

**ALBERTA TRANSPORTATION
GEOHAZARD ASSESSMENT PROGRAM
PEACE REGION – GRANDE PRAIRIE DISTRICT
2018 INSPECTION**



Site Number	Location	Name	Hwy	km
GP06B	N of Grande Cache	Tear Drop Slides	40:36	21.8
Legal Description		UTM Co-ordinates (NAD 83)		
NW30-58-7-W6		11U N 5,990,745	E 366,610	

	Date	PF	CF	Total
Previous Inspection:	May 30, 2017	9	4	36
Current Inspection:	May 23, 2018	9	4	36
Road AADT:	980	Year:		2017
Inspected By:	Don Proudfoot, Nicole Wilder (Thurber) Ed Szmata, Rocky Wang, Dwayne Lowen (AT)			
Report Attachments:	<input checked="" type="checkbox"/> Photographs <input checked="" type="checkbox"/> Plans <input type="checkbox"/> Maintenance Items			

Primary Site Issue:	Landslide in a 20 m high, 2H:1V highway embankment fill.	
Dimensions:	About 170 m wide along highway, by ~40 m long from highway down to toe.	
Date of any remediation:		
Maintenance:		
Observations:	Description	Worse?
<input checked="" type="checkbox"/> Pavement Distress	Two scarp cracks (135 m long, and 30 m long) separated by about 25 m, run along the highway in both the southbound and northbound lanes and are likely linked as one larger slide, affecting an approximate total 190 m length of pavement. Three dips exist in the pavement on the east side of the scarp cracks; the dips appeared to be worst and more defined in 2018. The cracks in the road shoulder were 70-90 mm wide.	<input checked="" type="checkbox"/>
<input checked="" type="checkbox"/> Slope Movement	Slight creep movements continue downslope in the east embankment fill ~10 m deep near the outside shoulder. Three embankment fill slumps (11 m/8m/19m wide) exist downslope of the highway. There was also a 600mm drop backslope slump that was longer this year with an apparent bulge, near the south end of the pavement crack.	<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 June 22, 2018: Inclinometers SI-2 = 3 mm/yr @ 3 to 8 m depth. Piezometers PN-2 = 8.4 m BGS; PN-3 = 6.6 m BGS; PN-4 = 1.1 m Above GS.		
Assessment:		
Two obvious scarp cracks exist over a total of ~190 m length (separated by a distance of 25 m) of highway surface straddling both lanes. Dips/settlement exist at three locations on the downslope side of the scarp. At the south end, a scarp crack was identified, and would appear to form a natural progression of the south end of the slide zone.		

It was reported in 2016 that the slide has been exhibiting slow, creep movements for a long time. The single inclinometer record has been monitored semi-regularly since 1998, with no large movements recorded. The depth of movement is shown between 5 to 9 m at the downslope (east) shoulder. The crack length observed this year is around ~190 m in the pavement at 2 locations, similar to what was observed 2017 and the north boundary is not clear. Also, there are no operational instruments downslope of the road shoulder to identify the shape/depth of the slide. This adds some uncertainty to the size/shape of the slide affecting the highway.

There are also 3 relatively small embankment slumps downslope of the highway surface further south of the scarp crack and backslope scarp. Piezometer PN-4 indicated to have a pore pressure 1 m to 3 m above ground surface over the last year, and a trace of seepage was observed from the scarp crack in the highway during a previous inspection. Therefore, these slumps are anticipated to be separate, shallow fill instabilities caused by previous groundwater seepage (no seepage observed this year) and have self-healed due to lack of activity, but they (especially the south one) may possibly be linked and form part of the larger slide in the pavement.

The slide affecting the pavement is probably the result of an overly steep (2H:1V) fill, aggravated by groundwater seepage. The slide also appears to be moving relatively slowly, based on the information above, and that there has been no significant recent patching.

Recommendations:

Investigation:

The old SI's were located on a previous visit and most were broken and are no longer being read. It would be beneficial for AT to try to locate the borehole logs and previous readings for these to help identify the soil conditions and depths of potential movement. If these can not be located, some additional boreholes should be drilled and instruments installed to provide information on the soil and groundwater conditions at this location, and to confirm slope stabilization design measures.

Maintenance:

Perform crack filling, milling, ACP levelling patches of the pavement if required at the two slide areas to remedy the cracking and settlement as required.

Short Term:

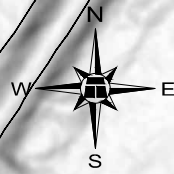
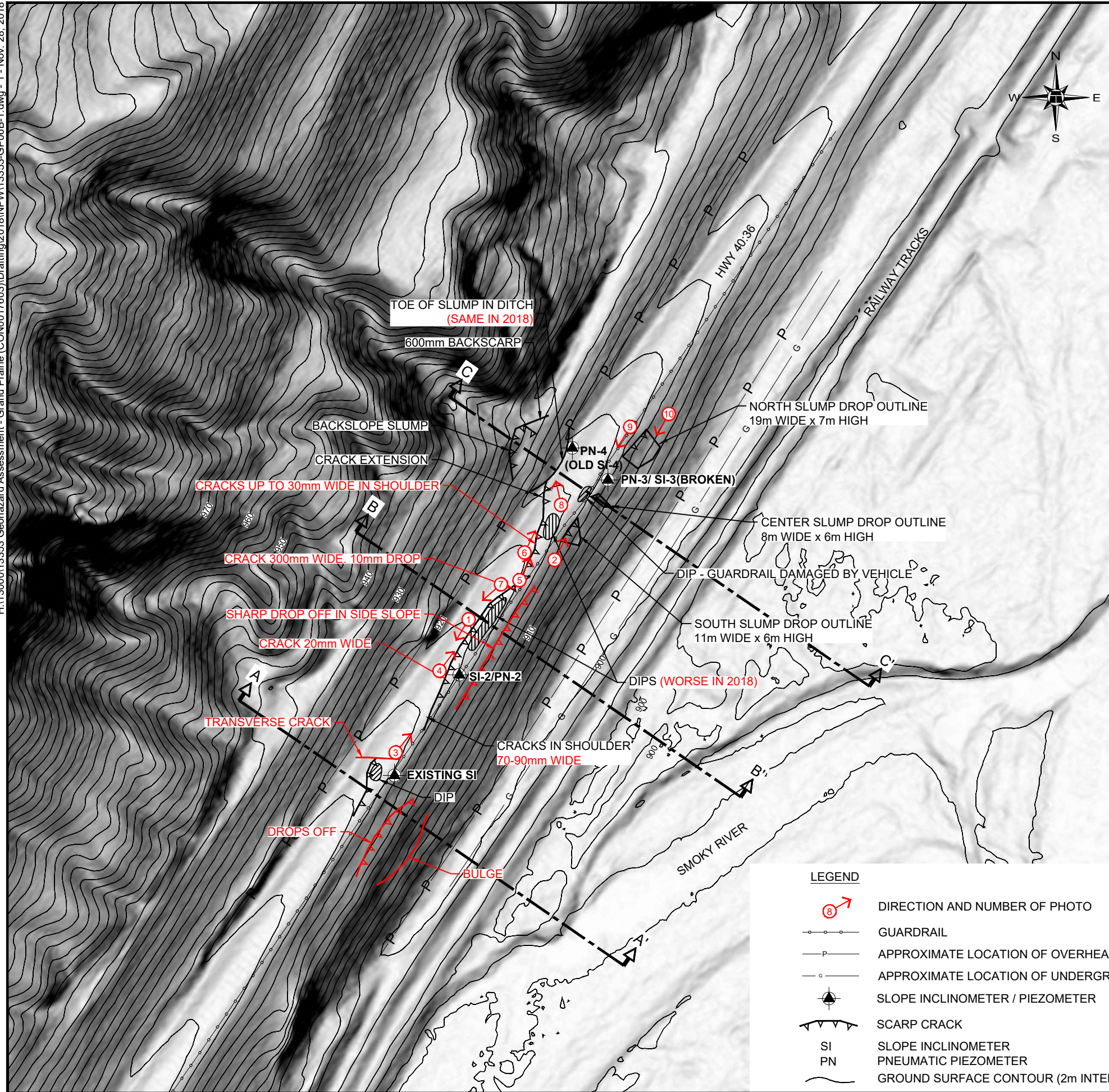
Continue monitoring the instruments and visually monitor both slides and the embankment fill slumps for progression of slide movements. The boundary of the slide scarp in the pavement needs to be more completely delineated (to see if the two cracks are joined), and whether the backslope scarp, or possibly some of the 3 downslope embankment slumps are also linked and form part of one larger slide.

Medium to Long Term:

Depending on the results of the boreholes and instruments, potential repair options might consist of:

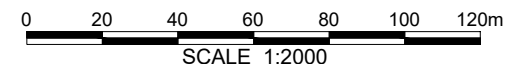
1. Horizontal drains (install with an air track drill).
2. Slope flattening with additional fill, and possibly a toe berm if room permits in front of the railway tracks (the existing ROW location must be checked). A multi-strand powerline and underground gas line exist between the embankment slope and tracks, which will need to be considered.
3. Lower the highway grade. A temporary detour could be located on the upslope side of the highway (a single strand power line exists there).
4. Pile wall.

H:113000113353 Geohazard Assessment - Grand Prairie (CON0017603) Drafting\2018\NPW\13353-GP06B-1.dwg - 1 - Nov. 28, 2018



KEY MAP
SCALE 1:30 000

- NOTES :**
1. FEATURE LOCATIONS ARE APPROXIMATE
 2. PREVIOUS OBSERVATIONS SHOWN IN BLACK
 3. MAY 23, 2018 FEATURES SHOWN IN RED



LIDAR PROVIDED BY ALBERTA TRANSPORTATION ;
ESRI IMAGERY FROM ESRI WORLD IMAGERY (DOWNLOADED 2016-12-23)

LEGEND

	DIRECTION AND NUMBER OF PHOTO
	GUARDRAIL
	APPROXIMATE LOCATION OF OVERHEAD POWER LINE
	APPROXIMATE LOCATION OF UNDERGROUND GAS LINE
	SLOPE INCLINOMETER / PIEZOMETER
	SCARP CRACK
SI	SLOPE INCLINOMETER
PN	PNEUMATIC PIEZOMETER
	GROUND SURFACE CONTOUR (2m INTERVAL)

PEACE REGION (GRANDE PRAIRIE)
GP06B-1: HWY 40:36 TEAR DROP SLIDES

2018 INSPECTION PLAN

DWG No. 13353-GP06B-1-1

DRAWN BY	ML
DESIGNED BY	NPW
APPROVED BY	DWP
SCALE	1:2000
DATE	NOVEMBER 2018
FILE No.	13353

THURBER ENGINEERING LTD.

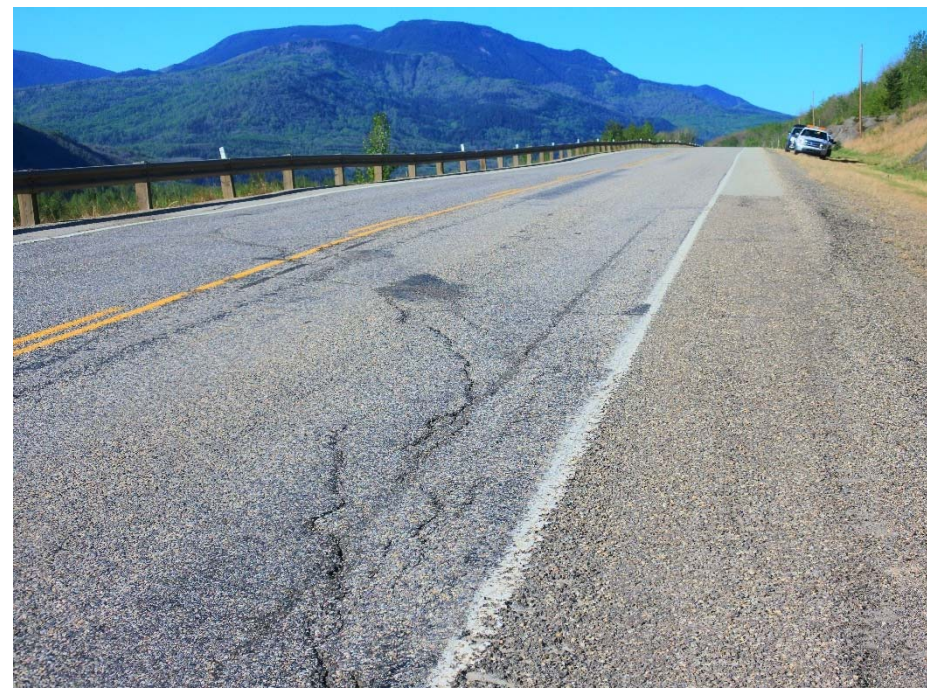


Photo 1.
Looking south along the northbound lane towards the south end of the site. Note the dip in the highway at this location.

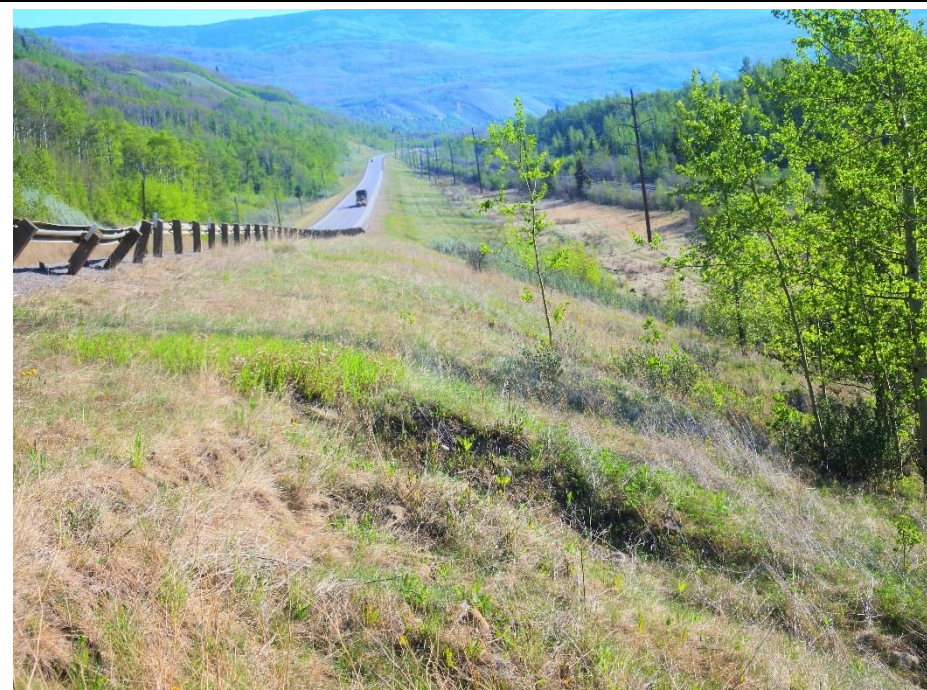


Photo 2.
Looking north along the east embankment at the South Teardrop embankment slump.

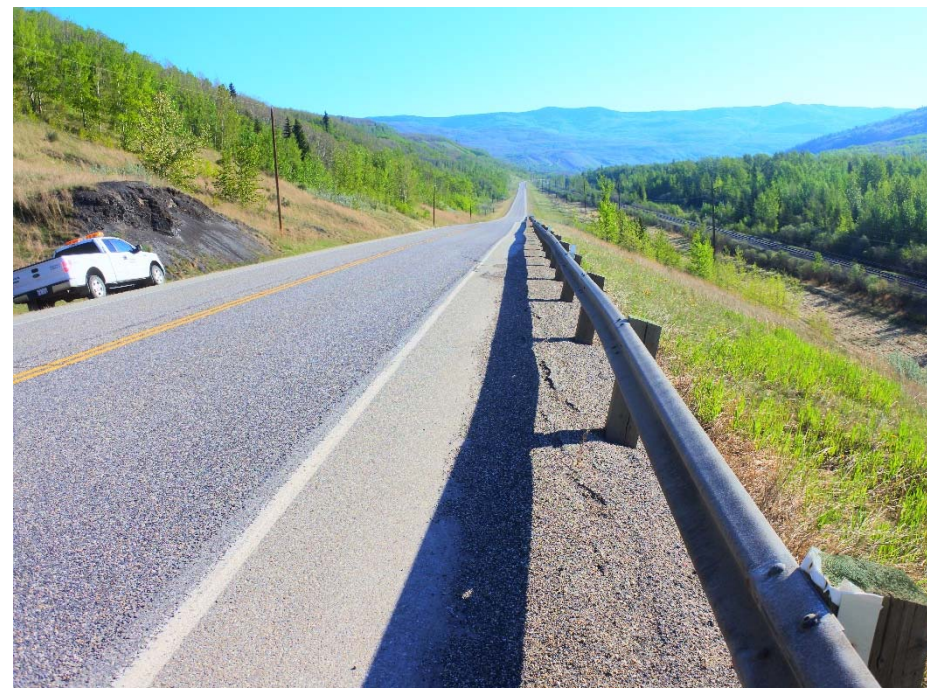


Photo 3.
Looking north along the highway at the south end of the scarp crack where it enters into shoulder

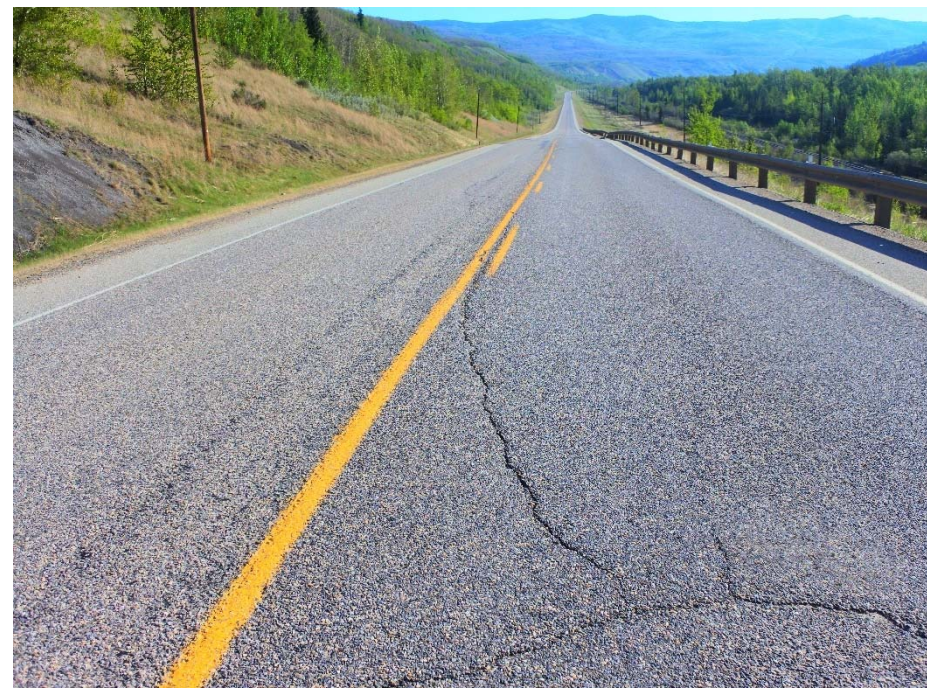


Photo 4.
Looking north along the northbound lane and guardrail at the scarp crack.



Photo 5.
Looking north along the northbound lane shoulder at where northern portion of scarp enters back into shoulder. Larger cracks observed open to 40 mm.

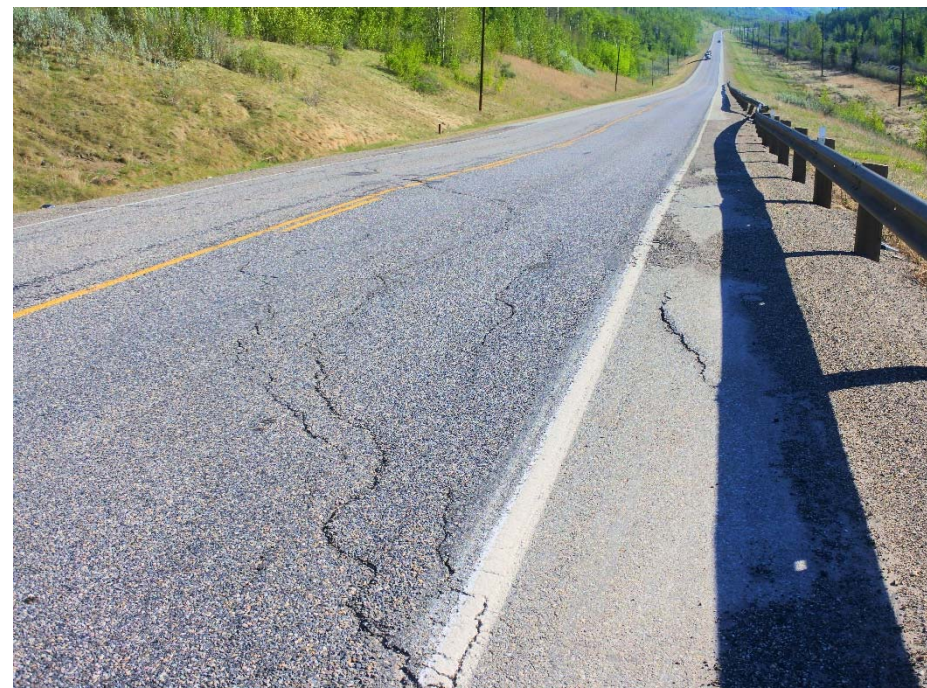


Photo 6.
Looking north along centerline at the scarp crack in the highway.



Photo 7.
Looking south
along the long
scarp crack in the
highway from near
the center of the
site.

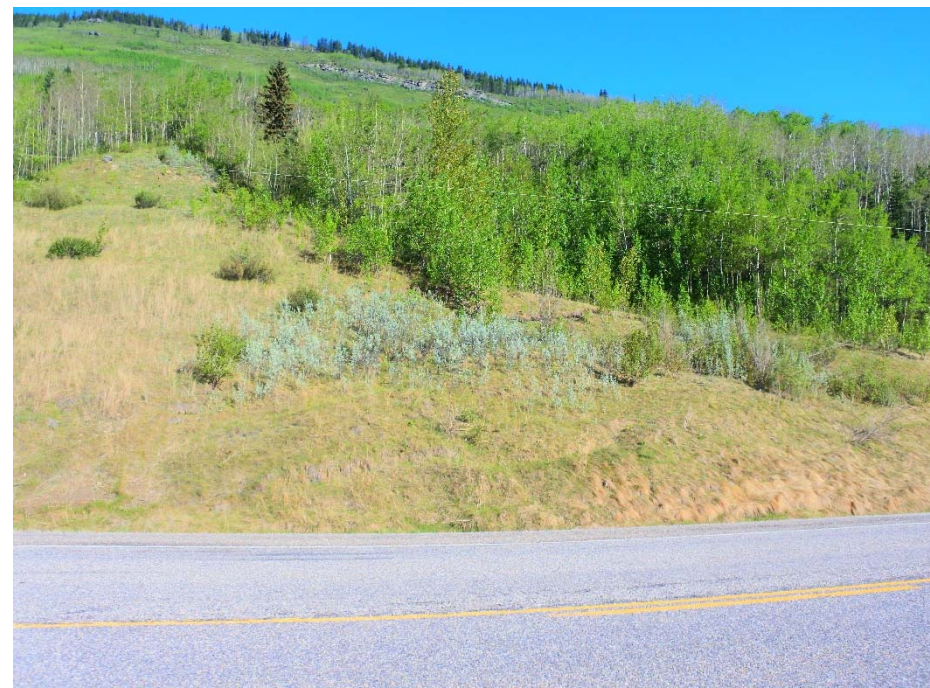


Photo 8.
Looking north at
backslope slump.

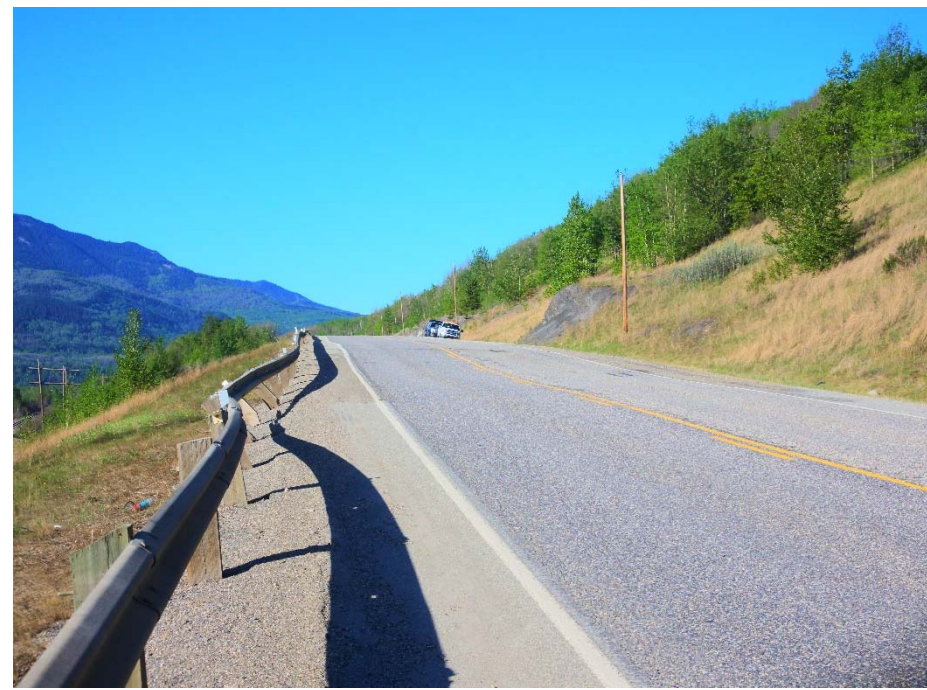


Photo 9.
Looking south at dip
in the road and
damaged guard rail.



Photo 10.
Looking south
along the east
embankment at
teardrop slide
failures.