



October 31, 2011

CG25352.200

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  
2011 Annual Inspection Report**

This letter documents the 2011 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 a rock fall barrier net.

AMEC Environment and Infrastructure (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 21, 2011 by Mr. Bryan Bale, P.Eng. and Mr. Tyler Clay, E.I.T., of AMEC in the company of Mr. Neil Kjelland, 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 2011 inspection is presented below:

- As shown in Photos S15-1 to S15-3, the barrier net was in poor condition at the time of the inspection. The accumulated cone of rock fall debris was large and was encroaching onto the barrier net, causing the net to become loaded and pushed towards the highway. The effective height of the barrier had been reduced to about 3 m in places (from the intended 5 m effective height). One of the barrier net support posts was tilted at approximately 45 degrees, and the braking elements on its support cables had been activated (refer to Figure S15-1).
- Several holes and tears were noted in the chain link fence attached to the barrier net, potentially allowing small rocks to pass through. One of the holes in the chain link fence was approximately 2 m x 0.5 m.
- The east support cables, which had been left detached in the past, were found to be properly connected. The cables were not sufficiently tensioned.
- The barrier net is repairable, but in its current state is likely almost completely ineffective against a large rock fall.
- The gully headwall in the talus slope above the highway rock cut slope appears to have retrogressed since the 2010 inspection. Refer to Photo S15-4.
- Numerous large rocks were noted on the ground behind the barrier net. Some of the rocks were very large (up to approximately 6 m<sup>3</sup>), and were tabular. Gravel and cobble sized rocks were noted on the road shoulder, indicating that smaller rocks are passing through or possibly bouncing over the barrier and likely reach the road surface. The jersey barriers between the net and the pavement also showed continued damage by rock strikes (Photo S15-5). The guardrail on the north side of the road showed damage from rock strikes. Two rocks, each weighing about 10 kg, were found adjacent to the guardrail and are thought to have landed on or travelled over the highway (Photo S15-6).

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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.

- 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.
- 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 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 increased since the barrier net was installed in late 2005. AMEC has submitted a draft report to AT that discusses the changed conditions at the site, and presents a revised rock fall analysis. Key conclusions from assessment and analysis documented in that report include:

1. The volume of rock fall is large and requires frequent and expensive maintenance to remove the accumulated rock fall debris, which builds up behind the barrier and reduces its capacity.
2. Based on measurements of some of the large rocks that have accumulated behind the barrier from 2006 onwards, the maximum size of rock falls at this site is known to be larger than was estimated in the 2005 design based on the information available at that time. Rock falls up to approximately 6 m<sup>3</sup> have been observed from 2006 onwards. The revised analysis has shown that these rock falls will exceed the barrier capacity.

The barrier net is currently damaged and requires maintenance to restore it to the design capacity. Frequent clean-out of the accumulated debris will allow the barrier to stop most rock falls, but there is potential for infrequent high-energy rock falls to occur that would exceed the barrier capacity. The current barrier, even if properly maintained, cannot entirely eliminate the risk of rock fall reaching the highway.

## RISK LEVEL

The recommended Risk Level to the highway at the barrier net location based on AT's rock fall risk matrix 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 activated breaking elements, slack tension cables, and the reduced

effective height. The actual reduction in net capacity is difficult to estimate, however a Consequence Factor of 7 is considered reasonable for the June 2011 condition of the net.

Therefore, the current recommended Risk Level at the barrier net site is 112, which is equal to the level assigned in 2010, and is the highest risk level assigned to this site in the past.

## **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 braking elements should be reset and the support cables should be properly tensioned and re-attached where required, as per the maintenance guidelines provided by the barrier net manufacturer.
- The gaps in the wire rope net should be repaired, along with the gaps in the chain link mesh, as per the maintenance guidelines provided by the barrier net manufacturer.

### **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.
- AMEC's report to AT assessing the suitability of the barrier net and options to upgrade, supplement or replace the existing barrier should be considered. At the time of writing, AMEC has submitted a draft of this report to AT for comment and discussion prior to finalizing the report and its recommendations.



## **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  
OCTOBER 31, 2011

Tyler Clay, B.A.Sc., E.I.T  
Geological Engineer

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