

**THURBER ENGINEERING LTD.**

Suite 200, 9636 - 51st Avenue  
EDMONTON, Alberta T6E 6A5  
Phone (780) 438-1460  
Fax (780) 437-7125  
www.thurber.ca



**ALBERTA TRANSPORTATION  
LANDSLIDE RISK ASSESSMENT**

**SECTION A: GEOTECHNICAL FILE REVIEW**

**NORTH CENTRAL REGION**

**SITE NC32: NORTH OF TOMAHAWK**

LEGAL LOCATION:	<b>W13 &amp; E14-51-6-W5M</b>
NEAREST LANDMARK:	<b>1.6 KM NORTH OF TWP RD 512</b>
Highway Control Section:	<b>HWY 759:04 KM ~4.8</b>
Date of Initial Observation:	<b>1999/2000</b>
Date of Last Inspection:	<b>2003</b>
Last Inspected By:	<b>Thurber Engineering Ltd. (Thurber)</b>
Instruments Installed:	<b>None</b>
Instruments Operational:	<b>Not Applicable</b>
Risk Assessment:	<b>PF(12) · CF(3) = 36</b>
Last Updated:	<b>July 2004 – Thurber Engineering Ltd.</b>

## 1. LOCATION

The site is located along Hwy 759:04 on the west and east sides of the highway 1.6 km north of Twp Rd 512 near Tomahawk. A site location plan is provided as Figure NC32-1 in Section F.

## 2. GENERAL DESCRIPTION OF SLOPE INSTABILITY

The existing distressed area noted during a site visit by Thurber in 2003, is located in a portion of the highway that gently slopes down towards the north. The highway was constructed as a cut section in the south end of the area of concern, where there is a 4 m to 5 m high back slope on both sides of the road. The west back slope has a slope angle of about 3H:1V and the top part has slumped (in high plastic clay). This slump has no relation with the highway distress.

The failure area of the pavement is about 150 m long and there is a recent (Fall 2002) patched area about 80 m long that covers both lanes on the south part of the failure area. The patch extends further to the north by about 66 m but covering only the northbound lane (east side). Muskeg areas were noted adjacent to the highway at this location. Sketches showing the plan and profile of the slide area are provided in Section F. Selected photographs taken during the site reconnaissance are also included in Section F.

The cracking pattern indicates that two distinct slides are occurring; one at the south end affecting both traffic lanes (moving east) and the other at the north end affecting only the northbound lane (moving northeast). In addition, a fence on the east side of the highway has a segment that is bowed to the east at the area of the south end slide, likely indicating movement due to the slide activity.

Further south, adjacent to the recent patched area, there is an older patch that shows some cracks along the centre of the southbound lane (west side) located as shown in the figures in Section F. Although it is difficult to visually assess, it is possible that this area is moving towards the west, perhaps due to embankment fill spreading over the muskeg.

The most active area at the time of the 2003 site visit was the north end of the failure area which had 20 mm wide cracks and a differential drop of about 25 mm across the cracks. The south end failure cracks were about 2 mm wide and no significant differential height was noted; however, there is a dip on the pavement surface in this area.

The side slopes are typically about 5H:1V, but at the centre of the north end failure the slopes are steeper (up to about 4H:1V). The highway embankment height along the distressed area varies from 1.7 m to 3.2 m.

The surrounding natural soil at the location of the pavement distress is mainly muskeg with evidence of high water level and is likely overlying high plastic clay. It is likely that the pavement distress is resulting from failure within high plastic clay below the muskeg or within the muskeg (if left in place during construction). High pore pressures within the clay may also be contributing to the instability. Subsurface investigation and instrumentation monitoring would be required to confirm the failure mode.

Continuing movement of the roadway surface is expected to occur. High precipitation events and freezing conditions may accelerate the slope movement rate at this site.

### 3. GEOLOGICAL/GEOTECHNICAL CONDITIONS

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

**Bedrock Geology:** The bedrock at the site is sandstone, shale, and conglomerate and bentonitic shale, siliceous limestone, and thin coal of the Paleocene Paskapoo Formation.

**Surficial Geology:** The site is located in a fine-grained ice-contact lacustrine deposit. Surficial soils are expected to consist of sands, silts, and clays, and some clay tills less than 20 m thick.

**Hydrogeology:** The shallow sandstone bedrock at the site may be able to provide up to 2 L/s of groundwater flow. A nearby water well in NW14-51-06-W5M drilled to 30 m reported groundwater at approximately 26 m below ground surface. Groundwater flow directions are downward in this area with interpolated near-surface horizontal flow toward the Tomahawk Creek to the north and, on a larger scale, toward the North Saskatchewan River to the south.

**Stratigraphy:** No information available.

### 4. CHRONOLOGY

The background of the site was obtained from conversations with Mr. Daryl Phillips, Public Works, County of Parkland, and Mr. Brian Swan, MCI, Alberta Transportation (AT) and from a review of AT files for the site.

**1999/2000**

The shoulders on both sides failed and the County repaired the highway by removing the slumped material and rebuilding the slope and shoulders using pitrun gravel.

**2000/2001**

Additional settlement required patching in the area.

**2001**

In September, the maintenance of the highway was transferred to AT.

**2002**

Additional patching was carried out by AT in fall and cracking reappeared about one month later.

**2003**

Thurber performed an emergency callout site reconnaissance in March. Although no immediate measures were recommended at that time, alternates were presented for long-term stabilization. A copy of this report is included in Section E.

### REFERENCES

1. Thurber Engineering Ltd., March 26, 2003. "Emergency Call-out for Embankment Side Slope Failure Located on SH 759:02, 1.6 km North of Twp Rd 512, North of Tomahawk, Alberta." File 15-16-163
2. Alberta Research Council, 1990. "Quaternary Geology, Central Alberta."
3. Alberta Research Council, 1972. "Hydrogeology of the Wabamun Lake Area, Alberta." Report 72-8.
4. University and Government of Alberta, 1969. "Atlas of Alberta."
5. Department of Mines and Technical Surveys, Geological Survey of Canada, 1951. Map 1002A: "Geological Map of Alberta."