

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION–GRANDE PRAIRIE
2020 INSPECTION REPORT**



THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
GP029	Saddle (Burnt) River Crossing North Valley Slope	RR771 Slide (Church Camp)	2:70	11.881
Legal Description		UTM Co-ordinates		
NW¼4-077-05-W6M		11U E 393076	N 6168469	

	Date	PF	CF	Total
Previous Inspection:	30-May-2019	11	6	66
Current Inspection:	28-May-2020	11	6	66
Road AADT:	3950		Year:	2019
Inspected by:	Ed Szmata, AT Rishi Adhikari, AT Graham Cooper, AT		Don Proudfoot, Thurber Nicole Wilder, Thurber	
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

Primary Site Issue:	<p>This section of Highway 2:70 is located adjacent to the crest of the valley slope on the west side of the Saddle (Burnt) River. The highway was widened further east in 2013 to accommodate the construction of a new northbound passing lane. A portion of the passing lane was likely constructed over the backscarp of an existing landslide on the west valley slope.</p> <p>River erosion at the toe of valley slope undermines the global stability of the overall valley slope in combination with artesian conditions observed to occur at this site.</p>		
Dimensions:	<p>The cracks observed on the ACP surface of the Hwy 2:70 indicated that the landslide backscarp extended beyond the SBL shoulder and into the drainage ditch. The lateral extent of the cracks observed in the ACP indicated that the affected area is about 240 m in width.</p>		
Maintenance:	<p>An ACP patch was placed in a small section of the SBL as well as a section of both NBLs over the previously distressed areas near the intersection between Highway 2:70 and Township Road 771 in 2019. It appears that some crack sealing was previously performed at the site.</p>		
Observations:	Description	Worsened?	
<input checked="" type="checkbox"/> Pavement Distress	Cracks are showing through the new patch they placed in 2019 with opening width up to 10 mm were observed on the shoulder of SBL. The scarp crack observed in the pavement extended 200 m further south through all lanes and into the east shoulder. The cracks in the east shoulder are about 20 mm in width. A crack extended about 50 m further south running parallel to a crack directly east of the crack extension. There is also a dip in the road that is evident when cars drive over the surface.	<input checked="" type="checkbox"/>	
<input checked="" type="checkbox"/> Slope Movement	The readings of the SIs installed in 2017 indicated the presence of a deep slip surface at a depth about 45 m below the existing ground surface. There was	<input checked="" type="checkbox"/>	

	also a movement zones observed between 17 m and 33 m depth below ground surface. Only SI17-5 did not show movement; however, this may be installed too shallow.	
<input type="checkbox"/> Erosion		<input type="checkbox"/>
<input checked="" type="checkbox"/> Seepage	Ponded water observed mid-slope northeast of SI-2.	<input checked="" type="checkbox"/>
<input type="checkbox"/> Bridge/Culvert Distress		<input type="checkbox"/>
<input type="checkbox"/> Other		<input type="checkbox"/>
Instrumentation:		
SI-1 (Destroyed)	Installed at about 20 m downslope (east) of Hwy 2:70 as a part of the 2007 geotechnical investigation program. This SI was likely destroyed during the construction of northbound climbing lane in 2013. Readings of this SI indicated a slip surface at an approximate elevation of 622.6 m (about 22 m below ground surface).	
SI-2	Installed about 60 m downslope of the Hwy 2:70 NBL at approximately the middle of the Saddle (Burnt) River west valley slope. This SI showed a rate of slope movement of: 8.0 mm/yr within depths from 6.4 m to 9.5 m below the existing ground surface since the Spring 2020 readings. A movement zone within depths of 34.4 m to 35.1 m showed no discernible movement.	
SI-3	Installed about 120 m downslope of the Hwy 2:70 NBL, approximately 20 m west of the crest of the top of bank of the lower terrace of the Saddle (Burnt) River. This SI showed a rate of movement of: 4.2 mm/yr within depths from 4.5 m to 7 m in spring 2020. The SI showed 1.1 mm/yr within depths of 9.4 m to 10.6 m in spring 2020. This SI was not read in Fall 2020 because it was frozen.	
PN-2	Installed at the same location as SI-2 with the tip at an elevation of 629.66 m 6.1 m below ground surface (B.G.S). A decrease in water level of approximately 0.5 m has been observed since the spring 2020. readings.	
PN-3	Installed at the same location as SI-3. Piezometer leads were damaged. The last water level measured in 2014 were at an elevation of about 626 m (approximately 5 m below ground surface).	
SI17-1	Installed about 12 m downslope of the Hwy 2:70 NBL, opposite of township Rd 771. This SI showed a rate of movement of: 4.1 mm/yr within depths from 25 m to 26.3 m. The SI showed a rate of movement of: 16.7 mm/yr within depths of 31.8 m to 33 m. However, this SI has since sheared off at 33.2 m below the ground surface.	
SI17-2	Installed about 55 m downslope of the Hwy 2:70 NBL and 43 m downslope of SI17-1. This SI showed a rate of movement of: 3.1 mm/yr within depths from 17.2 m to 19.7 m. The SI showed a zone of movement with rate of movement of 1.0 mm/yr within depths of 21.5 m and 23.3 m and showed a rate of movement of: 8.0 mm/yr within depths of 48.3 m to 50.8 m in spring 2020. However, this SI has since sheared off at 50.6 m below the ground surface.	
SI17-3	Installed about 137 m downslope of the Hwy 2:70 NBL and 75 m downslope of SI17-2. This SI showed a rate of movement of: 58.2 mm/yr within depths from 42.2 m to 44.6 m in Fall 2019; however, this SI has since sheared off at 43.6 m below the ground surface.	
SI17-4	Installed about 112 m downslope of the Hwy 2:70 NBL and 25 m north of SI-3. This SI showed a rate of movement of: 17.1 mm/yr within depths from 37.4 m to 39.2 m and a rate of movement of: 59.9 mm/yr	

	within depths of 43.5 m to 45.3 m in Fall 2018; however, this SI has since sheared off at 45.1 m below the ground surface.
SI17-5	Installed about 12 m west of Hwy 2:70 SBL and about 80 m upslope from SI-2. This SI has shown no discernable movement since installation.
PN17-1A PN17-1B	Installed at same location as SI17-1 with PN17-1A and PN17-1B tips are at elevations of 633.9 m and 610.5 m (11.7 m and 35.0 m B.G.S.), respectively. Both PN17-1A and PN17-1B are not functioning now.
PN17-2A PN17-2B PN17-2C	Installed at same location as SI17-2 with PN17-2A, PN17-2B and PN17-2C tips are at elevations of 628.4 m, 598.5 and 587.9 m (10.2 m, 40.1 m, and 50.8 m B.G.S.), respectively. PN17-2A showed a decrease in water level of 0.56 m, PN17-2B showed a decrease in water level of 0.28 m and PN17-2C showed a decrease in water level of 0.21 m since the spring 2020 readings.
PN17-3A PN17-3B PN17-3C	Installed at same location as SI17-3 with PN17-3A, PN17-3B and PN17-3C tips are at elevations of 603.8 m, 591.3 and 581.4 m (25.7 m, 38.2 m, and 48.1 m B.G.S.), respectively. PN17-3A has not been functioning since installation. PN17-3B and PN17-3C showed a decrease of 3.59 m and an increase of 0.42 m in water levels since the fall 2019 readings, respectively. These piezometers were frozen during the fall 2020 readings.
PN17-4A PN17-4B PN17-4C	Installed at same location as SI17-4 with PN17-4A, PN17-4B and PN17-4C tips are at elevations of 606.3 m, 590.9 and 582.7 m (24.9 m, 40.3 m, and 48.5 m B.G.S.), respectively. PN17-4A, PN17-4B and PN17-4C showed decreases of 0.50 m, 0.35 m and 3.38 m since the spring 2020 readings.
PN17-5A PN17-5B	Installed at same location as SI17-5 with PN17-5A and PN17-5B tips are at elevations of 633.2 m and 612.0 m (14.2 m and 35.4 m B.G.S.) respectively. PN17-5A and PN17-5B showed decreases in water levels of 0.35 and 0.49 m, respectively since the spring 2020 readings.
SP17-6	Installed in the farmers field about 125 m south of SI17-5 showed an increase of 0.70 m in water level since the spring 2020 readings.
<p>Assessment:</p> <p>Cracks on the ACP surface have been regularly observed and patched yearly since 2004. The distress and cracking of the pavement observed at the site since 2014 are likely the result of the widening of the roadway and the construction of pavement over the backscarp of the existing landslide.</p> <p>The depth of the slip surface previously observed in the slope inclinometer SI-1 was about 22 m below the existing ground surface, indicating that the landslide affecting the highway is a deep-seated slope failure. The new SIs installed on September 2017 indicated that the landslide failure plane is even deeper, at approximately 45 m depth. The cracks observed in the ACP indicated that the backscarp of the landslide extended into the drainage ditch beyond the SBL.</p> <p>The recently installed SIs confirmed that the landslide affecting the highway is in fact a deep-seated landslide; therefore, the most feasible mitigation measure is to realign the highway further west out of the landslide area. The conventional slope stabilization measures such as toe berms and pile walls are not feasible alternatives.</p> <p>A preliminary design for a highway re-alignment was carried out by Thurber and WSP to by-pass the affected area. The preliminary design was submitted to AT in July 2018.</p> <p>On July 24, 2018 a call-out was performed at this site as Mr. Ken Misik, AT's MCI for this area observed a pronounced dip at the inner wheel path of the road. A copy of the call-out letter dated August 16, 2018 is included in the site binder.</p>	

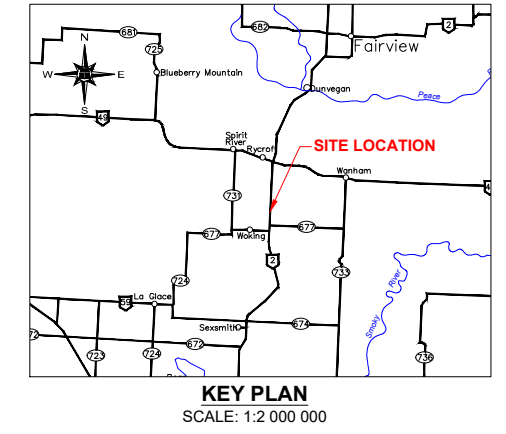
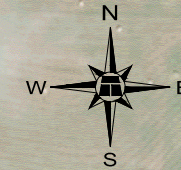
Currently, a detailed design for highway re-alignment is being carried out by Thurber and WSP, with an expected delivery date for the first quarter of next year. A key issue for the finalization of the detailed design is related to obtaining agreements for pipeline crossing and existing oil wells along the proposed re-alignment, in addition to the acquisition of additional ROW.

Recommendations:

Ballpark Cost


In the short term, the development of the cracks on in the ACP surface of the roadway should be regularly monitored. Cracks should be timely patched/sealed to prevent surface water infiltration into the landslide backscarp.

Monitoring



- LEGEND**
- ⊗ TEST HOLE FOR HIGHWAY REALIGNMENT
 - APPROXIMATE LOCATION OF INSTRUMENT
 - ⊕ APPROXIMATE LOCATION OF FORMER INSTRUMENT
 - ⊖ APPROXIMATE LOCATION OF FORMER TEST HOLE
 - SI SLOPE INCLINOMETER
 - PN PNEUMATIC PIEZOMETER
 - ▲ SCARP CRACK
 - CRACK
 - OP— OVERHEAD POWER LINE (APPROXIMATE)
 - G— GUARDRAIL (APPROXIMATE)
 - APPROXIMATE LOCATION OF ABANDONED WELL
 - BURIED TELUS CABLE (APPROXIMATE)
 - ①➔ DIRECTION AND NUMBER OF PHOTO

- NOTES :**
1. FEATURE LOCATIONS ARE APPROXIMATE
 2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
 3. MAY 28, 2020 FEATURES SHOWN IN RED
- 0 25 50 75 100 150 200 m
- SCALE 1:3000




PEACE REGION (GRANDE PRAIRIE)
GP29-1: HWY 2:70 RR771 SLIDE

2020 INSPECTION FIGURE

DWG No. 13353-GP29-1-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	RVC
SCALE	1:3000
DATE	DECEMBER 2020
FILE No.	13353



THURBER ENGINEERING LTD.



Photo 1.
Looking southwest from the SBL shoulder about 50 m north of the intersection between Hwy 2:70 and Township Road 771.



Photo 2.
Looking closer at cracks in northeast inner NB passing lane at cracks in ACP patch.



Photo 3.
Looking south
standing near
Township Road
771 looking at
crack in the SBL.



Photo 4.
Looking south at
the cracks in the
SBL shoulder just
south of Township
Road 771.



Photo 5.
New cracks
observed crossing
both NBL and
extending into the
shoulder.



Photo 6.
Looking north from
highway
embankment to the
east where scarp
crack was
observed.



Photo 7.
Looking east at low lying wet land area where water was ponded.



Photo 8.
New cracks observed crossing both NBL.