



**ALBERTA TRANSPORTATION  
LANDSLIDE RISK ASSESSMENT**

**SECTION A: GEOTECHNICAL FILE REVIEW**

**NORTH CENTRAL REGION - ATHABASCA**

**SITE NC49: HWY 41:22 NORTH SASKATCHEWAN RIVER BRIDGE NORTH  
ABUTMENT (km 23.2), 4 km SOUTH OF ELK POINT**

Legal Location:	SE-25-56-7-W4M
Nearest Landmark:	NORTH SASKATCHEWAN RIVER BRIDGE, 4 KM SOUTH OF ELK POINT
Highway Control Section:	HWY 41:22
Date of Initial Observation:	2004
Date of Last Inspection:	N/A
Last Inspected By:	Thurber Engineering Ltd. (SI reading only)
Instruments Installed:	1 SLOPE INCLINOMETER (2004)
Instruments Operational:	1 Slope Inclinator
Risk Assessment:	N/A
Last Updated:	2009 – Thurber Engineering Ltd.

## **1. LOCATION**

The subject site is situated at the North Saskatchewan River bridge location on Highway 41:22 (at km 23.2), approximately 4 km south of Elk Point, Alberta.

## **2. GENERAL DESCRIPTION OF SLOPE INSTABILITY**

There are few specifics available regarding this site. The available information, (Drawing No. RD-04519-C, attached in Section G of the binder; a profile through the highway alignment) indicates that original highway was shifted to the west around 1983. The new highway alignment, therefore, required the construction of a replacement standard bridge crossing (BF 70318) at the North Saskatchewan River location. The height of the embankment approach fills ranged from 6 m to 15 m at the south and north abutment location, respectively.

The geotechnical investigation carried out by TRANS prior to 1983 indicated that the subsurface conditions at the south side of the bridge typically consisted of sand and gravelly clay materials. On the other hand, the subsurface conditions at the north side of the bridge crossing typically consisted of medium to high plastic clay layers (Drawing No. RD-04519-C, attached in Section G of the binder).

In July, 1987, erosion gully developed along the northeast ditch draining surface water towards the North Saskatchewan River. The erosion gully was about 0.5 m deep and 1.0 m wide. It was proposed to line the eroded portion of the ditch with Velmat F40B for erosion protection. A deep erosion gully was also noted along the southwest ditch draining surface water towards the North Saskatchewan River. The gully was noted to cut below some gabion size stone riprap at the toe of the slope. The eroded material was quite sandy. It was proposed to excavate and replace the existing eroded material in the gully with a compacted clay fill. Gabion mattress overlying the compacted clay was also recommended at this location.

In 2004, concerns were brought up regarding potential movement at the north abutment location. Therefore, a 30 m deep slope inclinometer was installed by A.D. Williams Engineering Inc. penetrating through the north abutment approach slab to monitor any potential movement. The site was then added to the North Central Instrumentation Monitoring Program in 2005. The Slope inclinometer has been monitored since 2005 once then a year in the fall season.

The continued monitoring of the slope inclinometer indicated the existence of a creep movement at the north abutment location. The creep rates, measured from the slope inclinometer in 2008, range from 0.7 mm/yr (over 19.2 m to 21.0 m depth) to 1.3 mm/yr (over 13.7m to 16.2 m depth). Based on the instrumentation monitoring results, it appears that the fill placed on the north valley slope to reach



the final design grade has caused continuing creep movements. The instrumentation monitoring results are included in Sections C and D of the binder.

### 3. GEOLOGICAL/GEOTECHNICAL CONDITIONS

**Physiographic Region:** Eastern Alberta Plains (Atlas of Alberta, University and Government of Alberta, 1969).

**Bedrock Geology:** The bedrock at the site is an Upper Cretaceous bedrock of the Lea Park Formation from the Mesozoic era; dark grey marine shale, pale grey, glauconitic, silty with ironstone concretions (Geological Map of Alberta, AGS, 1999). The bedrock elevation is about 475 meters (Bedrock Topography of Alberta, AGS, 1995).

**Surficial Geology:** The surficial geology consists of undivided fluvial deposits. The deposits consist of fine sand, silt, and clay with minor gravel beds and include local till and bedrock exposures. (Shetsen, 1983).

**Hydrogeology:** The Lea Park Formation bedrock would be limited to less than 0.1 L/s groundwater flow. However up to 1.6 L/s would be expected in the fluvial deposits overlying the bedrock shale (Hydrogeological Map Sand River Alberta, Alberta Research Council, 1979). Groundwater flow is expected to be towards the North Saskatchewan River.

**Stratigraphy:** There are no available records of any test holes drilled at this location, except for the widely spaced test holes drilled in the vicinity of the bridge for the purpose of highway realignment.

### 4. CHRONOLOGY

Limited background information is available regarding this site, but it is understood that major highway realignment took place around 1983. However, the underlying reasons for the realignment are not known.

#### 2004

Installation of a 30 m deep slope inclinometer took place by A.D. Williams Engineering Inc. due to raised concerns about movement at the north abutment location.



## 2005 - Present

The site was added to the North Central Instrumentation Monitoring Program in 2005. The Slope inclinometer has been monitored since then once a year in the fall season.

The Fall 2009 slope inclinometer readings indicate that the north head slope has continued to display creep movement. The creep rates range from 0.2 mm/yr (over 19.2 m to 21.0 m depth) to 0.4 mm/yr (over 13.7m to 16.2 m depth).



## REFERENCES

1. University and Government of Alberta, 1969. "Atlas of Alberta."
2. Alberta Geological Survey, Alberta Energy and Utilities Board, 1999. "Geological Map of Alberta." Map No. 236.
3. Alberta Geological Survey, Alberta Energy and Utilities Board, 1995. "Bedrock Topography of Alberta," Map No. 226.
4. Shetsen, I., 1990. "Quaternary Geology Central Alberta," Surficial Geology Map available from Alberta Geological Survey, Alberta Energy and Utilities Board.
5. Alberta Research Council, 1975. "Hydrogeological Map of Vermilion, Alberta," Report No. 75-5, taken from D.V. Currie, 1971, Hydrogeology.