KLOHN CRIPPEN

June 1, 2004

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

Mr. Melvin Mayfield, P.Eng.
Project Engineer

Dear Mr. Mayfield:

Central Region GeoHazard Assessment Site C2
SH575:04 Nacmine Slide
May 2004 Annual Inspection and Instrumentation Report

Alberta Transportation has initiated a process of risk management at specific geohazard sites that includes a 3-ring binder document control system. This Annual Inspection report forms Section B and C of the document control system for the above site. The annual site inspection was undertaken on May 18, 2004 by Mr. Darren Ratcliffe, P.Eng. of Klohn Crippen Consultants Ltd. Mr. Ratcliffe was accompanied by Mr. Roger Skirrow, P.Eng., and Mr. Melvin Mayfield, P.Eng., of Alberta Transportation. The instruments were read by Mr. Joel Hilderman, EIT, of Klohn Crippen Consultants Ltd. on May 14, 2004.

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

1. PROJECT BACKGROUND

The town of Nacmine is situated in the flood plain of the Red Deer River and has been the site of intense coal mining activity. Based on information provided by Alberta Transportation and EUB, a mine known as #1473 exists directly under the slide area. The mine plans indicate that some rooms were depillared, which is the removal of roof support to collapse the room, while some were not. The main shafts were also heavily timbered and likely remain open today. Secondary shafts and rooms that were not

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depillared are subject to collapse at any time. Based on a review of the coal seam records, it is inferred that the mine rooms are about 60 m below the road elevation or about elevation 630 m.

SH575 is located between the town and the valley slopes to the south. The slide area is located on the south side of SH575 and extends for a length of about 400 m (Sta. 33+600 – Sta. 34+000). The slide was first observed in 1991 and has required periodic removal of material from the south highway ditch. An estimated 1 m thickness of material per year was removed from the ditch in the early years, but this has steadily reduced to periodic cleaning only.

Conjectured reasons for the slope failure include the build up of water in and the collapse of underground mine workings resulting in settlement and lateral movement of the slope. This could have been initiated due to the side slope cut (about 6 m) in 1985 for construction of the new highway alignment.

The hillside stratigraphy consists of interbedded sands, silts, clays and clayshales with occasional coal seams overlying shale bedrock. The bedrock was located at depths below the slope varying from 15 m to 30 m and was observed to contain slickensided surfaces. Clays and clayshales were typically of medium to high plasticity.

The slide location, site plan, instrument location plan and cross sections are illustrated on Figures 1 to 3. The slide features are illustrated in the attached photographs.

2. SITE OBSERVATIONS

The landslide has had the following historically observed features:

1. Cracking and heaving pattern in the backslope ditch indicating that the toe of the slide was in the highway ditch.
2. Visible cracking and backscarps in the hills suggesting a complex slide with multiple slip surfaces.
3. No apparent distress or movement in the road pavement.

The valley slope area is well vegetated and comprises a series of benches. No springs or other seepages from the slope were noted. A series of what appeared to be subsidence cracks were observed in the upper part of the slide area (Figure 1). The age of the cracks was difficult to determine, however, not all were identified in the September 2001 survey. Based on the vegetation, it is estimated that they are a few years old.

The backslope of the ditch at the toe of the slope is showing signs of surficial cracking and slumping.

In total twelve inclinometers were installed in 1993-1994, designated as SI #1 to 12. SI's #1 to #8 sheared due to slope movements soon after installation at the depths shown on Figures 2 and 3. Three inclinometers located beside the highway (#9, #10 and #12) are still operational with locations as shown on Figure 1. The instruments were read on May 14, 2004 and the following observations were noted:

SI #9
Essentially no movement was observed in this reporting period. The total resolved deflection at the surface remains about 10 mm.

SI #10
No movement was observed in this reporting period. The total resolved deflection to the northeast at the surface remains about 30 mm.

SI #12
No movement was observed in the period since October 2003. The total resolved deflection to the northeast at the surface remains about 50 mm.

It should be noted that these instruments are located near the highway where significant movements have not occurred. Therefore, the instruments do not represent the behavior of the slope at higher levels where movements may still be active.

3. SLIDE ASSESSMENT

Based on a review of the site observations, the following assessment is provided:

- There is evidence of subsidence cracking in the slopes, possibly related to the collapse of old mine rooms. There is also extensive evidence of historic landslide activity in the valley slopes above highway level, but no indication that instability has occurred below the highway level.

- The movements to date in the inclinometers immediately adjacent to the highway have been relatively small and cannot be seen as a deflection in the highway alignment. Movements have occurred above the highway on the south side due most likely to the ditch excavation work in recent years. Despite the ditch cleaning, it would appear that the rate of slope movement at the toe has declined or ceased for the present.

- The toe section of the slope is showing signs of localized cracking and slumping that is likely related to seepage softening the steep lower zone of the slope.

- Based on the risk level criteria provided by Alberta Transportation, a risk rating of 28 has been assigned to this site. This is based on a probability factor of 7 for an inactive slide but with high uncertainty, and a consequence factor of 4 due to the height of the slope and the possible affect on the highway.

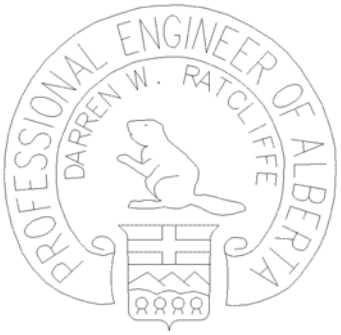
4. RECOMMENDATIONS

Due to the on-going slumping of the steep toe slope, it is recommended that the slope above the ditch be flattened by trimming the slope back to about the mid-point of the first bench. It should be noted that a power pole is located in this area and the clean up work of the slope and ditch should be performed appropriately to prevent the undermining of the pole. The waste material should be removed from the site and not placed anywhere on the slope above the trimmed area. After trimming, the ditch area should be monitored for movement.

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

Yours truly,

KLOHN CRIPPEN CONSULTANTS LTD.



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