



September 29, 2008

CG25277.B

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

Attn: Mr. Ross Dickson

**Re: Southern Region Geohazard Assessment Program
Site S20 – Highwood House Rock Cut, Highway 541:02
2008 Annual Inspection Report**

This letter documents the 2008 annual site inspection of Site S20 – Highwood House Rock Cut, on the north side of Highway 541:02, approximately 800 m east of the junction between Highways 40, 541 and 940 at Highwood House.

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 25, 2008 by Mr. Andrew Bidwell, P.Eng. and Mr. Bryan Bale 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 previous annual inspection report¹ and are summarized as follows:

- The site consists of a near-vertical to vertical rock cut slope with an estimated maximum height of greater than 20 m, with natural soil and bedrock slopes up to 35° inclination above the crest of the cut slope. A slope cross-section is attached as Figure S20-1.
- There is a rockfall hazard at this site that was first documented during the 2005 geohazards review of the Highway 40/541 corridor.

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

- Based on the “Ritchie ditch chart” rockfall catchment ditch design guidelines, the existing ditch adjacent to the cut slope is slightly undersized for the estimated maximum height of the cut slope.
- The rockfall debris typically consists of gravel sized rocks that have eroded out from the shale, coal and conglomerate beds exposed in the cut slope. However, up to boulder-sized rockfall debris has been noted in the ditch and along the north edge of the pavement during past inspections. This has included a boulder-sized rock that came to rest along the north edge of the paved surface .

SITE OBSERVATIONS

The site conditions had not changed significantly since the 2007 site inspection.

- There was continued accumulation of rockfall debris in the ditch, including large talus cones below relatively weaker rock layers exposed in the cut slope around the west end of the site. Photos S20-1 to S20-3 shows views of the rockfall debris in the ditch at the time of the site inspection.
- Gravel sized rocks were observed in the westbound lane and there were boulder sized rocks up to 1.5 m maximum dimension in the ditch at the time of the inspection.
- The exposed rocky soil face at the head of the chute/gully above the crest of the cut slope at the west end of the site appeared to have eroded further upslope since the 2007 inspection. Photo S20-4 shows a view of the rocky soil exposed in this area, which appears to be the source of some of the rockfalls at the west end of the site.

ASSESSMENT

There remains a risk that rockfall debris from the cut slope will bounce or roll onto the road surface. The risk is somewhat mitigated by the “Watch For Fallen Rock” signs in place for traffic approaching the cut slope segment of the highway from both directions along with the available catchment capacity of the east ditch. However, the accumulation of rockfall debris in the ditch reduces the effective ditch dimensions further below those recommended on the Ritchie Ditch guidelines for a near-vertical cut slope of this height.

RISK LEVEL

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

- Probability Factor of 15 based on the appearance of the debris that suggests that there is ongoing rockfall at this site.
- Consequence Factor of 3 based on:
 - The presence of gravel to cobble sized rockfall debris on the pavement on the north shoulder of the road and in the westbound lane during the current and past site inspections.
 - The previous observation of a boulder that had landed along the north edge of the pavement. This illustrates that it is possible for rockfall debris of this size to be deposited at locations along the edge of the road where they could be struck by a vehicle (particularly under poor visibility conditions or at night) and cause damage in the order of a flat tire or temporary loss of vehicle control at highway speed.

Therefore, the recommended Risk Level for this site is 45. This value is unchanged from the previous site inspections.

RECOMMENDATIONS

Maintenance and Short Term Measures

- AT's maintenance contractor should clean the accumulated rockfall debris from the ditch at this site as required in order to maintain the ditch capacity reasonably close to its maximum, particularly in the areas at the west end of the site where the talus cones accumulate at the toe of the rock cut and fill the ditch. The frequency of cleaning will depend on future rockfall volumes. Ditch cleaning should be treated as an ongoing maintenance task and performed as required. If the ditch is consistently kept clean and near its maximum capacity, then it may be possible to reduce the Consequence Factor for this site.

Long Term Measures

- The following additional measures should be considered to reduce the dependence on timely cleaning of the ditch:
 - Increasing the ditch depth if possible. There is a Telus pedestal in the north ditch at the west end of the site, therefore it would likely be necessary to relocate the buried Telus line if the ditch depth is increased.
 - Placing a line of jersey barriers along the north shoulder of the highway to increase the effective ditch capacity. This will help to contain rockfall debris in the ditch. This should only be done if AT's requirements for a minimum clear zone can be met (and also practicality with respect to snow-plowing). The barriers would also be effective in preventing vehicles that may run into the north ditch for other reasons from striking boulder-sized rockfall debris that has been contained in the ditch. It will be necessary to keep cleaning the rockfall debris from the ditch after the barriers are in place.
 - Consider scaling the cut slope in order to attempt to reduce the volume of rockfalls over the short term (e.g. a few years).
- As discussed on site during the inspection, AT is interested in using this site for a trial application of a Trumer Schutzbauten brand hanging rockfall barrier net installed along the crest of the cut slope at the outlet of the gully/chute (conceptual location as illustrated on Photo S20-5). The purpose of a net installed at this location would be to intercept airborne and bouncing rockfalls originating from the upper portion of the chute and directing them to fall vertically into the ditch rather than possibly bouncing outwards and onto the road. AMEC will submit a proposed scope and cost estimate for the design and tender package preparation for this work to AT under separate cover.
- The annual site inspections by AT and AMEC personnel should be continued.

Investigation

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

A surveyed cross-section of the slope may be required to design the trial application of the hanging rockfall barrier net described above – this will be covered in the proposal and cost estimate 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**

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Associate Geological Engineer

APEGGA Permit to Practice No. P-04546

Reviewed by:

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

Attachments: Cross-Section
Photos