

August 20, 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 940, Wilkinson Creek Bridge Area
June 2009 Inspection Report**

This letter documents the June 2009 inspection of the Wilkinson Creek bridge area on the north end of Highway 940, approximately 13 km southbound along the highway from the Highway 40 / 940 / 541 junction at Highwood House, AB.

AMEC Earth & Environmental (AMEC), a division of AMEC Americas Limited, performed this inspection at the request of Alberta Transportation (AT) during the 2009 Southern Region annual site inspection tour as part of AT's Geohazard Risk Management Program (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, Mr. Neil Kjelland, P.Eng. and Mr. Rick Nash of AT.

BACKGROUND

The June 2009 site inspection was the first work for this site under AT's GRMP.

AMEC understands from AT that three times since 1996 the creek has flooded and washed out a segment of the highway approximately 100 to 200 m southbound from the bridge. Presumably these events occurred as a result of peak flows during spring runoff. It is not known if there is an established monitoring procedure for monitoring creek flow levels in order to determine if/when to proactively close this segment of the highway in anticipation of a washout, or if this is done simply by having personnel do to the site during times of high creek flow and visually assessing the site conditions. The washouts have been repaired by trucking suitable road fill material to site and rebuilding the washed-out segment of the road alignment after the peak flows in the creek have subsided. The typical duration of road closure due to the washouts and during repair is not known, but is presumably at least several days in order to

R:\Projects\Calgary Geo\CG25309 - AT Southern Region 2009\600 Reports\Annual 2009\Hwy 940 Wilkinson Creek Bridge\Hwy 940 Wilkinson Cr

bridge 2009.doc

allow time for the peak creek flows to subside and to reconstruct the road surface. It is understood that the washout and erosion have not approached the south bridge and abutment in the past.

SITE OBSERVATIONS

The key observations from the June 2009 inspection are summarized as follows:

- This segment of Highway 940 is a two lane, gravel surface road that is open between May 1st and November 30th of each year.
- The position and orientation of the highway and bridge crossing relative to the creek channel is illustrated on the airphoto attached as Figure 1. Please also refer to Figure 2 for a schematic site plan of the washout area a short distance southbound from the bridge.
- As shown on Figure 1, a greater than 1 km segment of the creek channel roughly centered around the bridge site flows relatively straight along a north/northeast bearing with the exception of a pronounced east to west channel meander starting roughly 150 to 170 m upstream (measured along the creek channel) of the bridge and rejoining the overall north/northeast bearing channel roughly 20 m downstream of the bridge. Upstream of this meander (southbound along the highway) the creek channel flows adjacent to the toe of the east valley slope. Downstream of this meander (northbound along the highway) the creek channel flows adjacent to the toe of the west valley slope.
- The highway southbound of the bridge consists of a relatively thin fill embankment constructed on the relatively flat creek floodplain on the valley floor. At the time of the June 10, 2009 site inspection, the water elevation in the creek was less than 1 m below the highway surface elevation.
- As shown on the schematic site plan on Figure 2, there is a low levee along the left bank of the creek that is prone to overtopping by high creek flows. The floodwaters are then able to flow along the east side of and then overtop the highway surface and continue to flow northwards along the floodplain on the west side of the highway to rejoin the main channel a short distance downstream of the bridge. In other words, peak creek flows overtop the left bank of the creek and cut-off the meander in the main channel that the highway bridge crosses.

ASSESSMENT

Based on the alignment and elevation of the highway on the south approach to the Wilkinson Creek bridge relative to the creek channel alignment and floodplain elevation, future washouts during peak flows along the creek are likely to occur in the same manner as the three reported washouts since 1996. The peak flows that could lead to future washouts will almost certainly occur during the May 1st to November 30th period that this segment of Highway 940 is open. However, the frequency, duration and timing of flows that are high enough to cause another washout will depend on the spring runoff conditions each year.

Based on the visual assessment of the site layout in June 2009, it does not appear that future washouts will lead to erosion of the south embankment or approach to the existing bridge. However, it is possible that natural shifting of the creek channel around the bridge site over time may change the extent of future washouts and increase the hazard of erosion of the south bridge abutment during a washout event. This could be checked in my detail with a hydrotechnical assessment of the creek channel at this site.

There is also the possibility that with time, the meander in the creek channel beneath the existing bridge will become cut-off and abandoned in favour of a new active channel through the washout area and that after a future washout a second bridge will be required to cross a new active channel south of the existing bridge. The potential for this to occur could also be checked during a hydrotechnical assessment of the creek channel.

RISK LEVEL

Based on AT's Risk Level Criteria, the recommended Risk Level for this site is as follows:

- Probability Factor of 9, considered appropriate for the known active hazard, i.e. flood flows in the creek have reportedly washed out the highway on three occasions since 1996. The number and frequency of washouts prior to 1996 is not known.
- Consequence Factor of 6 to reflect the closure of the highway with a significant detour required as a result of the hazard occurrence.

Therefore, the recommended Risk Level is 54

RECOMMENDATIONS

There are the following options to reduce the risk of future washouts along with possible erosion/undermining of the south abutment of the existing bridge:

1. Bank protection and channel training measures to reduce the risk of channel overtopping during high creek flows.

This option would require significant amounts of dyking and bank protection (bioengineering or otherwise), likely extending well upstream of the previous washout areas in order to reduce the chances of being outflanked by peak flows. This option would also entail significant regulatory hurdles for this scope of in-channel work along the fish-bearing creek that would likely also be considered a navigable waterway in a regulatory context. Overall, the cost, technical challenges and regulatory issues for this option likely far outweigh the benefits for this secondary highway in a relatively remote area of the province.

2. Realignment of this segment of Highway 940 along with repositioning of the bridge crossing to a more suitable location at less risk from future flood events and creek channel shifts.

This option would be difficult because of the position and orientation of the creek channel within the valley floor. The existing bridge is at the only location in this area where it is possible for the highway to make a perpendicular crossing of the creek channel.

A variation on this option would be to replace the existing bridge with a bridge having a longer span and higher deck elevation that could cross both the existing bridge site as well as the washout-prone segment of the highway south of the existing bridge or proactively installing a second bridge to span a future washout location if it can be determined with enough certainty based on a hydrotechnical review of the site. However, the cost for this option likely far outweighs the benefits for this secondary highway in a relatively remote area of the province.

3. Accept the risk of future washouts and possible erosion of the south abutment of the existing bridge and promptly repair them when they occur in the future.

This is judged to be the most practical and cost-effective option for this site. When the highway washes out again in the future, the segment of Highway 940 southbound from the Wilkinson Creek bridge can be accessed via a lengthy detour through Longview, AB and Highway 532. If this option is selected, the plans and procedures for monitoring creek flows and visually monitoring for impending washouts must be documented and

written into the maintenance contract for this segment of the highway in order to minimize the chances of motorists inadvertently driving into a washout.

AMEC recommends Option 3.

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: Figures 1 and 2
Photos 1 and 2