



**KLOHN CRIPPEN**

June 17, 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  
H734:12 Slide  
Geotechnical Inspection Report**

This callout geotechnical report was prepared by Klohn Crippen Consultants Ltd. for Alberta Transportation Central Region under the Geohazard Assessment Agreement CE045/2004. The site inspection was undertaken on June 16, 2004 by Mr. Darren Ratcliffe, P.Eng., of Klohn Crippen Consultants Ltd. Mr. Ratcliffe was accompanied by Mr. Melvin Mayfield, P.Eng. and Mr. Dean Scott of Alberta Transportation.

**1. PROJECT BACKGROUND**

The project site is located on Highway 734:12 about 3 km south of the junction with Highway 584, approximately 45 km west of Sundre, Alberta. At this location, the highway is located at the crest of the James River valley orientated in a north-south alignment. The legal description of the site is NE19-33-08-W5 with approximate NAD83 coordinates of E629,740 and N5,745,805.

The highway is a gravel road and would appear to service logging and oil field operations and a number of recreational campsites in the area. Very little traffic was observed during the inspection (less than 5 vehicles per hour). No details are available on the construction history of the road.

A previous site inspection was undertaken at this location on September 12, 2003. Following the inspection, three loads of pitrun gravel were placed in the “Slide 1” location to reinstate the shoulder.

The site is illustrated on the attached photographs and on Figure 1.

## 2. SITE OBSERVATIONS

At the time of the site inspection on June 16, 2004, the following observations were noted:

- Two (2) slides about 20 m apart are present on the east side along this stretch of highway. For descriptive purposes the north slide is termed “Slide 1” and the south slide is termed “Slide 2”. A ditch is present on the west side of the road. Significant deterioration of Slide 1 has occurred since the previous inspection in September 2003.
- “Slide 1” has a total width of about 30 m and extends back into the highway surface by about 2.5 m over a length of about 10 m. The slide is semi-circular in plan with a main backscarp of about 1.5 m. In general, the slide area was soft and wet and comprised gravelly clay.

A 600 mm diameter CSP culvert is located under the road at this location and the downstream end has been displaced downwards by the slope movement. Despite the culvert break, water is still flowing from the outlet. However, the source of the water is from within the slope as the upstream end of the culvert and ditch was dry. The flow of water from the culvert flows initially northwards along tension cracks and then eastwards down the slope towards the James River located about 100 m away with a vertical drop of about 20 m. Due to the vegetation, it was difficult to determine the steepness of the valley slope below the slide area.

A second culvert is located about 25 m north of the broken culvert. This was observed to be a 400 mm diameter CSP and was dry at the time of the inspection. A spring flow was observed from the slope below the culvert.

A partially buried 0.4 m diameter pipe was located in the slope between the two culverts. When the debris blocking the pipe was removed, a significant flow of water was released from the pipe. It is considered that this pipe may have been placed at the time of the highway construction to carry the spring flows out of the slope.

- “Slide 2” is located about 20 m south of the first slide and is about 20 m wide. The slide is semi-circular in plan with a 1.5 m high scarp about 3 m from the edge of the road. The slide extends for a length of about 10 m down the valley side and seepage flows were also observed exiting from the slide area. Similarly, the ditch on the west side of the road was dry.
- The extent of the vegetation in the slide areas was generally poor in terms of both grass and trees. In contrast, the vegetation was much thicker outside the slide areas. This would tend to imply that these areas have been active for a significant length of time and are associated with the observed springs in the slope.

### 3. SITE ASSESSMENT

It is considered that this length of highway was constructed very close to the edge of the river valley and was built over natural springs in the area. The spring flows have softened the clayey soil and this has resulted in a slope movement towards the river. At this time, one slide has progressed back into the highway surface. This slide has also displaced the downstream end of a culvert. Although groundwater is flowing from the culvert outlet, it is uncertain if ditch flows can still pass through the culvert without entering the fill.

The rate of slide progression has increased significantly in the last 6 to 9 months possibly due to the gravel placed at the top of the slide or increased pore pressures within the slope although some groundwater is exiting the slide area. The groundwater flow is also softening the area below the slide.

Based on the risk level criteria provided by Alberta Transportation relating to safety, a risk rating of 66 was assigned to this site. This is based on a probability factor of 11 for an active slide with increasing rate of movement, and a consequence factor of 6 due to the potential closure of the road.

### 4. RECOMMENDATIONS

Due to the slide encroaching well into the road and creating a significant hazard, it is considered that this site warrants remedial action. The intent of the remedial work is to do the following:

- (1) Replace damaged culvert and control groundwater flows with pipes carrying the flow further down the slope.
- (2) Rebuild the edge of the highway using reinforced gravel, limiting the load placed at the crest of the slide.
- (3) Extend the highway width away from the valley edge for a length of about 50 m.
- (4) Vegetate the downslope area.

The remediation recommendations are shown on Figures 2 and 3 and are described in detail in the following sections and in the attached Terms of Reference. Costs are estimated on the attached Bid Form.

#### Groundwater Control

For Slide 1, it is proposed to replace the damaged 600 mm diameter culvert with a new 600 mm diameter CSP culvert over the full width of the highway. Equally spaced across the slide area four 150 mm diameter perforated HDPE (“Big-O”) pipes in filter socks are proposed at a depth of about 2 m below the highway surface

and extending at least to the centerline of the highway. The discharge ends of the HDPE pipes are to be connected to flexible corrugated HDPE pipes at least 20 m long placed on the surface of the slope to discharge water away from the crest.

For Slide 2, it is proposed to install two similar perforated pipe drains.

#### Subgrade Reinforcement

The soft wet soil excavated to install the drains is unsuitable for re-use and will have to be wasted. To reconstruct the embankment, it is proposed to place and compact pit run gravel obtained from a local source. It is understood that there would be no cost for gravel supply except for loading, haul and placement. The gravel is to be reinforced with geo-grid material, extending the grid for the full width of the highway in the culvert replacement zone and to at least the centerline of the highway in the other drain locations. Geo-grid sheets would be placed at about 0.5 m vertical spacing as the gravel fill was raised. A geo-grid such as the LP20X, recently used in the Cream Coulee slide repair, would be suitable. Additional filter fabric is to be placed at all soil-gravel interfaces.

To minimize the load placed at the top of the slide area, a relatively steep slope of about 1H:1V from the highway edge is proposed. To mitigate any safety concerns, a 30 m length of guardrail is proposed at the highway edge.

#### Increasing Highway Width

It is considered that the present road alignment is very close to the edge of the valley slope. Space does exist to the west of the highway to permit local widening of the road by a distance of about 3 m over a length of about 50 m. Any organics would need to be stripped and the shoulder grade raised with compacted fill to match the highway. A layer of road gravel surfacing would be placed to create the highway surface.

#### Vegetation

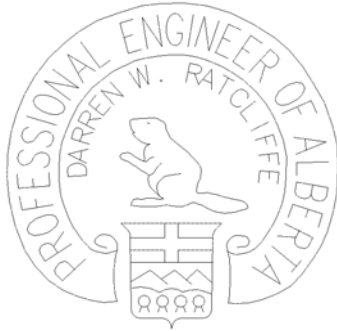
It is considered that live staking the area downslope of the slide with willow and poplar will help to increase the stability of the area. The stakes would be installed on a 1 m by 1 m grid and it is estimated that a total number of about 400 stakes are required.

It is estimated that the work would take about 3 days. As shown on the Bid Form, the estimated project cost is about \$39,000.

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

Yours truly,

**KLOHN CRIPPEN CONSULTANTS LTD.**



Darren Ratcliffe, P.Eng.  
Project Manager

Reviewed by Tom Murray, P.Eng.  
Manager, Geotechnical

APEGGA Permit to Practice No. 433

cc. Roger Skirrow, Alberta Transportation

## **FIGURES**