

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – PEACE-HIGH LEVEL
2017 CALL OUT**



Site Number	Location	Name	Hwy	km
	Peace River East Hill	98 Street Intersection Slide	2:60	38.4
Legal Description		UTM Co-ordinates		
NW¼ 31-083-021 W5M		11U E 481671	N 6233044	

	Date	PF	CF	Total
Previous Inspection:				
Current Inspection:	6-June-2017	9	4	36
Road AADT:	2220		Year:	2016
Inspected By:	Rocky Wang, TRANS Ed Szmata, TRANS		Don Proudfoot, Thurber Shawn Russell, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input checked="" type="checkbox"/> Maintenance Items			

Primary Site Issue:	<p>A landslide in the sideslope of the 98 Street/Hwy 2:60 on-ramp (Photos 3, 5, 6, 7, 8 and 9). Cracks have developed along the backscarp of the landslide in the pavement of 98 Street at the intersection with the Hwy 2:60 on-ramp.</p> <p>The outlet of a 460mm diameter concrete drain pipe has become disconnected along the flank of the landslide with water now pouring onto the slope and a scour is forming below (Photos 17 and 18).</p>	
Dimensions:	The landslide is estimated to be about 30 m wide along the backscarp in the ACP on 98 Street and as wide as 70 m on the slope. It is estimated that the slip plane of the landslide could be as deep as 8 m based on the lateral extent of the landslide.	
Maintenance:	No maintenance has been performed recently at the site. The property belonging to Alberta Transportation at the toe of the slope was recently regraded with some environmental excavation work done to remediate some salt contamination.	
Observations:	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Cracks have formed in the ACP at about 9.5 m from the west side concrete curb at the island of the 98 Street and Hwy 2 on-ramp intersection (Photos 4, 5, 6). The cracks are open from 50 mm to 80 mm in width and a dip has formed	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	A landslide has developed at the intersection of the roadway embankment sideslopes of 98 Street and the Hwy 2:60 on-ramp. Cracks have recently developed in the ACP of 99 street above. Trees along the toe of the slope have distinct bends in the lower portions of their trunks (Photo 19).	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Erosion	An erosion gully has formed at the based of a dislocated 460mm concrete pipe, which is likely the outlet pipe for the catch basins in the roadway above (Photo 17).	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	Seepage, with water ponding, was noted at the toe of the slope below the landslide (Photos 10 to 16).	<input checked="" type="checkbox"/>

<input checked="" type="checkbox"/> Bridge/Culvert Distress	A 460 mm diameter concrete drain pipe is disconnected at about the mid-slope height along the west flank of the landslide (Photos 17 and 18).	<input checked="" type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>

Instrumentation:

A standpipe believed to be TH11-15, of the geotechnical investigation completed in 2011 for the twinning of Hwy 2 was found at the crest on the slope to the west 98 Street. No recent reading data for the standpipe was available. The test hole logs from the 2011 report indicated a water level of 7.78 m below ground surface on January 20, 2012.

Assessment:

It is likely that the landslide was triggered by a combination of the overall slope steepness (from 2.5H:1V to 3H:1V), slope height (8 m to 12 m), saturation of the material in the toe of the slope and a loss of some of buttressing material at the toe of the slope during the remediation excavation work. The soil conditions encountered in Test Holes TH11-15 and TH11-17, drilled by AECOM as part of the 2011 investigation of the twinning of Hwy 2:60, are shown on DWG. No. 13351-2:60-CALLOUT-3. It appears that the slip surface is located near or below the contact between the clay embankment fill and the underlying native high plastic clay. Silt, sand and gravel layers are present in the clay, which is underlain by sandstone and clay shale bedrock. The groundwater table is about 8 m to 10 m below the existing ground surface which corresponds to slightly above the toe of the highway embankment sideslopes. The standpipe in TH17-11 at the toe of the slope has a water level of 1m above ground surface, which could explain the seepage noted at the toe of the slope. The 2.6H:1V embankment slope is likely too steep for the relatively weak high plastic clay underlying it especially given the relatively high groundwater table in the area.

Recommendations:

Pending the beginning of the construction work for the twinning of Hwy 2, the maintenance Contractor and the MCI should regularly inspect the road to check for cracks and possible backscarp retrogression and patch the pavement when necessary to maintain a safe surface. If aggressive slide movements occur, the connecting road between 98 Street and the ramp might need to be closed.

Cost
Maintenance

The embankment fill for the new bridge alignment should adequately buttress the slide area, once constructed, and stop the sliding. The fill for the new highway embankment will should be placed first over the flat-lying graded area at the base of the slope and built gradually upwards in flat layers butting against the existing slope. Subdrains should be installed prior to placing the fill to drain the toe area of the slope. The separated drain pipe will also need to be extended through the new embankment fill. The outlet channel should be armoured with rip rap down to flat ground level. It is understood that a new roundabout will be built in the new WBL at the crest of the new fill slope. It is understood that the highway twinning and remedial measures will be designed by AECOM.

Hwy 2:60
Twinning
Construction



Photo 1.
Looking north along the top of bank west of 98 Street north of the Hwy 2:60 on-ramp. There is a distinct dip in the sideslope at the top of bank.



Photo 2.
Looking south along the sideslope at the standpipe at the top of bank downslope of 98 Street. The standpipe is likely from test hole No. TH11-15 that was drilled as part of the geotechnical investigation by AECOM performed for the twinning in 2011.



Photo 3.
Looking southeast towards the 98 Street/Hwy 2 on-ramp intersection. There is a distinct dip in the curb along the projection of the cracks observed in the pavement on 98 Street.



Photo 4.
Looking southeast along the cracks in the pavement at the 98 Street/Hwy 2 on-ramp intersection.



Photo 5.
Looking south from the median at the 98 Street/Hwy 2 on-ramp intersection. The cracks in the pavement (ACP) are open from 50mm to 80mm and there is a distinct dip in the pavement about 9.5m from the edge of the curb on the west side of 98 Street.



Photo 6.
Looking northeast towards the median at the 98 Street/Hwy 2 on-ramp intersection. The cracks in the ACP are open from 50mm to 80mm and there is a distinct dip in the ACP about 9.5m from the edge of the curb on the west side of 98 Street.



Photo 7.
Looking east from the Hwy 2 on-ramp sideslope about 120m to the west of 98 Street. There is a slump in the backslope immediately below the cracks in the ACP in the median.



Photo 8.
Looking east along the top of bank of the Hwy 2 on-ramp about 120m to the west of 98 Street. There is a slump in the backslope immediately below the cracks in the ACP in the median.



Photo 9.
Looking east along the top of bank of the Hwy 2 on-ramp about 90m west of 98 Street. There is a slump in the backslope immediately below the cracks in the ACP in the median.



Photo 10.
Looking north along the slope below 98 Street.



Photo 11.
Looking northwest from the 98 Street/Hwy 2:60 on-ramp shoulder towards the former Alberta Transportation yard that has been regraded as part of the salt contamination remediation in the spring of 2017.



Photo 12.
Looking northwest from the 98 Street/Hwy 2:60 on-ramp shoulder towards the former Alberta Transportation yard that has been regraded as part of the salt contamination remediation in the spring of 2017.



Photo 13.
Looking west along the sideslope of the 98 Street/Hwy 2:60 on-ramp. The embankment is about 13m in height



Photo 14.
Looking east along the toe of the slope of the Hwy 2:60 on-ramp. The slope is about 13m in height. There are signs of seeping, flowing and ponding water along the toe of the slope. This area was regraded as part of the salt contamination remediation in the spring of 2017.



Photo 15.
Looking northeast along the toe of the slope below the 98 Street/Hwy 2:60 on-ramp intersection. Some water has ponded at the toe possibly from the culvert discharge immediately upslope of the toe, as well as the seepage from the toe of the slope.



Photo 16.
Looking northwest from the crest of the slope above the slump in the sideslope.



Photo 17.
Looking south at the disconnected 460 mm OD drain pipe in the backslope below the 98 Street/Hwy 2:60 on-ramp intersection and the scour channel that has developed below.



Photo 18.

Looking northwest at the scour channel that has developed below the disconnected 460 mm OD concrete drain pipe in the backslope below the 98 Street/Hwy 2:60 on-ramp intersection.



Photo 19.
Looking at a bent tree trunk at the lower mid-slope in the area assessed to be within the landslide.



Photo 20.
Looking west from the toe of the slope west of 98 Street.