November 2012

CG25399

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

Attention: Mr. Ross Dickson

Dear Ross:

Re: Southern Region Geohazard Assessment
2012 Annual Inspection Report
Site S20: Highway 541:02, Highwood House Rock Cut

This letter documents the 2012 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 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 Georgina Griffin, P.Eng., Bryan Bale, P.Eng., and Tyler Clay, E.I.T., of AMEC; and Roger Skirrow, P.Eng., Ross Dickson, and Nathan Madigan, E.I.T., of AT during the 2012 Annual Tour.

1.0 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 provided in the 2007 annual inspection report[1] and are summarized as follows:

- The site consists of a near-vertical rock cut slope with an estimated maximum height of more than 20 m, with natural soil and bedrock slopes up to 35° inclination above the crest of the cut slope. An approximate slope cross-section is attached as Figure S20-1.

- There is a rock fall hazard at this site that was first documented during the 2005 geohazards review of the Highway 40/541 corridor.

[1] AMEC Earth & Environmental, 2007. *Southern Region Geohazard Assessment, Annual Assessment Report, 2007*, Project Number CG25263, submitted to AT November 6, 2007.

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- Based on the "Ritchie ditch chart" rock fall 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 rock fall 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 rock fall debris has been noted in the ditch and along the north edge of the pavement during past inspections. This included a boulder-sized rock that came to rest along the north edge of the paved surface.

2.0 SITE OBSERVATIONS

Key observations from the June 2012 inspection were as follows:

- The appearance of the cut slope had not changed significantly since the previous inspections. Photo S20-1 shows a general view of the cut slope taken from the south side of the highway.

- Up to boulder-sized rock fall deposits were accumulated in the north ditch and up to the paved edge. The distribution and maximum size of the rock fall debris was unchanged from the 2010 inspection; however, the size of the main debris cones had decreased from ditch clearing since the last inspection. There were also gravel sized rocks along the paved shoulder and cobble sized rocks immediately adjacent to or on the paved surface. Refer to Photos S20-2 and S20-3.

- No damage to the road surface was observed.

- The gully eroding into the rocky soil in the natural slope above the crest of the rock cut slope was visually reviewed from the highway and appeared to have retrogressed slightly further upslope since the 2010 inspection. The rocky soil exposed in the gully appeared to continue to be the primary source of rock fall debris along the ditch line, based on the distribution of the accumulated debris along the ditch at the time of the inspection. Refer to Figure S20-1 for a cross-section sketch through the main gully from the 2009 inspection.

3.0 ASSESSMENT

The rock fall hazard at this site appears to have decreased slightly or remained the same since the 2010 inspection. In summary:

- There remains a risk that rock fall debris from the cut slope will bounce or roll onto the road surface. With the reduced size of the main debris cones noted, it is less likely that a larger boulder will reach the road surface in the short term. The probability will increase to previous levels as accumulation increases.

The risk to motorists is only somewhat mitigated by the “Watch for Fallen Rock” signs.

4.0 RISK LEVEL

The recommended Risk Level for this site, based on AT’s rock fall geohazard risk matrix, should be returned to the values recommended after the 2009 site inspection, as follows:

Probability Factor of 15 based on:

- The appearance of the debris that suggests that there is ongoing rock fall at this site. This is unchanged from the 2009 and 2010 inspection.
- Volume of visible unsupported rock on the upper cut slopes.

Consequence Factor of 3 based on:

- The presence of large boulders that have landed on the road shoulder, and the fact that they would cause serious damage or accidents if they were struck.
- Clearing of the ditch has reduced the size of the previous debris cones and restored the capacity of the ditch prior to the 2010 inspection.

This is a decrease from the value of 4 assigned in 2010 based on the decreased likelihood that a large boulder will land on the road.

Therefore, the recommended Risk Level for this site is 45, which is a decrease from the 2010 level of 60. Note that the risk could be returned to the 2010 level if the effective ditch width becomes reduced by not being cleaned regularly.

5.0 RECOMMENDATIONS

5.1 Maintenance and Short Term Measures

- As recommended following the previous annual inspections, AT’s maintenance contractor should clean the accumulated rock fall debris from the ditch regularly. It may be possible to reduce the Consequence Factor if the ditch is consistently kept clean.
- A standardized report form should be implemented to document rock fall at this site. AMEC could provide a sample of such an inspection form. Data from these inspections forms could be collected by AT and the active consultant to give a better indication of the rock fall hazard.

5.2 Long Term Measures

The following additional measures could be considered to reduce volume of rock fall reaching the road:

- Increase the ditch depth.
- Place a line of jersey barriers along the north shoulder of the highway to increase the effective ditch capacity.
- Scale the cut slope in order to attempt to reduce the volume of rock falls over the short term.
- Install a hanging rock fall barrier to confine rock fall to the ditch.

The annual site inspections by AT and AMEC personnel should be continued.

5.3 Investigation

If AT would like to proceed with the trial application of the hanging rock fall barrier net, AMEC could provide a proposal and cost-estimates for different options, including a LiDAR survey suitable for determining the required size and location for the net.

AMEC could also prepare a draft tender package for rock slope scaling work for this and other sites at AT's discretion.

6.0 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 Environment & Infrastructure, 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 Environment & Infrastructure,
a division of AMEC Americas Limited

ORIGINAL SIGNED AND STAMPED NOVEMBER 20, 2012

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Reviewed by:

APEGA Permit to Practice No. P-04546

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