

August 14, 2013

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

**Mr. Dennis Grace, P.Eng.  
Construction Engineer**

Dear Mr. Grace:

**Central Region Geohazard Assessment  
Site C42 H579:02 West of Water Valley  
2013 Site Inspection & Instrumentation Monitoring Report**

The above site was inspected and the slope inclinometer 2005-7 was read by Mr. Darren Ratcliffe, P.Eng, Mr. Peter Roy, EIT and Mr. Martin Lane, EIT of Klohn Crippen Berger Ltd. (KCB) on August 9, 2013. Inclinometer 2005-5 was unable to be located in the dense vegetation in the north ditch. The site is illustrated in the attached Figures. This report was prepared by KCB for Alberta Transportation Central Region under Contract No. CON0013499.

## **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 road 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 semi-circular scarp was 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 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 section provided on Figure 2.

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

Visual inspections of the site were conducted on August 9, 2013 by KCB. Observations from the inspections are noted below:

- The highway asphalt surfacing was reinstated in the summer of 2008, realigning the highway closer to its original configuration. The centre and shoulder lines were painted in 2009. The highway was in the process of being upgraded and repaved in June 2011. The highway alignment in the area of the slide remains unchanged from its 2008 configuration. No guardrail has been installed; however, an asphalt curb has been recently installed to reduce the runoff flow eroding the gravel.
- No cracking, settlement or other signs of movement in the highway surface or the gravel slope were observed.
- Erosion control matting was installed along the north ditch during the summer of 2011; the area is now well vegetated; however, SI 2005-5 could not be located.



*Inclinometer 2005-7 being read*



*North ditch*



*No cracking, settlement or other signs of movement in the highway or gravel slope observed*

### 3 INSTRUMENT READINGS

The following data plots are provided for Section D of the document control system for the slope inclinometer 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.

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. No discernible movement has occurred at this location since September 2006. This instrument could not be located in the dense vegetation at the time of the August 2013 inspection.

#### SI 2005-7

Slope indicator 2005-7 is located at the crest of the highway embankment as shown on Figure 1. The August 2013 inclinometer readings indicated a total downslope movement of approximately 23 mm, at a depth of about 5 m below the road surface since October 2005 and about 4 mm of movement in the past year.

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

The results from piezometer readings are provided in the attached tables and plot. As shown, the groundwater table typically varies from about 2 m to 14 m below the highway. Current groundwater levels have increased by 0.4 m from the level last year.

### 4 SITE ASSESSMENT

The current instrumentation readings indicate that small downslope movements continue at this site. The movement appears to be limited to the upper portion of the slope below the highway (less than 5 m depth). The increase in movement rate observed in slope inclinometer SI 2005-7 in 2013 can likely be attributed to high levels of precipitation in the spring of 2013. Although an increase in movement rate occurred in the spring of 2013, the actual magnitude of the movement rate and resulting displacement remain relatively low.

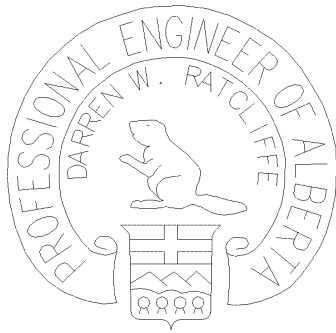
Based on the risk level criteria provided by Alberta Transportation relating to safety, a risk rating of 16 was assigned to this site. This is based on a probability factor of 4 for an active slide with low rate of movement, and a consequence factor of 4 due to the potential partial closure of the road.

## 5 RECOMMENDATIONS

Instrumentation monitoring should continue at this site on an annual basis or following heavy rainfall events. If movement rates at SI 2005-7 increase again in the spring of 2014, it is recommended that the instruments be read again in the fall of 2014.

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

Yours truly,  
**KLOHN CRIPPEN BERGER LTD.**



Darren Ratcliffe, P.Eng.  
Project Manager

APEGA Permit to Practice No. 9196