

**GEOHAZARD ASSESSMENT PROGRAM**  
**NORTH CENTRAL REGION – ATHABASCA**  
**2017 INSPECTION**



Site Number	Location	Name	Hwy	Km
NC 014-1	Northeast boundary of the Town of Fort Assiniboine	Fort Assiniboine	661:02	1.8
Legal Description		UTM Co-ordinates (NAD 83)		
NW-1-62-6-W5M		11 N 6023391	E	644779

	Date	PF	CF	Total
<b>Previous Inspection:</b>	May 18, 2016	8	4	32
<b>Current Inspection:</b>	May 17, 2017	8	4	32
<b>Road AADT:</b>	1000	<b>Year:</b>	2016	
<b>Inspected By:</b>	Tarek Abdelaziz, José Pineda (Thurber) Roger Skirrow, Arthur Kavulok (TRANS)			
<b>Report Attachments:</b>	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

<b>Primary Site Issue:</b>	Slope creep movements causing pavement distress to a side hill alignment due to seasonal high ground water levels
<b>Dimensions:</b>	About 250 m long
<b>Remediation</b>	None recently
<b>Maintenance:</b>	<p>Silt in Manholes 1 and 2 was hydrovaced from the interior of the CSP pipes. Highway cracks were spray patched in the fall 2014.</p> <p>Mr. Dale Kluin of the County Council provided the following information during the 2017 site visit:</p> <ul style="list-style-type: none"> <li>▪ Slope stability issues occurred during the construction of the highway in the 70's.</li> <li>▪ Two subdrain pipes were installed in the highway east ditch to reduce groundwater levels in the sandy soils. The subdrains were installed approximately 2.4 m below the ditch grade.</li> <li>▪ The subdrain system extends from Manhole MH4 located near the top of the hill to the existing creek near the bottom of the hill.</li> <li>▪ After the installation of the subdrain system, icing issues were noted in the highway ditch and its surface. The icing issue was believed to be in response to uncontrolled surface flow from the hill side towards the highway alignment.</li> <li>▪ Two manholes were constructed in the highway backslope to collect surface water from springs/natural drainage gullies. Each of the manholes was connected to a vertical CSP drop pipe filled with cobbles through a trench drain filled with rock. A trench drain filled with rock was also used to convey the flow from the vertical CSP drop pipe to the subdrain system in the ditch.</li> </ul> <p>Visual inspection of the drainage system during the 2017 site visit indicates the subdrain system consists of two 150 mm HDPE perforated pipes as observed from the inside of MH5 (cleanout manhole) and at the subdrain outlet locations.</p>

Observations:	Description	Worse?
<input checked="" type="checkbox"/> Pavement Distress	40 to 50 mm depression in the SBL of the Mid-Hill section; slight dip in the highway southbound lane behind the graben feature	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Mid-Hill slope section: 40 to 90 mm wide cracks with up to 40 mm differential height across cracks;	<input checked="" type="checkbox"/>
<input type="checkbox"/> Erosion		<input type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	<ul style="list-style-type: none"> <li>▪ <b>MH#1:</b> Water level measurement did not vary since 2016</li> <li>▪ <b>MH#2:</b> Heavily oxidized interior walls. Minor flow from one of the sub-horizontal drains</li> <li>▪ <b>Subdrain:</b> Water was flowing heavily at the subdrain outlet locations</li> </ul>	<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>
<input checked="" type="checkbox"/> Other	600 mm long x 300 mm wide 200 mm deep sinkhole in the highway ditch; 2.5 m long x 1.5 m wide x 0.2 m deep drop/settlement near the edge of the road; sag in the guardrail behind the graben feature located downslope of the highway to the north of the Mid-Hill section	<input type="checkbox"/>
<p><b>Instrumentation: (2SIs and 11 SPs)</b>  SI06-16 was sheared off at 7.8 m between the 2009 fall and the 2010 spring readings. SI06-15 has been blocked since 2007 and SI06-12 has been blocked since 2011.</p> <p>No discernable movement in SI06-6 and 06-11; groundwater levels fluctuated in most of the standpipes by +/-0.4 m; SP06-1 showed a decrease of 0.91 m and SP06-19-5 showed an increase of 0.84 m; SP06-19 continued to be dry.</p>		
<p>The site observations and historical instrument readings indicate that the slopes outside the Mid-Hill section of the hill continued to experience slow creep movements due to seasonal fluctuations in ground water levels.</p> <p>The Mid-Hill slope section continued to be active and is impacting the highway condition. The pavement distress within the Mill-Hill slope section created a rough ride to motorists.</p> <p>The local landslide located downslope of the highway to the north of the Mill-Hill slope section appears to be dormant. The existing dip in the highway SBL and the noted sag in the guardrail are probably a reflection of an old movement.</p> <p>The surface and subsurface drainage improvement measures installed above the highway surface during construction (i.e. subdrain pipes in the east ditch and CSP pipes and manholes above the highway surface) appear to have reduced groundwater levels and improved the stability of the hill. However, additional drainage improvement measures will likely need to be installed to further reduce groundwater levels and hence the movement rates.</p> <p>The presence of clear water in MH#1 indicates the effectiveness of the maintenance work completed in 2014. It is likely that the rock filled channel running downslope of MH#1 has been partially filled with silt, and hence slightly impeding free flow of water out of the manhole.</p> <p>Minor flow was noted from one of the sub-horizontal drains inside MH#2. The remaining sub-horizontal drains connected to MH#2 may have become completely plugged. MH#2 has no outflow pipe and the collected flow from the flowing sub-horizontal sub-drain is likely percolating into the ground.</p>		

**Recommendations:**

In the short term, it is recommended to seal all open cracks in the pavement to prevent surface water infiltration into the landslide cracks. A bump sign should be placed to the north of the Mid-Hill section dip area to warn motorists of the existing hazard. Consideration should be given for patching the Mid-Hill slope section to provide a smooth ride to travellers on the highway.

The existing sink hole in the ditch and the drop by the edge of the roadway should be backfilled with either gravel or clay.

In the long term, additional drainage improvement measures, such as deep drainage wells, will need to be installed above the highway to reduce ground water levels and further enhance the slope stability at this site. Detailed site survey and field slug tests were conducted as part of the preliminary engineering work that is being conducted to address ongoing movements at this site. Detailed long term remedial measures will be provided in the preliminary engineering report.