

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – PEACE-HIGH LEVEL
2018 CALL OUT**



Site Number	Location	Name	Hwy	km
PH031	Judah Hill	Michelin Slides	744:04	57.664
Legal Description		UTM Co-ordinates		
NE¼ 20-083-21 W5M		11V E 483226	N 6229678	

	Date	PF	CF	Total
Previous Inspection:	14-May-2018	17	6	100
Current Inspection:	30-Oct-2018	17	6	100
Road AADT:	540		Year:	2017
Inspected By:	Ed Szmata, TRANS		Shawn Russell, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

Primary Site Issue:	Slope instability affecting road and downslope area, including a 50 m wide slide at km 57.8 during the summer 1997. In 1997, the highway was shifted into the hill on a lightweight (shredded tire) embankment and the west side was buttressed with a tied-back pile wall. Further slide repairs using a shear key, toe buttress and light-weight shredded tire fill were carried out in 1998. Some continued cracking and movement noted at the south end of the site. Additional slope movement noted at north end of site, between the km 57.8 slide and the repairs conducted for the Makeout Slide. New slide movement noted on the east side of Hwy 744 towards the Heart River since 2014. Landslide activity now occurring in opposing directions, leaving the road on a narrow ridge.	
Dimensions:	km 57.8 slide – 50 m to 70 m wide. Slide movement now extending between Michelin and Makeout slides, suggesting a much larger slide zone possibly 500 m wide and extending downslope towards the Peace River. The backscarp of the slide in the Heart River Valley is about 120 m wide along the ATCO Gas pipeline right-of-way.	
Maintenance:	Highway was closed from May 2013 to December 2013 due to the Sunshine Landslide failure at km 58.2 and no maintenance has been performed since then other than ancillary work performed in the surrounding areas as part of Contract CON0015153, such as the regrading of the NBL ditch, the profiling of the inlet to the 2005 NBL ditch subdrain pipe and the grading of the landslide scarp feature below the 1997 pile wall below the SBL.	
Observations:	Description	Worsened?
<input checked="" type="checkbox"/> Pavement Distress	Cracking in the road at km 57.8 is slightly worse. A dip is present in the road at km 57.83, just north of cracking at km 57.8.	<input type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Growth and movement at the landslide through the ATCO R/W towards the Heart River.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Erosion		<input type="checkbox"/>
<input type="checkbox"/> Seepage		<input type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>

<input type="checkbox"/> Other		<input type="checkbox"/>
Instrumentation: Updated from Fall 2018 Readings		
	Installed at the toe of Michelin Slide repair.	
SI98-10i	Six distinct zones of movement identified, with incremental movement since Spring 2018 of up to 2.3 mm, annual rates of movement up to 5.6 mm/yr, which are similar to the last readings. The overall total cumulative movement of the SI casing is 265 mm since initialization in October 2000.	
SI94-43i	Installed approximately 450 m downslope of the road (slope distance) on the Peace River side, approximately 100 m below the level of the road. No change in incremental movement since Spring 2018, with about 52 mm of movement since initialization in October 2000.	
SI10-4 SI10-5 (Sheared at 2.1 m) SI10-6 (Sheared at 3 m)	Installed on the east side of highway (Heart River Side). Since their initialization (26 Mar 2010), there has only been small creep movement of about 5 mm from 6 m to 7 m depths noted in SI10-4, up to 226 mm of movement over the upper 12 m towards the Heart River in SI10-5 prior to it shearing off at 2.1 m and 238 mm of movement towards the Heart River noted in SI10-6 over the upper 6 m of the SI prior to shearing off at 3.0 m.	
SI10-7 SI10-8 (SAA) SI10-9	Installed at crest of slope, on the west side of the road (Peace River Valley). Since their initialization (26 March 2010), all three have exhibited downslope movement towards the Peace River. SI10-7 indicates 21 mm of movement at 2.5 m to 6.8 m depth, with 11.4 mm of movement at 8.6 m to 9.8 m depths, SI10-8, which has been replaced with a SAA since the fall of 2014, indicates 49.3 mm of movement at 13.9 m to 18.2 m depths and SI10-9 indicates a total cumulative creep movement of 3.9 mm at 6.5 m to 7.7 m depth with 21.6 mm of movement at 11.9 m to 14.4 m depth.	
PN10-4 PN10-6	There was 0.7 m of water above tip at PN10-4 in September of 2018 (a decrease of 0.05 m since the spring of 2018) and 2.14 m above the tip at PN10-6 (a 0.12 m increase since the spring of 2018). The corresponding groundwater levels below ground surface are 19.33 m and 8.06 m, respectively.	
PN10-5 (Blocked) PN10-7 PN10-8 PN10-9	4.8 m to 5.8 m of water above tips. Between no variation to -0.11 m of change from previous readings in the spring 2018. The groundwater levels were at 7.1 m to 12.7 m depth below ground in the spring of 2018.	
	Were installed nested in a single drill hole at 12 m and 18.1 m below ground surface respectively, near SI10-8(SAA) in June of 2017.	
VW17-1 VW17-2	There was no water measured above the tip at VW17-1 in September 2018 (a decrease of 1.55 m from the spring of 2018) while VW17-2 has not shown any signs of pore water pressure above the tip since its installation. The corresponding groundwater depth below ground surface for VW17-1 was 11.05 m.	
Assessment:		
Further rapid retrogression of the backscarp of the slide that is moving toward the Heart River indicates that the road is at risk from both eastward and westward movement. SI10-5 and SI10-6 indicate active movement towards the Heart River. As first mentioned in 2012, there is no room to move the road at this location and because of the severity and rapidity of movement, design for a pair of tied-together retaining walls should be conducted quickly to limit the extent of work required.		
ATCO have regularly reported that their natural gas line experiences some strain/stress by the Heart River side landslide activity and have now abandoned the line all together.		

Recommendations:

Cost

Long-term repair using ~ 230 m of tied back retaining walls.

Approximately 80 m would be required on the Heart River side and 150 m on the Peace River side, extending south from the km 58 wall. ~ \$ 13 million

An alternative option for consideration is to lower the highway grade starting south of the Heart River slides, through to north of the Michelin slides to unload the slide areas and provide more room for addressing the landslides at PH012 and PH031 with cheaper retaining walls. The trade off would be more grading and more pavement construction in order to reduce pile wall and soil nail costs.



Photo 1.
Looking northeast along the SBL guardrail of Hwy 744:04 from km 57.8 at the dip in the SBL immediately north of the 2015 realignment. No significant change since May 2018.



Photo 2.
Looking north from the centerline of Hwy 744:04 from km 57.81 at the dip in the SBL to the north of the 2015 realignment.



Photo 3.
Looking northeast from the top of scarp of the slide on the Heart River side along the former ATCO pipeline right-of-way. There has been some retrogression of the backscarp and the graben at the center of the slide has dropped since May 2018.



Photo 4.
Looking south at the south flank of the Heart River side slide from the former ATCO pipeline right-of-way. There has been some additional retrogression and soil loss along the backscarp since May 2018.



Photo 5.
Looking south at the south flank of the Heart River side slide from the former ATCO pipeline right-of-way. The scarp is 0.4m from SI10-04 and the drop along the scarp is at 4.5 m.



Photo 6.
Looking west from the former ATCO pipeline right-of-way towards the outlet of the 600 mm Diameter CPP and the dip in the SBL at km 57.825.

