



**KLOHN CRIPPEN**

July 4, 2003

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 Landslide Assessment Site C3**  
**SH872:06 North of Battle River Crossing**  
**May 2003 Annual Inspection and Instrumentation 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, 2003 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 22, 2003.

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

**1. PROJECT BACKGROUND**

The slide is located on SH872 about 0.5 km north of the Battle River crossing and 10 km north of Brownfield. The slide was initially apparent as two “bumps” in the highway: the lower bump and bend in guardrail is at Sta. 37+290, and the upper bump at Sta. 37+410. Seven slope inclinometers were installed in 1992, six of which failed within three years. In 1998, the pavement was removed in the areas of distress and replaced with a dust abatement coating. Drainage measures, including 150 mm diameter perforated pipes,

were also installed at this time to intercept the groundwater. A speed restriction on the highway has been in effect since 1998.

The soil conditions were observed to be silty clay interbedded with sand over clayshale bedrock. The bedrock was observed to have bentonitic and sandstone layers. The instability appears to be caused by a mass movement towards the Battle River on a shear zone at the interface between clayshale bedrock and the overlying clay, ranging from 15 m to 5 m below the surface.

It is understood that this section of highway is scheduled for re-paving in 2003.

The slide location, site plan and cross-section are illustrated on Figures 1 and 2. The slide features are illustrated in the attached photographs.

## **2. SITE OBSERVATIONS**

At the time of this inspection, the guardrails on both sides of the highway were observed to have no noticeable deflections along their length. It is understood that in previous years the deflections of the guardrail were highly apparent and required adjustment on a regular basis. Two patches were placed in 2001, as shown on Figure 1, and are now showing signs of distress.

The ditch on the west side of the highway has been improved with a nylon mesh erosion protection fabric and a 150 mm diameter perforated pipe was installed with a maximum depth of 5 m in 1998. The perforated pipe is buried beneath the west ditch and daylights south of the culvert crossing. At the time of the inspection, a small flow of water was observed at the south end. The north end of the pipe is vented to atmosphere. On the east side of the highway, opposite the vented drain, another drain outlet was observed from a transverse 150 mm diameter perforated pipe across the highway.

A seepage area was observed to the northwest as shown on Figure 1. A small pond has formed above the ditch level from a spring in the slope and the water slowly flows to the culvert under the highway.

About 250 m to the north of the site shown on Figure 1, ponded water is present in the west highway ditch. The water flows east from the south end of the pond in a culvert under the highway. Although the flow is directed to the east, there maybe some contribution of water to the slide area via the regional water table.

A summary of the instrumentation at the site is provided in Table 1.

**Table 1 Instrumentation Summary**

ID	S/N	Ground Elevation (m)	Tip Elev (m)	Stick-up (m)	Date Installed	Current Piezometric Elevation (m)	Comments
<b>Slope Inclinometers</b>							
1		654.64	618.04	0.9	24-Sep-92	-	Sheared @ 9.5 m
2		649.60	634.40	1.2	24-Sep-92	-	Sheared @ 5.8 m
3		658.60	619.00	0.9	25-Sep-92	-	Sheared @ 12.0 m
4		653.41	619.91	0.9	26-Sep-92	-	Sheared @ 9.5 m
5		649.85	625.45	0.9	27-Sep-92	-	Ok, but stick-up now 0.3 m
6		648.79	633.59	1.0	28-Sep-92	-	Sheared @ 4.0 m
7		658.33	640.03	1.2	28-Sep-92	-	Sheared @ 13.0 m
8		658.13	635.0	0.61	14-Nov-00	-	Ok
9		656.68	636.6	0.61	13-Nov-00	-	Ok
10		653.12	636.1	0.61	14-Nov-00	-	Ok
<b>Pneumatic Piezometers</b>							
8A	15722	654.59	636.89	-	24-Sep-92	-	Destroyed
10A	15723	657.74	636.54	-	25-Sep-92	-	Destroyed
12A	15837	653.41	638.51	-	26-Sep-92	644.49	
15A	15845	648.71	636.51	-	27-Sep-92	-	Destroyed
<b>Standpipe Piezometers</b>							
8		654.59	636.59	0.69	24-Sep-92	-	Blocked
9		654.59	650.29	1.20	24-Sep-92	-	Blocked
10		657.74	652.44	0.80	26-Sep-92	-	Destroyed
11		657.85	648.94	1.10	26-Sep-92	-	Destroyed
12		653.52	638.32	1.20	26-Sep-92	650.73	
13		653.65	646.95	0.90	26-Sep-92	649.14	
14		648.61	644.51	1.00	27-Sep-92	-	Blocked
15		648.71	637.61	1.10	27-Sep-92	-	Blocked

Four inclinometers and five piezometers are still operational and provided the following data on May 22, 2003.

**SI #5**

A movement of about 10 mm to the south has occurred since November 2002. The total cumulative movement at the surface is now about 100 mm. The movement appears to be occurring at about 4 m depth.

**SI #8**

A movement of about 6 mm to the south has occurred over the last 12 months. The total cumulative movement at the surface is now about 20 mm. The movement appears to be occurring at the interface between the clayshale bedrock and the overlying clay at about 14 m depth.

**SI #9**

Movement of about 5 mm to the southeast has occurred over the last 12 months. The total cumulative movement at the surface is now about 35 mm. The movement appears to be occurring at the interface between the clayshale bedrock and the overlying clay at about 12 m depth.

**SI #10**

Movement of about 3 mm to the southeast has occurred over the last 12 months. The total cumulative movement at the surface is now about 30 mm. The movement appears to be occurring at the interface between the clayshale bedrock and the overlying clay at about 8 m depth.

The recorded water levels are consistent over the last few years and are generally lower than that observed in the early 1990's.

**3. SITE ASSESSMENT**

Although the alignment of the guardrails is unchanged, the instability in the area is still active but at a much reduced rate compared with the early 1990's. The direction of the slope movements for each of the inclinometers is shown on Figure 1. The general trend of movement is to the south or southeast (towards the Battle River), and appears to be concentrated on a near horizontal shear zone at about elevation 645 m as shown on Figure 2.

The reduction in movement rate is likely due to the effectiveness of the installed drainage system that has generally lowered the groundwater level. However, the area has not fully stabilized and the movements shown in the last data set are likely due to the recent increased precipitation. It would appear that although the installed drainage measures have had some effect, additional measures are required to stabilize the area.

Based on the risk level criteria provided by Alberta Transportation, a risk rating of 18 has been assigned to this site. This is based on a probability factor of 9 for an active slide but with slow rate of movement, and a consequence factor of 2 as closure of the highway is unlikely.

**4. RECOMMENDATIONS**

It is understood that Alberta Transportation has scheduled this highway section to be repaved in 2003. As the existing drain is already at 5 m below the surface, the likely most cost effective approach to improve the subsurface drainage system is to include an "L" shaped finger drain from the existing drain to pick up the spring at the north end of the site, as shown on Figure 3. The finger drain would comprise a similar 150 mm diameter perforated

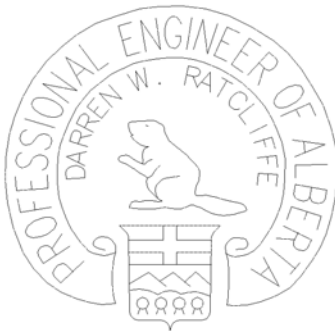
pipe in a gravel trench about 5 m deep. The final geometry and depth will need to be field fitted depending on the conditions encountered during construction.

As part of the 2003 construction work, the non-functioning instrumentation can be abandoned. The instruments to be removed are shown on Figure 3.

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

Yours truly,

**KLOHN CRIPPEN CONSULTANTS LTD.**



Darren Ratcliffe, P.Eng.  
Senior Geotechnical Engineer


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

APEGGA Permit to Practice No. 433



**CENTRAL REGION  
LANDSLIDE RISK ASSESMENT  
SITE INSPECTION FORM**

SITE NUMBER AND NAME <b>C3 H872:06 Battle River</b>		HIGHWAY & KM	PREVIOUS INSPECTION DATE May 23, 2002	INSPECTION DATE <b>May 22, 2003</b>
LEGAL DESCRIPTION SW 5-40-10-W4	NAD 83 COORDINATES N 5703250 E 376180		RISK ASSESMENT PF: 9 CF: 2 TOTAL: <b>18</b>	

SUMMARY OF SITE INSTRUMENTATION:  4 SI operational 2 standpipe piezometers 1 pneumatic piezometer  LAST READING DATE: May 22, 2003	INSPECTED BY:  
PRIMARY SITE ISSUE: Ground Movement, pavement distress	
APPROXIMATE DIMENSIONS:	
DATE OF ANY REMEDIAL ACTION:	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X				X
Slope Movement	X				X
Erosion					
Seepage					
Culvert Distress					

<b>COMMENTS</b>
Refer to inspection and instrumentation report and attached photos