Klohn Crippen Berger

May 31, 2006

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

Mr. Alain Momedi, P.Eng.
Project Engineer

Dear Mr. Momedi:

Central Region GeoHazard Assessment Site C8
SH597:02 East of Blackfalds
May 2006 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 annual site assessment report forms Section B of the document control system for the above site.

The site was inspected on May 16, 2006 by Mr. Darren Ratcliffe, P.Eng. of Klohn Crippen Berger Ltd. Photographs from the inspection are attached. The instruments were also read as part of the inspection.

This report was prepared by Klohn Crippen Berger Ltd. for Alberta Infrastructure & Transportation Central Region under Contract No. CE045/2004.

1. PROJECT BACKGROUND

From Sta. 305+00 to 309+00 of SH597 (about 7 km east of Blackfalds), the grade line for the highway fill is set on a side hill crossing of a bowl shaped valley. A creek is located at the toe of the fill, which flows to the Red Deer River approximately 1 km away. Shortly after construction in 1977, settlement and pavement cracking was observed between Sta. 306+35 to 307+81. Further subsidence was observed in the ditch on the north side of the road in 1982. Instrumentation measurements indicated that the highway fill was failing along the bedrock contact and moving southwards towards the creek. Remedial works installed in 1983 included a key trench, a toe berm and horizontal drains.

From 1993 to 1996, about 100 mm to 150 mm of asphalt was added each year to maintain the road surface. Movements were typically noted following periods of heavy rain. In

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1996 to the east of the main embankment, a section of pavement about 50 m long was excavated to a depth of about 8 m. The excavation was backfilled with compacted pit run gravel, with a filter cloth and perforated pipe drainage system, which was overlain with compacted clay fill. A 3 m deep french drain about 200 m long was installed below the north ditch.

The highway was re-paved in 1998 and 2000. No movements were observed in the period 1996 to August 1999. In August 1999, following a heavy rainfall, significant cracking in the slope was observed and this was attributed to settlement of the fill placed in 1996. To confirm this theory, instrument installation was performed in 1999. A topographic survey of the site was also undertaken in September 2001.

The slide location, site plan, instrument locations and cross-section are illustrated on Figures 1 and 2. Note that no detailed information or construction drawings are available for the reconstruction work carried out at this site.

2. SITE OBSERVATIONS

A visual inspection of the site noted no cracking or displacement of the highway pavement. Similarly, no new cracks or significant widening of existing cracks was observed.

In total, three inclinometers (SI99-1 to 3) and two standpipe piezometers (SP99-4 & 5) were installed in 1999. No installation logs are available for the instruments. The instruments are as noted on the attached "Field Summary of Instrumentation Monitoring Form".

The following data plots are provided for Section D of the document control system for SI99-1, 99-2 and 99-3:

- 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
- Displacement – time plot showing zone of movement in B direction
- Resolved single movement vector plots.

Comments on the SI data are provided below:

SI 99-1
No movement in the reporting period. Total cumulative movement since November 1999 is less than 5 mm.

SI 99-2
Downslope movement has continued with approximately 10 mm of movement measured at the surface since October 2005. Total cumulative movement at the surface is approximately 110 mm downslope. Shear zones are apparent at about 6 m and 2 m, approximately corresponding to the base of the pit run gravel zone and overlying clay fill, respectively. Virtually, all of the recent movement is located in the upper material; however, there is some indication of continued movement in the lower zone. The 2006 reading shows that the rate of movement has returned to the rate observed in 2001-2005.

SI 99-3
Approximately 50 mm of downslope movement was recorded at the surface since October 2005. Total cumulative movement at the surface is approximately 350 mm of resolved movement downslope. Shear zones are located at approximately 2 m and 5 m below the surface of the slope with about 100 mm of total movement at the 5 m depth (no significant increase in movement in the last six months). Movements appear to coincide with the fill/native soil interface and drain locations. However, this instrument has reached the maximum measurable movement at the 5 m depth and can no longer be read without the risk of the probe jamming in the casing. This is therefore the last reading to be obtained in this instrument.

The results from the standpipe piezometers are provided in the Table below:

Piezometer	Ground Elevation (m)	Stick-Up (m)	Tip Depth (m)	Depth to Water (m) (BTOP)	Water Depth below ground (m)	Phreatic Surface Elevation (m)
SP 99-4	80.00	1.10	8	6.9	5.8	74.2
SP 99-5	77.50	1.05	6	4.9	3.8	73.7

The standpipe readings in the period 2000 to 2005 indicate a maximum variation in water level from 72.85 m to 75.07 m or 2.2 m. The latest readings show that groundwater levels have fallen by about 0.5 m to 0.9 m since the last readings in October 2005.

3. INTERPRETATION

It would appear that any movement that is occurring is confined to the south side of the highway. The current instrumentation readings suggest continued movement to the south, with a decrease in the rate of movement since 2005. This is likely related to the high precipitation levels experienced in 2005 resulting in high groundwater levels and softening of the upper layer of the fill.

The constructed remedial work section shown in Figure 2 is very approximate and is based on a sketch from Thurber Consultants Ltd. The movements in SI 99-2 and SI 99-3 would appear to be originating within the pit run gravel, although it is more likely that the movements are occurring at the fill/native soil interface. The water levels in the slope were consistent with the drains at the base of the gravel layer, but the groundwater levels have risen significantly.

Based on the risk level criteria provided by Alberta Infrastructure & Transportation, a risk rating of 27 has been assigned to this site. This is based on a probability factor of 9 for an active slide, and a consequence factor of 3 due to potential partial closure of the highway.

4. RECOMMENDATIONS

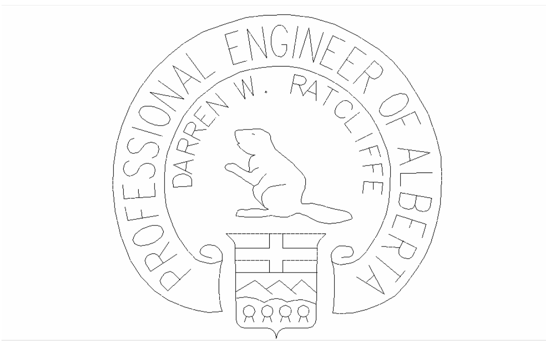
Although damage to the highway surface has not occurred recently, movements continue to occur on the downslope side of the highway. It is recommended that instrumentation monitoring of the remaining operational instruments should continue.

If any cracking becomes apparent in the slope or at the pavement level it is recommended that remedial action be taken. A possible stabilization method is to use launched soil nails as the movement occurs within the 6 m length of an individual nail. It is estimated that about 120 nails would be required in a 30 m by 15 m area at a total cost of about $75,000. No additional slope surface treatment would be undertaken.

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

FIELD SUMMARY OF INSTRUMENTATION MONITORING

SITE: C8
NAME: EAST OF BLACKFALDS
FILE: SH597:02

PROBE # 50302500-26237
DATAMATE # 50300940-6377

SI NUMBER	99-1	99-2	99-3				FIELD OBSERVATION
GND ELEV (m)	82.70	82.93	77.59				Elevations referenced to survey
STICK-UP (m)	0.85	0.98	0.48				performed in September 2001
PIPE INSTALLED (m)	15	13	13				
PIPE INSTALLED (ft)	49	42	42				
READING DEPTH (ft)	48	40	40				
AZIMUTH OF A+ GROOVE	N	S	S				
READING DATE	16-May-06	16-May-06	16-May-06				99-1 and 99-2 clear and free running
FILENAME	BF99-1	BF99-2	BF99-3				99-3 is blocked at shear plane
STANDPIPE PIEZOMETER	SP99-4	SP99-5					
GND ELEV (m)	80.00	77.50					
STICK-UP (m)	1.1	1.05					
PIPE INSTALLED (m)	8	6					
DEPTH TO WATER BTOP (m)	6.9	4.88					
DEPTH TO WATER BGL (m)	5.8	3.83					
WATER ELEVATION (m)	74.2	73.67					