Klohn Crippen Berger

October 30, 2007

Alberta Infrastructure & Transportation
Central Region
#401, 4902 – 51 Street
Red Deer, Alberta
T4N 6K8

Ms. Alison Kerik Watts

Dear Ms. Kerik Watts:

Central Region GeoHazard Assessment
Site C42 SH579:02 West of Water Valley
October 2007 Site Assessment & Instrumentation Monitoring Report

Alberta Infrastructure & Transportation has initiated a process of risk management at specific geohazard sites that includes a document control system. This site assessment and instrumentation monitoring report forms Sections B and C of the document control system for the above site.

The site was inspected and the instruments were read on October 29, 2007 by Mr. Darren Ratcliffe, P.Eng. of Klohn Crippen Berger Ltd. (KCBL). The site is illustrated in the attached Figures and photographs.

This report was prepared by KCBL for Alberta Infrastructure & Transportation Central Region under Contract No. CE045/2004.

1. PROJECT BACKGROUND

The project site is located along Highway 579:02 approximately 4 km west of Water Valley, Alberta and about 300 m southeast of the bridge crossing over the Little Red Deer River. The highway has a northwest/southeast orientation at the project site and is located on a southwest facing valley above a tributary creek that flows into the Little Red Deer River as shown on Figure 1.

After a period of heavy rain in June 2005, landslide movement was evident along the south side of the highway affecting a section of highway approximately 60 m in length. It is understood that the eastbound lane of the highway settled by approximately 1.5 m.

An inspection of the site was performed on June 27, 2005 by AMEC Earth and Environmental (AMEC). At the time of the inspection, a semicircular scarp was

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observed to extend back to the centreline of the road. Prior to the June 27, 2005 inspection, the settled area of the highway had been backfilled with granular material by the local maintenance contractor. A second landslide area with potential to affect the highway was also noted by AMEC approximately 200 m northwest of the primary landslide.

Following the June 27, 2005 inspection, it is understood that an additional settlement of about 0.5 m occurred in the following week. Similarly, the area was backfilled with granular material. As a temporary measure, approximately 100 m of the eastbound lane was closed and the highway was rerouted to the north around the landslide area.

In the past, this section of Highway 579 was maintained by the Rocky View Municipal District (RVMD). AMEC noted that a previous landslide movement occurred around 1995 causing a major failure of the roadway in this location. At the time, the failed area of the road was excavated to several metres depth and a drainage blanket of granular material was placed at the base of the excavation. A drainage pipe, surrounded by rock and wrapped in filter cloth, was installed in a groundwater spring located at the base of the excavation. The road was then reconstructed. A french drain consisting of a perforated pipe was also installed in the north ditch.

In August and September 2005, AMEC conducted a topographic survey of the site as shown on Figure 1. The backslope above the highway is approximately 20 m high and has an inclination of about 3H:1V. The slope below the roadway is also about 20 m high, however the survey did not extend to the creek at the base of the slope.

In September-October 2005, a geotechnical investigation and an instrumentation program were implemented by AMEC. The program included four standpipe piezometers (2005-1, 2, 3 and 8), one pneumatic piezometer (2005-6) and two slope inclinometers (2005-5 & 7) in the main slide area. An additional standpipe piezometer (2005-4) was installed in the slide area to the west. The test hole and instrument locations are shown on Figure 1.

The geotechnical investigation revealed a layer of firm to stiff fill consisting of sand, silt, and clay about 6 m to 9 m thick. The fill was underlain by stiff to hard medium plasticity clay till overlying siltstone bedrock. The till varied in thickness from about 3 m to over 16 m thick. The stratigraphy is shown on the sections provided on Figures 2 and 3.

AMEC concluded that the landslide consisted of a rotational failure of the road fill embankment that extended into the native soil. It was suspected that that this movement occurred as a result of other rotational failures in the lower portion of the slope towards the tributary creek. The lower rotational failures appeared to be occurring in response to creek erosion at the toe of the slope and possibly groundwater discharge in the slope related to the significant precipitation in June 2005.

2. SITE OBSERVATIONS

A visual inspection of the site was conducted on October 29, 2007 by KCBL. Observations from the inspections are noted below and are illustrated in the attached photographs:

- No significant changes in the status of the slope were observed since the previous inspection on April 11, 2007.
- No cracking, settlement or other signs of movement in the highway surface or the gravel slope were observed.
- The highway surface is in a very poor condition. Pot holes and significant degradation of the asphalt pavement were noted.
- An erosion channel feature that had developed in the granular fill slope was noted in 2006. The channel was about 0.3 m to 0.5 m wide and about 0.3 m deep and extended from the crest of the slope to the toe in September 2006. The channel has now enlarged to about 1.0 m wide and about 0.5 m deep.

3. INSTRUMENT READINGS

The following data plots are provided for Section D of the document control system for slope inclinometers 2005-5 and 2005-7:

- Cumulative and incremental displacement in A direction on same page.
- Cumulative and incremental displacement in B direction on same page.
- Displacement – time plot showing zone of movement in A direction.
- Resolved single movement vector plots.

Comments on the inclinometer data are provided below:

SI 2005-5
Slope indicator 2005-5 is located on the north (backslope) side of the highway as shown on Figure 1. The October 2007 inclinometer readings indicate a downslope movement of approximately 2.5 mm at a depth of about 3 m below the road surface since October 2005. However, only 0.5 mm of movement has occurred since September 2006. Small, shallow movements less than 2 m deep were also observed downslope parallel to the highway alignment.

SI 2005-7
Slope indicator 2005-7 is located at the crest of the highway embankment as shown on Figure 1. The October 2007 inclinometer readings indicate a downslope movement of approximately 6.5 mm, at a depth of about 5 m below the road surface since October 2005, with an increase of 2 mm since April 2007. The current movement rate is approximately 3.6 mm/year. Small movement was also observed downslope parallel to the highway alignment.

The inclinometer plots are also reproduced on the section provided on Figure 2 with an interpretation of the movement zone.

The results from the piezometers are provided in the attached tables and plot. As shown the groundwater table varies from about 3 m to 12 m below the highway. No significant changes in water level have been observed over the past year.

4. INTERPRETATION

The current instrumentation readings suggest that only very small downslope movement continues at this site. The movement appears to be contained to the upper portion of the slope below the highway (less than 5 m depth).

Based on the risk level criteria provided by Alberta Infrastructure and Transportation relating to safety, a risk rating of 28 was assigned to this site. This is based on a probability factor of 7 for an active slide with very low rate of movement, and a consequence factor of 4 due to the potential partial closure of the road.

5. RECOMMENDATIONS

Based on the site observations, it would appear that the slope has stabilized at the present time and highway surfacing could be reinstated. It may not be possible to straighten the road alignment completely, as the gravel shoulder is not sufficiently wide. However, the area appears stable enough for the pavement to be extended onto the gravel zone. If the road alignment is straightened, it is recommended that instrument road boxes be raised to enable the continuation of instrument readings. The provision of a guardrail at the crest of the slope should be considered for traffic safety.

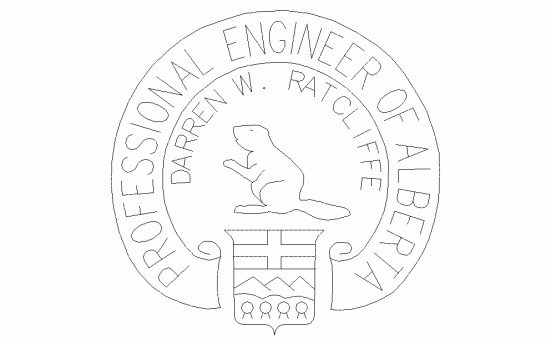
The erosion feature on the gravel slope should be protected with a buried 600 mm diameter HDPE half-pipe acting as a channel drain down the slope surface.

Instrumentation monitoring should continue at this site, particularly following heavy rainfall events.

Please contact the undersigned if you have any questions regarding this report.

Yours truly,

KLOHN CRIPPEN BERGER LTD.



Darren W. Ratcliffe, P.Eng.
Project Manager

APEGGA Permit to Practice No. 9196