

August 28, 2009

CG25309.B

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

Attn: Mr. Ross Dickson

**Re: Southern Region Geohazard Assessment Program
Highway 40, Mount Armstrong Viewpoint Retaining Wall
June 2009 Inspection Report**

This letter documents the June 2009 site inspection of the retaining wall below the Mount Armstrong viewpoint along Highway 40, approximately 2 km westbound from the junction between Highways 40, 541 and 940 at Highwood House.

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 10, 2009 by Mr. Andrew Bidwell, P.Eng., and Mr. Bryan Bale, EIT of AMEC in the company of Mr. Ross Dickson and Mr. Neil Kjelland, P.Eng. of AT.

BACKGROUND

The only previous assessment of this site under AT's Geohazard Risk Management Program (GRMP) was during 2005 as part of the Highway 40/Highway 541 corridor review. Please refer to the report on the corridor review¹ for further details. In summary:

- The east end of the approximately 9 to 10.5 m high, vertical retaining wall is above a steep (approximately 36° slope between the highway and the Highwood River. The height of the slope is roughly 20 m or more. The toe of this slope is exposed to erosion along the river channel, and there are also several erosion gullies in the slope face that have formed due to surface runoff.

¹ AMEC report "Geohazards Review, Highway 40/Highway 541 Corridor, Southwestern Alberta", submitted to AT on April 10, 2006, AT contract number CE044/2004, AMEC project number CG25211.

- The gully headslopes are close to the toe of the retaining wall in several locations, with a minimum offset from the toe of the wall in the order of 3 m.
- A potential hazard of destabilization of the wall by ongoing erosion and upslope retrogression of the gullies was noted.

The June 2009 inspection was recommended to AT as a follow-up to the 2005 inspection to confirm or revise the recommended Risk Level that was based solely on the 2005 inspection.

SITE OBSERVATIONS

Key observations from the June 2009 inspection were as follows:

- There were no significant changes to the slope and gullies below and adjacent to the toe of the wall since the 2005 inspection. The gully at the east end of the wall was still in the same proximity to the toe of the wall, without any signs of fresh retrogression towards the wall. Photos 1 to 3, attached, show views of the site from the June 2009 inspection.
- The short lengths of metal strips of the type used in retaining wall backfill that were noted as being exposed in one of the gully headwalls during the 2005 inspection were still visible. As noted in the previous inspection, it is not clear if these were construction waste left adjacent to the toe of the wall, or if they had somehow been backfilled into the slope around gully in an attempt to stabilize the area.
- The wall continued to appear vertical and in good condition. There was no cracking or settlement in the paved area adjacent to the crest of the wall that would suggest deformation or destabilization of the wall since the 2005 inspection.

ASSESSMENT

The wall has not been destabilized by erosion and upslope retrogression of the gullies adjacent to the toe of the wall since the 2005 inspection. This hazard still cannot be ruled out with certainty, however the lack of significant erosion between the 2005 and 2009 inspections does provide some assurance that the hazard is relatively low.

If, in the future, further erosion and retrogression of the gully slopes does occur then the offset between the gully headwalls and the toe of the wall could be reduced below the current minimum of approximately 3 m, leaving a minimal "buffer zone" between the gullies and the wall along with limited working space for any sort of repair and stabilization works. The consequences of possible destabilization of the wall under such conditions are partially mitigated by offset of the road from the wall due to the paved viewpoint area at the crest of the

wall and the traffic lanes of the highway along with the fact that this segment of Highway 40 is only open between June 15th and December 1st of each year.

The dry, rocky soils exposed in the gully headslopes would be very challenging to proactively erosion-protect. They are likely unsuitable for launched soil nails along with any sort of bioengineering treatment to try to vegetate the exposed soils.

The previously-recommended review of the design records for the wall in order to confirm that the proximity of the steep slope to the toe of the wall was accounted for in the stability calculations for the wall has not been performed. However, this does not seem to have been an issue since construction given that the wall continues to stand vertically with no visible signs of settlement or instability in the paved area adjacent to the crest of the wall.

RISK LEVEL

AMEC recommends the following Risk Level for this site, based on AT's general geohazard risk matrix:

- Probability Factor of 4, which is mid-way between a value of 3 (for an inactive hazard with occurrence or remobilization improbable) and 5 (for an inactive hazard with a remote probability of remobilization and a moderate level of uncertainty). This is a reduction from the value of 5 recommended after the 2005 inspection, based on the apparent little to no erosion and retrogression of the gully headwall adjacent to the toe of the slope between 2005 and 2009.
- Consequence Factor of 4 based on a scenario of gully headwall erosion destabilizing the wall, affecting the eastbound lane of the highway and requiring partial closure of the highway. The same value was recommended after the 2005 inspection.

Therefore, the recommended Risk Level for this site is 16, which is a reduction from the value of 20 after the 2005 inspection due to the reduction in the recommended Probability Factor.

RECOMMENDATIONS

Maintenance and Short Term Measures

Nothing recommended.

Long Term Measures

Periodic inspections of the gully headslope conditions and offset from the toe of the wall should be performed in the future, however an annual site inspection with the associated reporting under AT's GRMP is not warranted unless the site conditions worsen. Therefore, AMEC recommends that this site be included in the future Southern Region annual site inspection tours by AT and AMEC personnel, however starting with the 2010 inspection a field form be used to document the site conditions. The field form should include a schematic illustration of the relative position of the wall face and the gullies with space to record visual observations of the site conditions (including the offset between the gully headwalls and the wall toe). This form could be developed during the 2010 inspection.

As noted in the report on the 2005 inspection, if in the future a higher level of monitoring of the wall condition becomes necessary, it should be possible to install a series of survey targets on the wall face in order to monitor for and track changes in the wall face elevation and profile over 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:

Pete Barlow, M.Sc., P.Eng.
Principal Geotechnical Engineer

Attachments: Photos 1 to 3



Photo 1 (top) – June 2009

Facing westbound across the wall face, showing the relative position of the highway, wall and steep slope below the wall.



Photo 2 (bottom) – June 2009

Closer view, facing westbound, across the wall face below the highway.



Photo 3 – June 2009

Facing down from the crest of the wall, towards some of the erosion gullies in the slope below the wall. Note the position of the Highwood River channel visible in the right background.