GEOHAZARD ASSESSMENT PROGRAM

NORTH CENTRAL REGION – ATHABASCA

2010 INSPECTION

Government of Alberta ■ Transportation

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

Site Number	Location	Name	Hwy	km
NC 25	16 km east of Hwy 41:22 near the Town of Lindbergh	WEST LINDBERGH HILL SLIDE	646:04	16
Legal Description		**UTM Co-ordinates (NAD 83)**		
NW-27-56-5-W4M		12 N 5969352.8 E 522398.9		

	Date	PF	CF	Total
Previous Inspection:	June 22, 2009	9	2	18
Current Inspection:	May 25, 2010	9	2	18
Road AADT:	1280		**Year:**	2009
Inspected By:	Tarek Abdelaziz, Don Proudfoot (Thurber) Roger Skirrow, Neil Kjelland, Calvin Kissel, Arthur Kavoluk (TRANS)			
Report Attachments:	☑ Photographs ☑ Plans ☐ Maintenance Items			

Primary Site Issue:	Active slide movement on the north side slope causing distress of the highway roadway surface along the east and west bound lanes.	
Dimensions:	About 75 m along the highway and 80 m wide perpendicular to north edge of highway.	
Date of any remediation:	Construction of a tied-back concrete wall to retain the portion of the slide mass below and upslope of the highway along with minor earthwork (completed in July 2007). ACP overlay in late 2007.	
Maintenance:	In late 2009, gravel placed downslope of the wall to smooth out the differential drop in the side slope. Highway surface was not patched since 2007.	
Observations:	**Description**	**Worse?**
☑ Pavement Distress	Up to 100 mm dip in both highway lanes. A new 5-10 mm wide longitudinal crack was noted on the EBL to the west of the western limit of the patch, which is not considered to be slide related.	☐
☑ Slope Movement	10-25 mm wide diagonal reflective crack at the west limit of the slide. Settlement of gravel in contact with the wall at the downslope side by 150 mm between late 2009 and May 2010. New 10-15 mm long reflective crack on the EBL by the eastern limit of the slide. The headscarp developed downslope of the wall dropped by 100-200 mm between 2009 and 2010	☑
☐ Erosion		☐
☐ Seepage		☐
☐ Bridge/Culvert Distress		☐
☐ Other		☐

Instrumentation: (4SIs, 2SPs,6 VCs)

SI02-1, SI07-1, and SI07-3 showed no discernible movement. The rate of movement in SI07-2, located in one of the piles, was 6 mm/yr over 0 to 17.5 m depth. The majority of the load celsl indicated a reduction in the anchor loads by 3 to 7 kN.

Water levels remained relatively unchanged in the standpipe piezometers.

Assessment (Refer to attached Figure)**:**

The anchor design loads dropped by 15 to 30 % immediately after locking off the loads in 2007. The variation in loads afterwards remained negligible in the majority of monitored anchors, except for the readings from the load cells VC 1466 and 1467, installed at the west side of the slide, where the loads reduced by 6 to 9% between 2007 and 2010. Although the anchor design loads dropped by 15-30 % in 2007, the wall moved laterally by less than 0.05% of the wall height between late 2007 and May 2010.

The site observations and the instrument readings indicate that the highway conditions remained relatively unchanged since our 2008 site inspection visit and suggest that the pile wall has been effective in retaining the portion of the slide mass along the highway.

The fresh cracks along the wall face and downslope of the wall location suggest that the slide mass downslope of the wall has been active. The slide mass downslope of the wall will probably continue to move, and again will create a drop off at the wall face.

The cracks noted outside the western edge of the patched area are likely not slide-related cracks and are probably reflecting sub-grade or pavement structure issues.

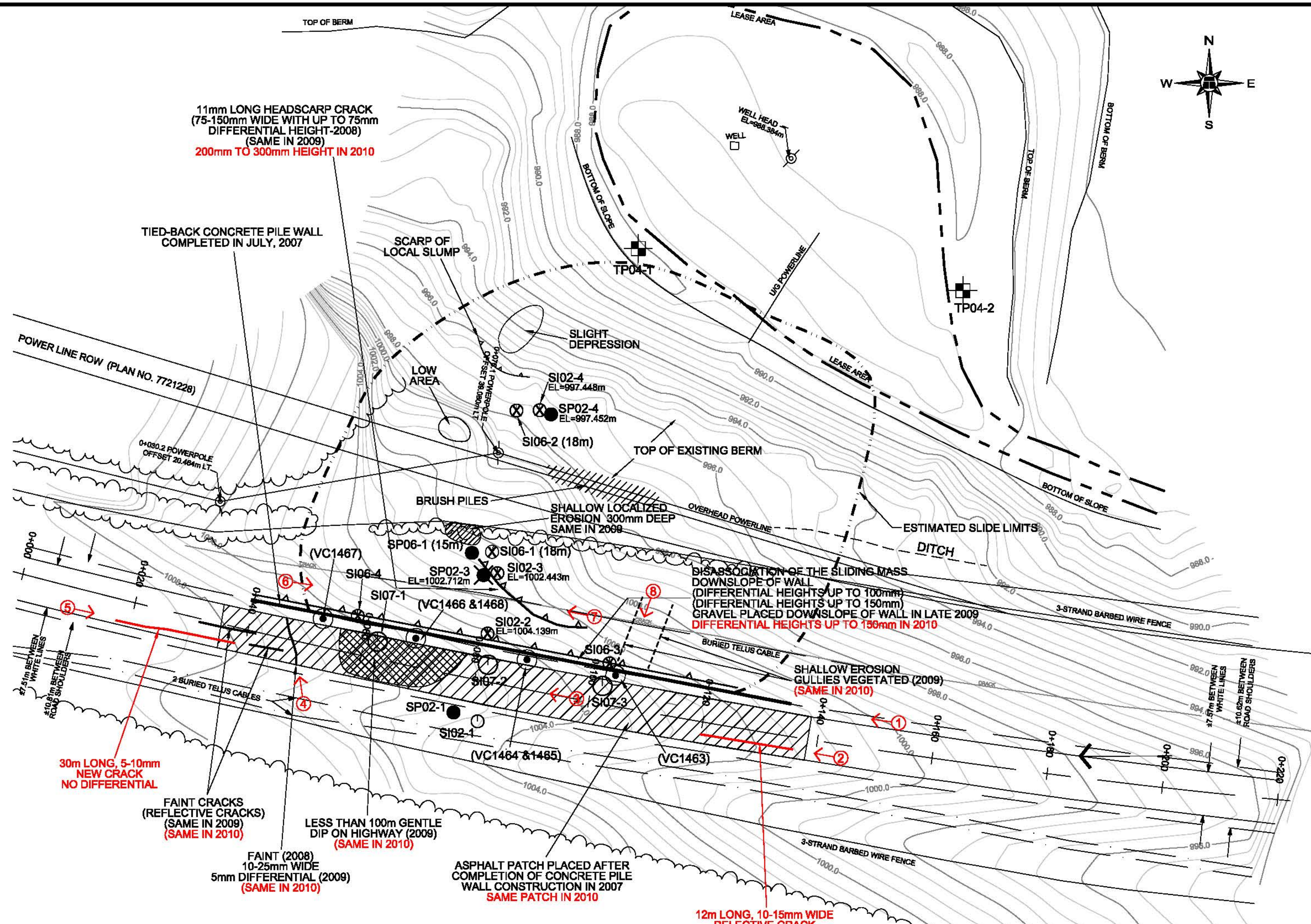
Recommendations:

In the short term, open cracks on the highway surface should be sealed to prevent the built up of excess pore water pressure on the wall. As a temporary measure, gravel may be used again to smooth the side slope at the contact between the wall and the downslope slide mass to protect potential runaway cars from the sharp drop along the face of the wall. In the longer term, and as previously recommended in the 2009 inspection report, a permanent solution would be to install a guardrail along the shoulder of the highway or construct a toe berm on the well pad to stabilize the downslope slide mass.

In the future, it may be required to re-stress the wall anchors, if the wall movement becomes intolerable. The decision to re-stress these anchors will be founded on the future instrument readings.

As discussed on site, this site will be removed from the Geohazard Visual Assessment Program. However, semi-annual instrumentation monitoring will be continued to appraise the ongoing effectiveness of the remedial measure. The local MCI should continue to monitor and record the development of any new cracks/depression on the highway surface and sideslope.

Z:\15\15-16-216\15-16-216_NC 25.dwg - 15-85-33-1 - Nov. 26, 2008 1:56 PM


TOP OF BERM
LEASE AREA
N
W
E
S
WELL HEAD EL=988.384m
WELL
BOTTOM OF SLOPE
BOTTOM OF BERM
TOP OF BERM
11mm LONG HEADSCARP CRACK (75-150mm WIDE WITH UP TO 75mm DIFFERENTIAL HEIGHT-2008) (SAME IN 2009)
200mm TO 300mm HEIGHT IN 2010
TIED-BACK CONCRETE PILE WALL COMPLETED IN JULY, 2007
SCARP OF LOCAL SLUMP
TP04-1
TP04-2
U/G POWERLINE
SLIGHT DEPRESSION
LOW AREA
POWER LINE ROW (PLAN NO. 7721228)
LEASE AREA
SI02-4 EL=997.448m
SP02-4 EL=997.452m
SI06-2 (18m)
TOP OF EXISTING BERM
0+030.2 POWERPOLE OFFSET 20.464m LT.
BRUSH PILES
SHALLOW LOCALIZED EROSION 300mm DEEP SAME IN 2009
OVERHEAD POWERLINE
BOTTOM OF SLOPE
ESTIMATED SLIDE LIMITS
DITCH
SP06-1 (15m)
SI06-1 (18m)
(VC1467)
SP02-3 EL=1002.712m
SI02-3 EL=1002.443m
SI06-4
SI07-1
(VC1466 &1468)
DISASSOCIATION OF THE SLIDING MASS DOWNSLOPE OF WALL (DIFFERENTIAL HEIGHTS UP TO 100mm) (DIFFERENTIAL HEIGHTS UP TO 150mm) GRAVEL PLACED DOWNSLOPE OF WALL IN LATE 2009
DIFFERENTIAL HEIGHTS UP TO 150mm IN 2010
3-STRAND BARBED WIRE FENCE
SI02-2 EL=1004.139m
BURIED TELUS CABLE
SI06-3
SHALLOW EROSION GULLIES VEGETATED (2009)
(SAME IN 2010)
SI07-2
SI07-3
2 BURIED TELUS CABLES
SP02-1
SI02-1
(VC1464 &1465)
(VC1463)
±7.51m BETWEEN WHITE LINES
±10.81m BETWEEN ROAD SHOULDERS
±7.57m BETWEEN WHITE LINES
±10.62m BETWEEN ROAD SHOULDERS
30m LONG, 5-10mm NEW CRACK NO DIFFERENTIAL
FAINT CRACKS (REFLECTIVE CRACKS) (SAME IN 2009)
(SAME IN 2010)
LESS THAN 100m GENTLE DIP ON HIGHWAY (2009)
(SAME IN 2010)
FAINT (2008) 10-25mm WIDE 5mm DIFFERENTIAL (2009)
(SAME IN 2010)
ASPHALT PATCH PLACED AFTER COMPLETION OF CONCRETE PILE WALL CONSTRUCTION IN 2007
SAME PATCH IN 2010
3-STRAND BARBED WIRE FENCE
12m LONG, 10-15mm WIDE RELECTIVE CRACK

LEGEND

- TEST PIT
- SLOPE INCLINOMETER (OPERATIONAL)
- STANDPIPE PIEZOMETER
- DAMAGED
- SI SLOPE INCLINOMETER (SHEARED OFF)
- LOAD CELL
- APPROXIMATE PHOTOGRAPH LOCATION AND DIRECTION (MAY 25, 2010)

NOTE: MAY 25, 2010 FEATURES SHOWN IN RED

BASE PLAN SURVEYED BY EXH ENGINEERING SCIENCES LTD.

THURBER PROJECT #15-16-246

ALBERTA TRANSPORTATION

NC25 - HWY 646:04 km 16 WEST LINDBERGH HILL SLIDE INSTRUMENT LOCATIONS AND SITE FEATURES (MAY 25, 2010)

LINDBERGH, AB NE 27-56-5-W4M

THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

ENGINEER:	DRAWN:	APPROVED:
TSA	HH	
DATE: MAY, 2010	SCALE: 1:750	DRAWING No. 15-16-246-NC25

Photo #1 General view of highway surface at slide location, looking west

Photo #2 10-15 mm wide reflective crack on the highway EBL, looking west

Photo #3 Looking west at the dip on the highway surface

Photo #4 10-25 mm wide open arc-shaped crack at the western limit of the slide, looking north

Photo #5 5-10mm wide open cracks outside the western limit of the patched area, looking east

Photo #6 Gravel fill placed along the wall face in late 2009, looking west

Photo #7 Active scarp crack downslope of the wall, looking west

Photo #8 Settlement of gravel in contact with the wall downslope face by up to 150 mm, looking south