



September 8, 2008

CG25277.B

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 S30 – Gabion Wall, Highway 742:02  
2008 Annual Inspection Report**

This letter documents the 2008 annual site inspection of Site S30 – Gabion Wall, along Highway 742:02, south of Canmore, AB and approximately 3.8 km southbound along Highway 742 from the Canmore Nordic Centre turn-off.

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**

This segment of Highway 742 is located on the northwest side of the upper portion of the Canmore Creek valley, immediately downstream of North Whiteman's Dam and upslope of the Grassi Lakes Provincial Recreation Area. The Upper Grassi Lakes Trail in the provincial recreation area is downslope of the highway at this site.

The highway is oriented along a bearing of 050/230 (i.e. northeast/southwest) along a bedrock slope on the lower portions of the east flank of Mount Rundle. The attached schematic site plan illustrates the site layout. The segment of the highway at the gabion wall site appears to be constructed on a fill embankment across a swale in the bedrock slope.

The highway is unpaved with a relatively narrow gravel running surface. The width of the road is typically in the order of 10 m or less. There are no ditches along either side of the road at the gabion wall site and there is a guardrail along the downslope side of the road.

P:\Projects\Calgary Geo\CG25277 - AIT Southern Region 2008\600 Reports\Annual Tour 2008\S30 annual 2008.doc

AMEC Earth & Environmental  
A division of AMEC Americas Limited  
221 – 18<sup>th</sup> Street SE  
Calgary, AB, CANADA T2E 6J5  
Tel +1 (403) 248-4331  
Fax +1 (403) 248-2188

[www.amec.com](http://www.amec.com)

It is understood that the highway was constructed around the late 1980's with layers of geogrid reinforcement in the granular fill embankment. The gabion wall appears to have been constructed as an erosion prevention measure for the vertical embankment face. There does not appear to be a "structural" connection between the gabion wall and the embankment.

The western end of the gabion wall collapsed during July and August 2007. Photo S30-1 shows the extent of the wall collapse. AMEC performed a call-out site inspection of the gabion wall in late August 2007<sup>1</sup>.

The primary cause of the failure of the gabion wall was judged to be a concentration of groundwater flow daylighting around or slightly downslope of the toe of the western end of the wall and causing surface erosion and gulying that undermined the base of the wall. A repair consisting of removing the debris from the collapsed segment of the wall and applying a layer of reinforced shotcrete to restore the erosion protection for the western end of the fill embankment was recommended.

The June 2008 site inspection was the first annual inspection by AT and AMEC personnel. AT requested that AMEC proceed with the recommended shotcrete repair design for the collapsed segment of the wall after the June 2008 inspection. The design work is underway at the time of writing.

## **SITE OBSERVATIONS**

Key observations from the June 2008 inspection were as follows:

- The lateral extent of the collapsed segment of the wall had not increased significantly since the August 2007 inspection.
- The granular backfill has continued to ravel out from behind the geogrid wraps exposed by the collapsed segment of the gabion wall. This, in combination with surface runoff flowing off the road, has led to surface erosion and gulying along the downslope edge of the road. Photos S30-2, 4 and 5 show views of the erosion and gulying retrogressing back towards the guardrail.
- There were three locations along the east segment of the wall (i.e. the segment that did not collapse in 2007) where there was visible erosion of the slope material from below the base of the wall. This has resulted in localized undermining of up to 0.3 to 0.4 m across up to 2 m width of the wall base. See Photos S30-6 and 7.

---

<sup>1</sup> AMEC report "Report on August 23, 2007 Call-Out Request, Highway 742 Gabion Wall, Near Canmore, AB", submitted to AT August 28, 2007, AMEC project no. CG25263.

- The easternmost of these three locations also had a small erosion gully forming in the downslope edge of the road backfill, i.e. in the road surface between the guardrail and the top of the intact segment of the gabion wall. This suggests that runoff from the road surface may be washing away the uppermost portion of the downslope edge of the road surface despite the erosion protection of the downslope face by the gabion wall. It also suggests that the undermining of the gabion wall may be at least partly due to surface runoff percolating down through the road backfill and the gabion baskets, then discharging onto the slope face at the toe of the wall and eroding away the slope material.

## **ASSESSMENT**

The risk to the highway from the loss of erosion protection to the west end of the gabion wall has increased slightly since the August 2007 site inspection because the gullying and general surface erosion of the downslope edge of the fill embankment adjacent to the collapsed segment of the gabion wall has continued and now threatens to undermine the guardrail.

The possibility that runoff from the road surface is connected to localized undermining of the intact segment of the gabion wall (and on that basis presumably to similar undermining of the west end of the gabion wall that led to its subsequent collapse) shows that surface drainage control from this segment of the highway needs to be incorporated into the repair design. There is currently no ditch along the upslope side of the highway, so surface runoff would need to be directed to either side of the gabion wall area.

As discussed in the report on the August 2007 site inspection, it is judged that the collapse of the western end of the gabion wall has not significantly increased the pre-existing, natural rockfall risk to the areas downslope of the gabion wall site.

## **RISK LEVEL**

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

- Probability Factor of 13 based on the increase since August 2007 in the rate of surface erosion and gullying on the downslope edge of the road and retrogressing back towards the guardrail. This is an increase from the value of 12 recommended after the August 2007 site inspection. This value also reflects the likelihood that, if left unrepaired, the gabion wall failure will expand into at least the central portion of the wall over time. It also reflects the apparent recent erosion and initial undermining of portions of the eastern end of the wall.

- Consequence Factor of 6 because if the erosion protection to the downslope face of the fill embankment is not restored, the guardrail and eventually the running surface of the highway will become undermined.

Therefore, the recommended Risk Level is 78, which is an increase from the value of 72 recommended after the August 2007 site inspection.

## **RECOMMENDATIONS**

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

- Regrade the road surface and establish an impermeable berm along the downslope edge of the road to prevent surface runoff from flowing below the guardrail and causing further surface erosion along the downslope edge of the road fill embankment. The surface runoff discharge onto the slope face below the highway on either side of the gabion wall area will need to be carefully managed to avoid harmful erosion in those areas.
- Remove the debris from the collapsed segment of the gabion wall and apply the recommended shotcrete repair. (The repair design is underway at the time of this writing.)

### **Medium To Long Term Measures**

- Repair the recent undermining of portions of the eastern end of the gabion wall, either using location-specific methods such as infilling with concrete (possibly in conjunction with the shotcrete repair for the western end of the gabion wall) or as part of underpinning the currently non-collapsed segment of the gabion wall as a preventative measure.
- The annual site inspections by AT and AMEC personnel should be continued.

### **Investigation**

No site investigation work is recommended at this time.



## **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**

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

APEGGA Permit to Practice No. P-04546

Reviewed by:

Paul Cavanagh, M.Eng., P.Eng.  
Associate Geotechnical Engineer

Attachments: Site Plan  
Cross-Section  
Photos