

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, Rocky Creek, Hood Creek and Fortress Junction Cracking Sites
June 2009 Inspection Report**

This letter documents the June 2009 inspections of three sites along Highway 40:

- Rocky Creek crossing, located approximately 7 km north of the Fortress Junction service station.
- Fortress Junction Cracking site, located approximately 1 km south of the Fortress Junction service station.
- Hood Creek crossing, located south of the Fortress Junction Cracking site and approximately 3.3 km north of the junction between Highway 40 and Highway 742.

AMEC Earth & Environmental (AMEC), a division of AMEC Americas Limited, performed these inspections 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 inspections were 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 assessments of these sites 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:

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.

- Rocky Creek crossing – two hazards were identified: the potential for shifting of the creek channel away from the existing bridge crossing, and the potential for debris to block the creek channel at the former bridge site approximately 150 m upstream of the current Highway 40 bridge and a subsequent breaching of the dam sending a large volume of impounded water and debris flowing to the current bridge site.
- Fortress Junction Cracking site – possible slumping affecting an approximately 16 m long segment of the southbound lane.
- Hood Creek crossing – potential for debris to block the culvert, causing water and debris to impound on the upstream side of the highway.

The June 2009 inspections of these sites were recommended to AT as follow-ups to the 2005 inspections, given that the recommended Risk Levels based on the 2005 inspections were relatively high and the expectation that follow-up inspections in 2009 may provide a basis to reduce the recommended Risk Levels.

ROCKY CREEK

Site Observations

- The creek channel was still well-entrenched into the alluvial fan deposits at the time of the June 2009 inspection, with negligible amounts of channel shifting apparent since the 2005 inspection. Photos 1 and 2 show views of the creek channel upstream and downstream of the Highway 40 bridge from the June 2009 inspection.

Assessment

The assessment of little potential for unexpected or sudden shifting of the creek channel away from the bridge crossing from the 2005 inspection remains valid.

Risk Level

Note that the June 2009 site inspection did not include an inspection of the creek channel further up the watershed for signs of previous debris flows or channel blockages. Therefore, the recommended Risk Level of 24 with respect to potential channel blockage by debris and subsequent breaching upstream of the current bridge site cannot be confirmed or revised from the June 2009 observations.

Recommendations

No further work is recommended for the Rocky Creek site. If AT would like to confirm or revise the recommended Risk Level of 24 for potential channel blockage and subsequent breaching, then an inspection of the creek channel extending well upstream of the Highway 40 crossing should be performed in order to check the channel conditions and look for evidence of past debris flows. Please refer to the 2006 report on the Highway 40 corridor review for further details.

FORTRESS JUNCTION CRACKING SITE

Site Observations

- There was little to no change in the cracking and slight downdrop of the segment of the southbound lane that was noted during the 2005 inspection. Photos 3 and 4 show comparative views of the site from the 2005 and 2009 inspections.
- No additional cracking or other damage to the road surface was noted, nor any toe bulge or visible deformation of the embankment slope below the highway.

Assessment

The pattern and distribution of the cracking and downdrop of the road surface is still suggestive of slumping of a segment of the southbound lane. However, the damage to the road surface has not noticeably worsened since the 2005 inspection. Therefore, any slumping that may have caused the cracking and downdrop of the road surface does not appear to have been active between the 2005 and 2009 inspections.

Risk Level

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

- Probability Factor of 3 based on the inactive hazard, with occurrence or remobilization judged to be improbable.
- Consequence Factor of 4 based on the possibility that additional slumping of the area delineated by the cracks could require temporary closure and repair of the southbound lane of the highway.

Therefore, the recommended Risk Level for this site is 12, which is a reduction from the value of 20 recommended after the 2005 inspection.

Recommendations

No further inspections of this site are recommended, unless in the future AT or maintenance contractor personnel note additional damage to the road surface.

HOOD CREEK

Site Observations

- The creek channel upstream of the highway crossing was relatively clear of debris (Photo 5) and it did not appear that the “basin” upstream of the highway had refilled with rock and other debris since the large volume of debris was excavated out early in 2005.
- The culvert inlet was clear of debris at the time of the site inspection (Photo 6). There was some debris visible within the culvert, downstream of the inlet.
- The culvert outlet was approximately 1/3 full of debris at the time of the site inspection (Photo 7).

Assessment

For reference, at the time of the 2005 inspection, the culvert inlet and outlet were both approximately 50% blocked with debris and the culvert pipe was fully blocked with debris a few metres in from either end. The low volume of creek flow during the 2005 inspection was percolating through the debris in the culvert despite the debris blockage.

Assuming that the maintenance contractor did not take any special measures to clear the culvert itself of debris after the 2005 inspection, it appears that most of the debris that filled the culvert at the time of the 2005 inspection was somehow eroded away by creek flows between 2006 and 2009. During the same period only nominal amounts of additional debris accumulated along the channel immediately upstream of the culvert. Such “natural flushing” of the culvert was not expected and the recommendations from the 2005 inspection included clearing the existing culvert if possible and/or installing a second culvert to act as an “emergency drain” if the culvert blockage led to impounding of water upstream of the highway. It appears that this was not actually necessary.

Risk Level

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

- Probability Factor of 7 because debris buildup along the channel upstream of the highway is considered to be ongoing. This is a reduction from the value of 9 recommended after the 2005 inspection.
- Consequence Factor of 2 for a situation where the "basin" upstream of the highway becomes filled with a significant volume of debris again, possibly leading to the impounding of water and destabilization of the highway embankment and/or debris spilling onto the highway. This is a reduction from the value of 5 recommended after the 2005 inspection.

Therefore, the recommended Risk Level for this site is 14. This is a reduction from the Risk Level of 45 recommended after the 2005 inspection.

Recommendations

No further inspections of this site are recommended, unless in the future AT or maintenance contractor personnel note significant debris accumulation in the "basin" upstream of the culvert inlet.



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**

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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 7



Photo 1 (top) – June 2009

Rocky Creek

Facing downstream along the creek channel from the Highway 40 bridge. Note how the channel is well-entrenched in the alluvial fan deposits.



Photo 2 (bottom) – June 2009

Rocky Creek

Facing upstream along the creek channel from the Highway 40 bridge.



Photo 3 (top) – June 2009
Fortress Junction Road Cracking Site
Facing southbound across the settlement and cracking area in the southbound lane. The pattern of the cracking and downdrop is suggestive of slumping of a segment of the downslope lane, however when compared to Photo 4 from the 2005 inspection it does not appear that the damage to the road surface has worsened in recent years.



Photo 4 (bottom) – 2005
Fortress Junction Road Cracking Site
The same area as shown in Photo 3, as it appeared during the 2005 inspection.



**Photo 5 (top) – June 2009
Hood Creek**

Facing downstream towards the culvert inlet with Highway 40 visible in the background. A large volume of debris was excavated from this “basin” upstream of the culvert in 2005. It appears that relatively little additional debris has accumulated in this area since that time.



**Photo 6 (bottom) – June 2009
Hood Creek**

Closer view of the culvert inlet, which was clear of debris at the time of the June 2009 inspection. The inlet was approximately 50% blocked with debris at the time of the 2005 inspection, with the culvert pipe completely filled with debris a few metres in from the inlet.



Photo 7 (top) – June 2009

Hood Creek

Culvert outlet, which was approximately 1/3 blocked with debris at the time of the June 2009 inspection. The outlet was approximately 50% blocked with debris at the time of the 2005 inspection, with the culvert pipe completely filled with debris a few metres upstream from the outlet.