May 24, 2001

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

Mr. Melvin Mayfield, P.Eng.
Construction Services Coordinator

Dear Mr. Mayfield:

Central Region Landslide Assessment Site C18
SH837:02 River Scour @ km 1.9
2001 Annual Inspection Report

Alberta Transportation has initiated a process of risk management at site-specific slope movement sites that includes a 3-ring binder document control system. This Annual Inspection report forms Section B of the document control system for the above site. The annual site inspection was undertaken on May 22, 2001 by Mr. Darren Ratcliffe, P.Eng. of Klohn Crippen Consultants Ltd. Mr. Ratcliffe was accompanied by Mr. Roger Skirrow, P.Eng., Mr. Fred Cheng, P.Eng., Mr. Melvin Mayfield, P.Eng., Mr. Frank Vidmar, Mr. Nelson Chipiuk and Mr. Stephan Zitterer of Alberta Transportation.

This report was prepared by Klohn Crippen Consultants Ltd. for Alberta Transportation Central Region under Contract No. CE053/2000.

1. PROJECT BACKGROUND

About 10 km northwest of Drumheller, SH837 was constructed at the base of the Red Deer River valley. The highway is primarily used by tourists in the summer as part of the "Dinosaur Trail" to access the Royal Tyrrell Museum of Paleontology, the Midlands Provincial Park and the surrounding Badlands area.

The highway is located at the toe of a steep valley slope (about 1.5H:1V) and for a length of about 860 m is directly adjacent to the Red Deer River. It is believed that the road was constructed on an original trail along a narrow terrace in the area and the surfacing was placed on native material. Drilling was performed in 1981 and indicated about 0.5 m to 5.5 m of medium to high plasticity clay (weathered bedrock) over sandstones and shales.

For this 860 m long section of the highway, the surfacing consisted of gravel and an oil-bound surface.

Over the last twenty years numerous proposals have been put forward to improve this highway to a minimum RCU 209 design standard. Due to the narrow terrace, various types of reinforced earth retaining walls or riprap protected granular fills pushed out into the river have been proposed. In 1988, it was agreed that it was unreasonable to spend the $1.0M to $1.5M required to carry out these measures and protect this section of highway. Instead, a 2.5 m deep ditch was proposed beside the road at the base of the hill, with a target for the riverside fill slopes towards the river set at 2H:1V. Guardrails were also proposed to be installed adjacent to the river. Although a nominal ditch was constructed at the toe of the valley slopes, no other improvement works were undertaken.

A study in 1992 recommended providing a 0.5 m minimum freeboard above the 1:100 year flood level (highwater elevation 688.6 m). The recommended bank protection measures using Class II rock riprap would cost about $700,000 for the 860 m long section. This section of road has washed away at least twice, most recently in either 1948 or 1951. Without the installation of protective measures at the toe of the slope, additional repair work should be expected in the future along this section of highway.

During the summer of 2000, Alberta Transportation noted an instability in the riverbank at about km 1.9 in the 860 m section adjacent to the river. The slide was observed for at least the first two weeks of July while highway patching work in the area was carried out. Deterioration in the condition of the slope following a period of rain was reported on July 14, 2000. A joint site inspection was undertaken on July 18, 2000 by Mr. Darren Ratcliffe, P.Eng., of Klohn Crippen Consultants Ltd. and by Mr. Lyle Newman and Mr. Frank Vidmar of Alberta Transportation to determine the nature and condition of the slide. Further deterioration of the slide area was subsequently reported to Klohn Crippen on July 25, 2000.

The slide material at the edge of the river appeared to consist of fine-grained, clay-rich soil-like material, most likely consisting of weathered bedrock material. The material was observed to be highly erodable and becomes very soft when wet. At about 0.9 m below the road level, a saturated sandy seam was observed in the scarp.

At this location, the highway pavement is 6.7 m wide and the scarp of the slip was about 0.8 m from the edge of the paved surface. By July 25, 2000 the scarp had further advanced towards the road and was 0.7 m from the edge of the pavement. The width of the slide at this point was about 4 m, however, cracking and evidence of slide/slumping activity extended for about 14 m. The road surface was about 7 m above river level. The existing riverbank slopes are typically very steep (about 1H:1V or steeper) and erosion of the toe of the riverbank by the river was ongoing.

Sloughing of the steep backslopes above the road was highly apparent. The road ditch on the west side of the road, at the toe of the backslope, had completely silted up at this location. It appeared that storm runoff was flowing across the road and down the slide zone towards the river. This flow of water was causing both erosion and softening/slumping of slope material. It appeared that a substantial portion of the material that would have comprised the original slope between the road and the river had been eroded away and thereby reduced the stability of the slope.

In the fall of 2000, the ditch on the west side of the road was excavated to a depth of about 0.5 m. Pit run gravel was placed in the scour zone by dumping over the edge of the scarp. No riprap was placed at the toe. Despite significant movement of the gravel out into the river, a shoulder of about 2 m wide has been formed at the road edge. This has significantly improved the safety of the highway.

The current features of the site are illustrated in Figure 1 and in the attached photographs.

2. SITE OBSERVATIONS

The slide is essentially unchanged from the previous visit on November 10, 2000, however additional minor cracks are forming at the crest of the riverbank and in the highway surface. The location of the cracks would tend to suggest that the near vertical bank that is located immediately to the north is becoming unstable.

3. SITE ASSESSMENT

Without any riprap at the toe of the slope it is uncertain how long the gravel will remain in place. There is also evidence of additional instability that may lead to a larger failed area.

Based on the risk level criteria provided by Alberta Transportation, a risk rating of 42 has been assigned to this site. This is based on a probability factor of 7 for an inactive slide but with a high probability of remobilization and a consequence factor of 6 as closure of the highway is possible following a heavy storm.

4. RECOMMENDATIONS

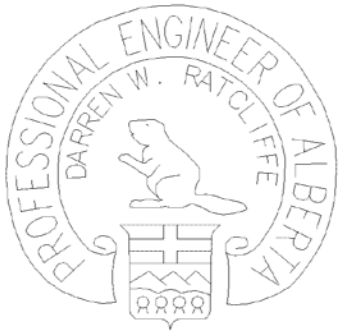
It is recommended that some form of stabilizing berm with Class II rock riprap or similar slope protection be placed along this section of highway. The construction should be carried out using compacted pit run gravel to reinstate the slope to about 2H:1V. The berm can comprise traditional Class II rock riprap or gabion baskets. To place the berm, a crane or similar equipment could be used to lower the rocks into place. The pit run gravel can be placed by dumping from the road edge and compacting in horizontal lifts with hand operated tampers or small compaction equipment if access is feasible.

It is expected that these measures would be constructed to repair specific instances of river scour along this length of highway. Based on the high cost to repair the whole length of the section, it is probably more cost effective to repair the critical erosion features as they occur. Based on previous reports, it is possible that a significant storm could wash out a significant section of road. If major repairs to the entire section are undertaken, the highway could be reconstructed to RCU 209 design standard with erosion protection.

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

Yours truly,

KLOHN CRIPPEN CONSULTANTS LTD.



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KLOHN-CRIPPEN CONSULTANTS LTD.
Signature _____
Date _____
PERMIT NUMBER: P 433
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Darren Ratcliffe, P.Eng.
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FIGURES