



October 14, 2010

CG25332.200

Alberta Transportation  
2<sup>nd</sup> Floor, 803 Manning Road NE  
Calgary, AB T2E 7M8

Attn: Mr. Ross Dickson

**Re: Southern Region Geohazard Assessment Program  
Site S15 – Crowsnest Lake Rock fall Barrier, Highway 3:02  
2010 Annual Inspection Report**

This letter documents the 2010 annual site inspection of Site S15 – Crowsnest Lake Rock fall Barrier, along Highway 3:02 on the southeast shore of Crowsnest Lake, west of Coleman, AB and a short distance east of the border between Alberta and British Columbia. There is a rock fall hazard to the highway at this site that is being mitigated by the rock fall barrier net.

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 22, 2010 by Mr. Bryan Bale, P.Eng. and Mr. Andrew Bidwell, P.Eng., of AMEC in the company of Mr. Neil Kjelland, P.Eng., Mr. Roger Skirrow, P.Eng., and Mr. Ross Dickson 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 2007 annual inspection report<sup>1</sup>.

The rock fall hazard at this site was first identified by AT in the late 1990's. Subsequent work by AT and their geotechnical consultants culminated in the installation of the current rock fall barrier net in November 2005. The annual inspections of the site have been continued since the barrier net was installed in order to monitor the effectiveness of the barrier net and troubleshoot

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

its required maintenance. A call-out site inspection to assess the rock fall hazard along the segment of the highway immediately west of the barrier net was also performed in June 2008<sup>2</sup>.

## SITE OBSERVATIONS

A summary of the observations from the 2010 inspection is presented below:

- As shown in Photos S15-1 to S15-4, the barrier net was in poor condition. It is believed that the net was last repaired in late 2008. The debris cone was large and required removal. The east post support cables were disconnected, likely due to the maintenance contractor not reconnecting the cables after accessing the area, and the two middle posts had activated braking elements on the support cables or broken cables entirely. At least one post had a broken shear pin at its base. The barrier net is repairable, but in its current state is likely almost completely ineffective against a large rock fall. AMEC understands that maintenance may have been performed since the June 2010 inspection, but has not confirmed the extent of the repairs.
- Numerous large rocks were noted caught in the barrier net, and the accumulation has pulled the net down reducing its effective height. Some of the rocks were very large (up to 2.5 m<sup>3</sup>), and were tabular. Gravel and cobble sized rocks were noted on the road shoulder, indicating that rocks are bouncing over or through the barrier and likely reach the road surface. The jersey barriers between the net and the edge of the pavement also showed continued damage by rock strikes.
- There was at least one location where one or two of the wire rope rings on the main net had been severed with a resulting gap in the net. This damage has been observed since 2006.
- There were several gaps in the chain link mesh installed across the wire rope net, which could allow small rock fall debris to fly through the net.
- The gully headwall in the talus slope above the highway rock cut slope appears to have retrogressed since the 2009 inspection. The two distinct upper gullies noted in 2009 appeared to have merged into a single gully, indicating that gully expansion is ongoing. Refer to Photo S15 -5 and S15-6.
- Rock fall along the segment of the highway to the west of the barrier net remains a concern with predominantly gravel to cobble sized rock fall. Most of the rock fall is

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<sup>2</sup> AMEC report "Report On June 3, 2008 Site Inspection, Highway 3:02 Crowsnest Lake, Alberta", project number CG25277.D, submitted to AT on June 16, 2008.

contained in the ditch however some rocks are deposited on the road edge. The rock fall conditions along this segment of the highway are largely unchanged from the June 2008 call-out site inspection of this area.

## **ASSESSMENT**

The rock fall hazard at this site has not changed significantly since the barrier net was installed in late 2005, however the frequency of rock falls may be increasing as the gully erosion in the talus slope above the highway cut slope expands upslope and laterally. This erosion is expected to continue in the future. The design capacity of the rock fall barrier is judged to remain sufficient because the maximum size of rocks exposed in the upper portions of the gully are not significantly different than previously noted and the design rock fall case for the barrier net was for a large rock releasing from the gully headwall. The lateral extent of the rock fall barrier is also judged to be sufficient because any rolling rocks/rock falls are channelled into the existing gully by the shape of the slope face.

The barrier net is still judged to be the most practical and cost-effective way to reduce the risk to the highway from rock fall at this site. However, it requires maintenance to restore it to the design capability. Inspection and maintenance procedures for the barrier net are listed in the documentation provided by the manufacturer. In its current state, it will not be able to contain large rock fall as has been observed in the past.

## **RISK LEVEL**

The recommended Risk Level to the highway at the barrier net location is as follows:

- The Probability Factor for this site should be set at 16 to reflect the active rock fall.
- The Consequence Factor for this site should be set at 7 to reflect the reduced capacity of the net due to the east side anchor cables being disconnected, and the damage to the support posts and cables. The actual reduction in net capacity is difficult to estimate, however a Consequence Factor of 7 is considered reasonable for the June 2010 condition of the net, and is equal to the value recommended in May 2008 when the barrier net also required extensive maintenance. A Consequence Factor of 1 has been previously recommended for a properly maintained net at design capacity.

Therefore, the current recommended Risk Level at the barrier net site is 112, which is equal to the value recommended following the May 6, 2009 inspection, and an increase from the value of 80 recommended in June 2009. The Consequence Factor could be greatly reduced if the east anchor cables are reconnected and the net is repaired.

## **RECOMMENDATIONS**

### **Maintenance and Short Term Measures**

- The maintenance contractor should clean out the rock fall debris as required in order to keep the volume of accumulated debris behind the net to a practical minimum.
- The anchor cables for the net should be re-attached and properly tensioned as soon as possible. The manufacturer's guidelines for installing, inspecting and maintaining the net detail these procedures.
- The damaged support posts should be re-attached at the shear pins, and properly straightened. The braking elements should be reset, and the support cables should be properly tensioned and re-attached where required.
- The gaps in the wire rope net should be repaired, along with the gaps in the chain link mesh.

### **Long Term Measures**

- The barrier net should be regularly inspected and maintained as recommended in the manufacturer's guidelines.
- Rock fall debris behind the barrier net should be cleaned out as required to keep the volume of accumulated debris at a practical minimum.
- The annual site inspections by AT and geotechnical consultant personnel should be continued.

### **Investigation**

AMEC is currently performing an assessment of options to upgrade, supplement or replace the existing rock fall barrier net. This work will be reported 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**

ORIGINAL SIGNED  
OCTOBER 14, 2010

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

APEGGA Permit to Practice No. P-04546

Reviewed by:

Andrew Bidwell, M.Eng., P.Eng.  
Associate Geological Engineer

Attachments: Site Plan  
Photos