightly towards the wall.
- No new cracking was observed on the road. Refer to Photograph S5-5.
- The graded fill slopes adjacent to the retaining wall where soil nails were installed were not seeded after construction in May 2008, but are becoming fairly well vegetated. Refer to Photograph S5-6. Some soil nails are protruding through the fill and there are areas that still do not have vegetative cover.

² AMEC report “Highway 36:02, Site S5 – Chin Coulee, Soil Nailing and GCS Wall Construction, Observations From Site Visits During Construction”, submitted to AT on May 27, 2008, AT Service Contract Number R1/037/08, AMEC project number CG25276.

- An erosion gully has been forming below the culvert outlet to the west of the wall. A survey stake was installed at the crest of the gully during the June 2009 inspection to enable future checks for retrogression of the gully headwall towards the highway.

The May 2009 instrument readings at this site did not show any confirmed slope movement, which continues the trend of no significant slope movement since 2000 and 2002. Based on the locations of the functioning slope inclinometers GA98-2 and 2002-1 (illustrated on the site plan), this indicates that the previous landslide movement delineated by the visible scarp just below the south shoulder of the highway has not expanded laterally or retrogressed upslope and below the highway, nor has there been any recent reactivation of the deeper-seated landslide movement extending below the highway.

ASSESSMENT

The risk to the road surface from the shallower, fill embankment movements that were undermining the guardrail in recent years has been reduced since the 2007 inspection by the spring 2008 soil nailing and retaining wall construction to support the headscarp area and guardrail. The retaining wall is becoming damaged due to erosion undermining the footing and by settlement of the wall on the colluvium soils beneath the foundation. With time, the wall will become less effective in supporting the guard rail posts and the risk to the road surface will increase. Fill placement on top of the wall may be required to support the guardrail posts, or longer posts could be installed.

As the settlement and deformation of the wall continues over time, the wall will provide less of a buttress to the steep slope along the guardrail line. However, the launched soil nails into the steep slope behind the wall backfill and extending laterally on either side of the wall area will continue to provide some benefit and overall the risk to the highway from the guardrail becoming undermined should remain less than was the case prior to the soil nailing and wall construction in May 2008.

The spring 2008 repair work was targeted to address the shallower, fill embankment movements and does not have any affect on the risk to the road from a potential reactivation of the overall deep-seated landsliding at this site. The risk to the highway from deep-seated landsliding has been managed by the planning and preliminary design for an upslope shift of the highway alignment as part of the 2004 Functional Planning Study. This repair design could be finalized promptly if required in the future due to a reactivation of the deep-seated landsliding with significant damage to the existing highway.

RISK LEVEL

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

Shallow Landsliding (Fill Embankment Along Downslope Side Of Road, Undermining The Guardrail)

- Probability Factor of 10 based on the assumed moderate rate of ongoing shallow movement in the slope below and adjacent to the highway (i.e. the ground movement that sheared-off SI 98-3 on the slope below the highway). The existing instrumentation at this site does not penetrate into this slide area, therefore the movement has been conservatively assumed to be ongoing.
- Consequence Factor of 1 based on the estimated negligible potential damage to the highway (at least in the short term, i.e. a few years) resulting from the assumed ongoing shallow slope movement downslope of the highway. This is a reduction from the value of 2 recommended after the 2007 inspection, based on the spring 2008 repairs to support the guardrail area.

Therefore, the current recommended Risk Level with respect to the shallow landsliding is 10, which is a reduction of the value of 20 recommended after the 2007 inspection. As noted above, the post-repair damage to the retaining wall has started to reduce the effectiveness of the retaining wall in support the guardrail and downslope edge of the pavement, however it is judged that the launched soil nails continue to provide benefit and overall the Consequence Factor of 1 recommended after the 2008 repair remains valid at this time.

Potential Deep-Seated Landsliding

The risk associated with potential deep-seated landsliding at this site is unchanged from the 2008 inspection. In summary:

- Probability Factor of 3 since instrument data shows that the deep-seated movement below the road alignment has been inactive for several years and the probability of remobilization is judged to be low.
- Consequence Factor of 5 on the basis that a large portion of the highway could be significantly damaged by a reactivation of the deep-seated failure mode.

Therefore, the current recommended Risk Level with respect to the potential deep-seated landsliding is 15, which is equal to the value assigned following the 2008 annual inspection.

RECOMMENDATIONS

Maintenance and Short Term Measures

- The condition of the retaining wall is degrading, and the wall's ability to support the guardrail posts will lessen in the future. The launched soil nails in the slope behind and adjacent to the wall area are expected to continue to provide benefit. However, the maintenance contractor should be aware of future work that may be required to maintain the guardrail, including fill placement or longer guardrail posts, and should inspect the retaining wall regularly to determine if such repairs become necessary..
- Apply hydroseeding to the regraded slopes in the May 2008 repair area that have not yet become naturally revegetated.

Long Term Measures

- Continue the semi-annual instrument readings, including a cursory visual inspection of the condition of the wall and adjacent slope face.
- Discontinue the annual site inspections by AT and the regional geotechnical consultant unless the visual inspections during the semi-annual instrument readings identifies something of concern.

Investigation

No further investigation work for this site is recommended at this time.

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**

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APEGGA Permit to Practice No. P-04546

Reviewed by:

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Attachments: Site Plan
Photos