



November 2013

CG25399

Alberta Transportation
2nd 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 S18: Highway 40:12, Galatea Creek Rock Cut**

This report documents the 2013 annual site inspection of Site S18 – Galatea Creek Rock Cut, along Highway 40:12, approximately 32 km south of the junction between Highway 40 and Highway 1 and just north of the Galatea Creek Provincial Recreation Area.

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., Tyler Clay, E.I.T., Clinton Chan, E.I.T., of AMEC; and Roger Skirrow, P.Eng., of AT during the 2013 Annual Tour.

1.0 SUMMARY

The site condition is relatively unchanged from the 2012 inspection. The risk level is unchanged. There will likely be an accumulation of rock fall debris in the east and west ditches. Effectiveness of the ditches can be increased by either placing a line of Jersey barriers along the shoulder of the road or increasing the capacity of the ditches. The maintenance contractor should continue cleaning the ditches and monitoring the road surfaces. The site should be inspected next in 2014.

AMEC Environment & Infrastructure
A Division of AMEC Americas Limited
140 Quarry Park Boulevard SE
Calgary, Alberta, CANADA T2C 3G3
Tel: +1 (403) 248-4331
Fax: +1 (403) 248-2188
www.amec.com

\\cal1-fs2\cal1-ee-geo\Projects\Calgary Geo\CG25xxx - AT Projects 2010 Forward\CON0013506_12 (399)\AT Southern 2013\200 - Annual Inspections\S18 Galatea Creek\2013 S18 Annual Inspection_final.docx

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 provided in the 2008 annual inspection report¹ and are summarized as follows:

- The site consists of a through-cut in bedrock along this segment of the highway. The East Cut Slope is near-vertical with a maximum height of approximately 16 m. The West Cut Slope is near-vertical with a maximum height of approximately 10 m.
- There is rock fall hazard at this site that was first documented during a June 2004 call-out site inspection by AMEC.
- The east ditch does not meet the sizing guidelines from the Ritchie Ditch Chart and during past inspections up to cobble sized rock fall debris was noted on the road surface across the northbound lane and onto the centerline.
- There is also a hazard of rock block sliding, wedge or toppling failures from the East Cut Slope because the East Cut Slope is oriented unfavourably relative to the bedrock structure at this site. Numerous rock bolts were installed in the East Cut Slope during construction in order to mitigate the risk to the highway from these hazards.
- The west ditch meets the sizing guidelines from the Ritchie Ditch Chart. No evidence of rock fall reaching the road from the West Cut Slope was noted during past inspections.

3.0 SITE OBSERVATIONS

Observations from the 2013 inspection are summarized as follows:

- Photo S18-1 shows a general view of the West Cut Slope. The site conditions have not changed significantly in recent years.
- There continued to be an accumulation of rock fall debris in both the east and west ditches. The rock fall debris included material up to cobble size and small boulder size, which is consistent with observations from past inspections. An approximately 1 m³ boulder was noted in April 2013 by an AMEC employee on the east shoulder but the debris had been removed as of the May inspection. Numerous cobbles and gravel were observed on the west shoulder. Rock impact scars were apparent on the road surface, as in past inspections. Refer to photos S18-2 to S18-4.

¹ AMEC Earth & Environmental, 2008. *Southern Region Geohazard Assessment Program, Site S18 – Galatea Creek Rock Cut, Highway 40:12, 2008 Annual Inspection Report*, Project Number CG25277, submitted to AT September 8, 2008.

4.0 ASSESSMENT

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

- The rock fall conditions have not changed at this site since the previous inspection. There remains a risk that rock fall debris from the East Cut Slope will bounce or roll onto the road surface. The risk is somewhat mitigated by the “Watch For Fallen Rock” signs in place on either side of the through-cut to warn drivers, along with the available catchment capacity of the east ditch, but the hazard of large rocks being deposited on the pavement remains.
- As noted in the previous inspection reports, the risk from potential rock block sliding, wedge, or toppling failures in the East Cut Slope is judged to be lower than the rock fall risk because of the rock bolts installed in the East Cut Slope.
- The risk to the highway from rock fall from the West Cut Slope is low because the west highway ditch is larger and able to contain virtually all of the rock fall debris from the West Cut Slope.

5.0 RISK LEVEL

The current recommended Risk Levels for this site, based on AT’s rock fall geohazard risk matrix, are as follows:

East Cut Slope

- A Probability Factor of 15 is recommended based on the apparent frequency of rock fall reaching the road surface.
- A Consequence Factor of 3 is recommended based on the history of cobble-sized rocks rolling onto the pavement at this site which could damage a vehicle or cause a collision.

Therefore, the recommended Risk Level for the East Cut Slope is 45. This value is unchanged from the previous site inspection.

West Cut Slope

- A Probability Factor of 12 is recommended based on the apparent frequency of rock fall from the West Cut Slope.
- A Consequence Factor of 1 is recommended because there has been no evidence of rock fall debris from the West Cut Slope reaching the road.

Therefore, the recommended Risk Level for the West Cut Slope is 12. This value is unchanged from the previous site inspection.

6.0 RECOMMENDATIONS

6.1 Maintenance and Short Term Measures

- AT's maintenance contractor should clean the accumulated rock fall debris from the east and west ditches often in order to maintain maximum catchment capacity. This should be treated as an ongoing maintenance issue.
- The road surface should be inspected daily by the maintenance contractor, and any rock fall should be removed from the road surface.
- A standardized report form should be implemented for this site and other rock fall hazard sites. The form would be used for inspections by the MCI to note any significant (cobble sized or larger) rock falls onto the road surface. The form would prompt the inspector for information such as rock size, location, damage to road surface, etc. AMEC could provide a sample of such an inspection form. Data from these inspections forms would be collected by AT and the active consultant to give a better indication of the rock fall hazard.
- If the debris is not cleaned out and kept off the road as described above, the Consequence Factor for the rock fall risk from the East Cut Slope will increase.

6.2 Long Term Measures

- The Consequence Factor for the East Cut could be reduced by increasing the capacity of the east ditch to contain rock fall debris. The ditch sizing criteria on the Ritchie Ditch chart or more recent guidelines based on work by the British Columbia Ministry of Transportation should be used as a guide.
- Alternatively, a line of jersey barriers could be placed along the east shoulder of the road in order to increase the effective depth of the ditch.
- Scaling at this site could reduce the Probability Factor and should be considered.
- The annual inspections at this site should be set to bi-annual inspections unless changes are reported by the MCI.

6.3 Investigation

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

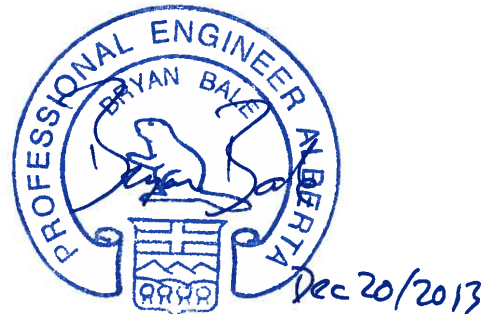
7.0 CLOSURE

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**



Clinton Chan, B.A.Sc., EIT
Geological Engineer

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

APEGA Permit to Practice No. P-04546

Reviewed by:
Georgina Griffin, M.Eng., P.Eng.
Associate Geotechnical Engineer