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THURBER

ALBERTA TRANSPORTATION LANDSLIDE RISK ASSESSMENT

SECTION A: GEOTECHNICAL FILE REVIEW

NORTH CENTRAL REGION

SITE NC33: SOUTH OF TOMAHAWK

LEGAL LOCATION:	**SW25 & SE26-50-6-W5M**
NEAREST LANDMARK:	**100m NORTH OF TWP RD 504**
Highway Control Section:	**HWY 759:02 KM ~15**
Date of Initial Observation:	**1999/2000**
Date of Last Inspection:	**2003**
Last Inspected By:	**Thurber Engineering Ltd. (Thurber)**
Instruments Installed:	**None**
Instruments Operational:	**Not Applicable**
Risk Assessment:	PF(12) · CF(3) = **36**
Last Updated:	July 2004 – Thurber Engineering Ltd.

1. LOCATION

The site is located along Hwy 759:02 on the west and east sides of the highway about 100 m north of Twp Rd 504 (south of Tomahawk). The site location is shown on Figure NC33-1, Section F.

2. GENERAL DESCRIPTION OF SLOPE INSTABILITY

The site was inspected by Thurber in 2003. The highway embankment at this site is up to approximately 2 m high with side slope angles of about 5H:1V. The highway embankment shows evidence that it is failing on both sides: the southbound lane (west side) is failing toward the west and northbound lane (east side) is failing towards the east. The failure is typical of a bearing capacity failure. 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 site has a history of instability going back to the 1980's. The settlement and cracking has been managed through excavation and replacement of muskeg beneath the highway and ongoing surface patching.

The southbound side is the most active area at present with an arc-shaped crack about 42 m long (Figure NC33-1) and 25 mm wide, with a differential drop of up to 90 mm. The west ditch is in a wet muskeg area and shows signs of being squeezed by the side slope failure. A slight heave of the ground surface was noted close to the east side of the west ditch which is a possible indication of the toe of the slide.

The northbound side is less active. The road pavement has a slight depression without any sharp drop. The old patch on the road surface has classic arc shape and discontinuous cracks (with no sharp drop) for a total length of approximately 60 m. Water is ponding at the toe of the northbound side slope at the location of the distressed pavement. The ditch feeds through a buried CSP at this location. Bulrushes are present in the area indicating the presence of near surface or high groundwater level. This is consistent with a muskeg area environment.

Based on site observations, the failure is likely shallow, consistent with a bearing capacity type failure due to weak foundation soils. The surrounding natural soil at the location of the pavement distress is mainly muskeg. The side slopes of the highway embankment are reasonable for the type of foundation material: gentle slopes at about 5H:1V.

The removal of muskeg from the embankment foundation may have not been deep enough to bring the highway embankment to a permanent equilibrium

condition or there is a possibility of an increased pore pressure or water level in the foundation due to poor drainage. On-going patching the pavement will increase the load causing the slope to continue to move. Subsurface investigation and instrumentation monitoring is required to confirm the failure mechanism.

Continued creep of the roadway surface is expected to occur. The current pavement drop on the southbound lane is likely to increase over time. High precipitation events and/or freeze/thaw action may re-activate slope movement on the northbound lane, increasing the cracking and the pavement dip.

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. Immediately to the south, in the North Saskatchewan River valley, the surficial geology is a stream and slopewash eroded deposit with soils consisting of exposed till and bedrock with local slump material.

Hydrogeology: The shallow sandstone bedrock at the site may be able to provide up to 2 L/s of groundwater flow. Groundwater is at approximate elevation 732 m and a nearby water well in NW25-50-06-W5M drilled to 33 m reported groundwater at approximately 3.8 m below ground surface. Groundwater flow directions are downward in this area with interpolated near-surface horizontal flow toward the North Saskatchewan River about 3 km to the south.

Stratigraphy: No information available.

4. CHRONOLOGY

The background of the site was obtained from conversations with Mr. Brian Swan and Mr. Wilf Cousineau, MCIs, Alberta Transportation (AT) and from a review of AT files for the site.

1977

The highway was constructed following the removal of about 1.2 m of muskeg.

1980s

An excavation was performed to remove all of the remaining muskeg along the route. Exact locations of the removal are unknown but muskeg depths of up to 5.8 m were reported. Backfill material consisted of pit run and lime and side ditches were cut into the muskeg.

PRIOR TO 2001

Continual settlement led to a side slope failure which was repaired by the County of Parkland. Several patches have been required in the past. The exact date and nature of theses repairs could not be confirmed by the County.

2001

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

2002

Patching of the southbound lane was carried out by AT in the fall.

2003

Thurber performed an emergency callout site reconnaissance in March. No immediate measures were recommended at that time although long-term remediation alternatives were given. A copy of the report is included in Section E.

REFERENCES

1. Thurber Engineering Ltd., March 31, 2003. "Emergency Call-out for Embankment Side Slope Failures Located on SH 759:02, 100 m North of Twp Rd 504, South of Tomahawk, AB." File 15-16-164.

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. Department of Mines and Technical Surveys, Geological Survey of Canada, 1951. Map 1002A: "Geological Map of Alberta."

5. University and Government of Alberta, 1969. "Atlas of Alberta."