

SITE NUMBER AND NAME: NC057 – Highway 624 Embankment Failure	HIGHWAY AND KM: 621:02, km 16.420	PREVIOUS INSPECTION: May 22, 2020	CURRENT INSPECTION: June 29, 2021
LEGAL DESCRIPTION: NE & NW 34-50-07-W5	NAD83 COORDINATES: UTM11U 5915066N, 637131E		RISK ASSESSMENT: PF: 10 CF: 6 Total: 60
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 1,260 (2020)		CONTRACTOR MAINTENANCE AREA (CMA): 509	

SUMMARY OF INSTRUMENTATION: Two vibrating wire piezometers and one standpipe piezometer functional	INSPECTED BY: Stantec: Leslie Cho AT: Bernard Ching, Rishi Adhikari, Wilf Cousineau
LAST READING DATE: July 6, 2021	
PRIMARY SITE ISSUE: Highway embankment failure due to high groundwater level and weak foundation soils.	
APPROXIMATE DIMENSIONS: 140 m long by 15 m wide	
DATE OF ANY REMEDIAL ACTION: Pavement dip repaired in 2006. Granular drains installed in 2007. Milled and paved in 2014 and 2017.	

ITEM	CONDITION EXISTS		DESCRIPTION AND LOCATION	NOTICEABLE CHANGE FROM LAST INSPECTION	
	YES	NO		YES	NO
Pavement Distress	X		Pavement cracking reflecting through overlay.	X	
Slope Movement	X		Eastbound lane (EBL) slumping near BH17-06. Bulge feature south of BH17-06 approximately at mid-embankment height. Vertical differential developing southwest of BH17-01 on westbound lane (WBL)	X	
Erosion		X			X
Seepage	X		A spring was observed at BH17-03 in 2018 and 2019 and was not observed since. Anecdotal evidence from the nearby residents suggests springs exist in this area.		X
Bridge/Culvert Distress		X			X

COMMENTS
<ul style="list-style-type: none"> • Pavement cracks continue to reflect through the previous 2017 mill and overlay. • On the WBL, cracking has progressed to about 25 m east of BH17-02. • A 25 mm vertical displacement was observed at the west extents of the pavement cracks on the WBL. • The EBL pavement cracks near BH17-06 increased to about 70 mm to 90 mm vertical displacement. <ul style="list-style-type: none"> – Tire marks were visible at this crack suggesting vehicles may be hard braking when they feel the drop. – EB vehicles were observed to be crossing into on-coming traffic to avoid the pavement drop. – The speed limit was reduced to 50 km/h and a bumpy road sign placed. However, some EB vehicles appear to maintain regular highway speeds, presumably to better clear an uphill segment about 400 m east of the site. • A potential bulge was observed south of BH17-06 approximately halfway down the embankment slope. • The piezometer levels remain high at this site with the piezometers showing artesian conditions as high as 0.4 m above ground surface. High piezometric levels are likely contributing to the embankment instability.

- Given that the vertical differential is increasing on both lanes of the highway, a full road closure is possible with further slope movement. As such, the Consequence Factor was increased by 2.
- Range Roads 71 and 72 could be used for detours and would require less than 20 minutes of additional travel time. However, travel over gravel roads would be required and may not be suitable for transport trucks.

RECOMMENDATIONS

- Pavement cracks should be sealed to reduce surface water infiltration into the embankment. Additional pavement patches are not recommended since it is considered an additional driving force on the embankment. Mill and fill could be completed to address the vertical displacement until remediation is completed.
- Preliminary remediation design was completed by Stantec in January 2018. The selected remedial option includes improving embankment drainage using tire derived aggregate. The preliminary cost was estimated to be \$980,000, excluding engineering. The feasibility of this option is highly dependent on the availability of recycled tires.
- Sheet piles may also be considered along both sides of the embankment which would eliminate the need to excavate and replace the existing pavement structure. The high-level cost of construction for sheet piling is \$2,000,000, excluding engineering.
- Site inspections should continue annually.
- Instrumentation readings should continue to be read semi-annually.
- If remediation will not be undertaken in the next few years, slope inclinometers should be considered to monitor the depth and rate of slope movement. This information will be useful for characterizing the failure and optimizing the design.

PREPARED BY: Leslie Cho, M.Eng., P.Eng.**REVIEWED BY:** Carrie Murray, M.Eng., P.Eng.

2021 Site Inspection Photos at NC057



Photo 1: West limits of WBL pavement cracks. Approx. 25 mm dip. Looking southeast.



Photo 2: Diagonal pavement cracks approximately at km 2.55. Looking southeast.

2021 Site Inspection Photos at NC057



Photo 3: Faint cracks progressing east of BH17-02. Looking east.

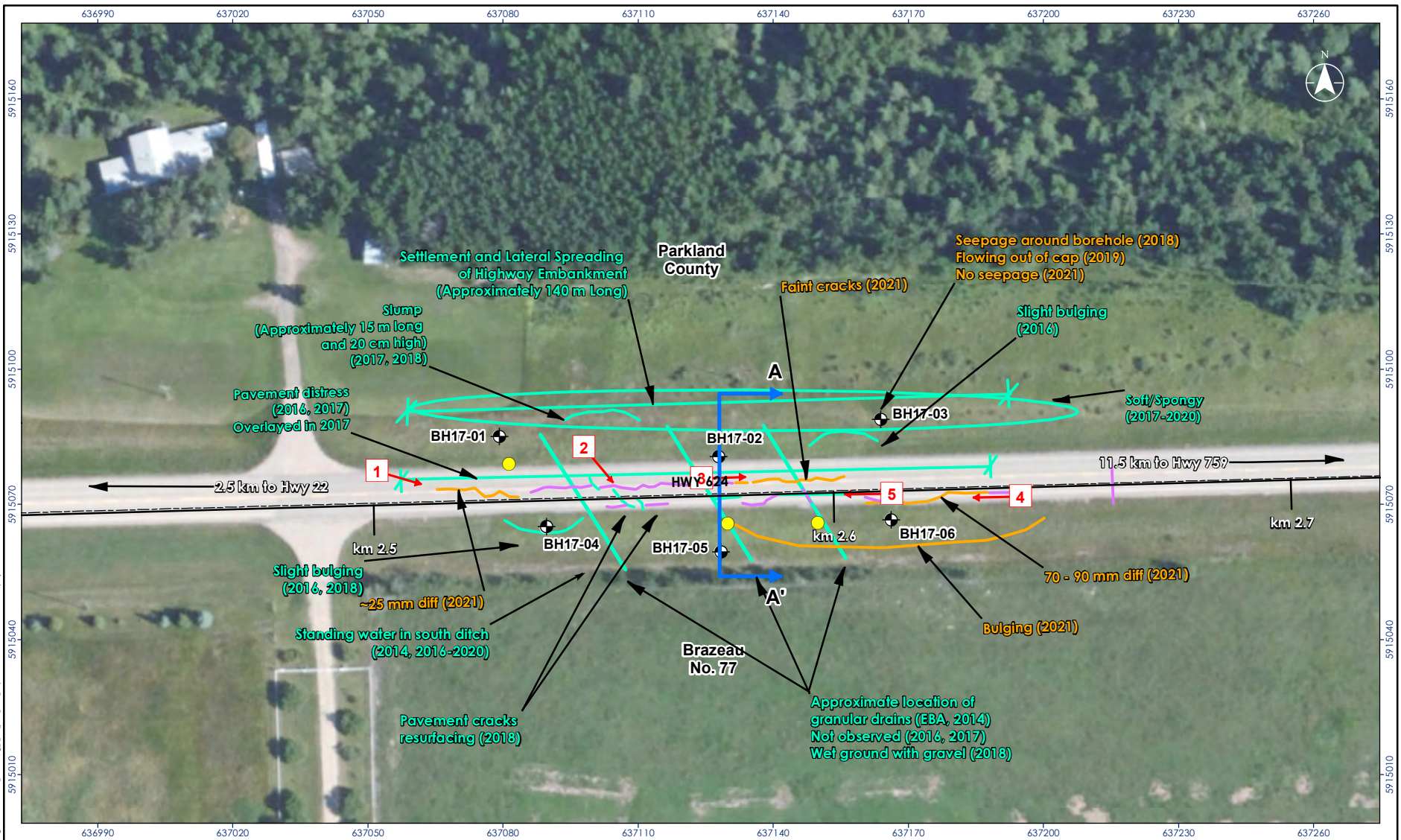


Photo 4: Pavement cracking on EBL. 70 mm to 90 mm differential. Tire marks apparent at drop location. Looking west.

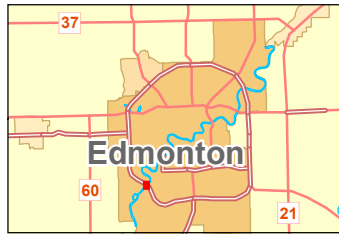
2021 Site Inspection Photos at NC057



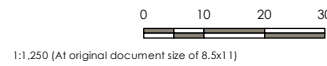
Photo 5: Pavement cracking on WBL with tire marks. Looking west.



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 Prepared: 2021-09-14 by: jgibner
 Reviewed: 2021-09-14 by: jgibner



- Borehole Location
- Gravel Drain
- Previous Observation
- 2020 Pavement Cracks
- 2021 Observation
- Municipality Boundary
- Photo Number and Direction
- Cross Section Location



- Notes**
1. Coordinate System: NAD 1983 UTM, Zone 11U
 2. Base features: Geogratis, ©Department of Natural Resources Canada. All rights reserved.
 3. Imagery: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Geomapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

Project Location
 Hwy 624, 2.5 km East of Hwy 22
 Alberta
 123315222
 Prepared by AK on 2021-09-14
 Quality Review by LC on 2021-09-14
 Independent Review by CM on 2021-09-14

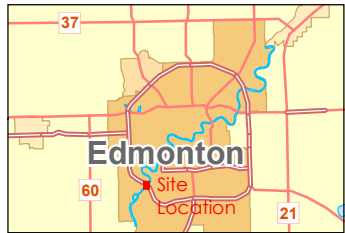
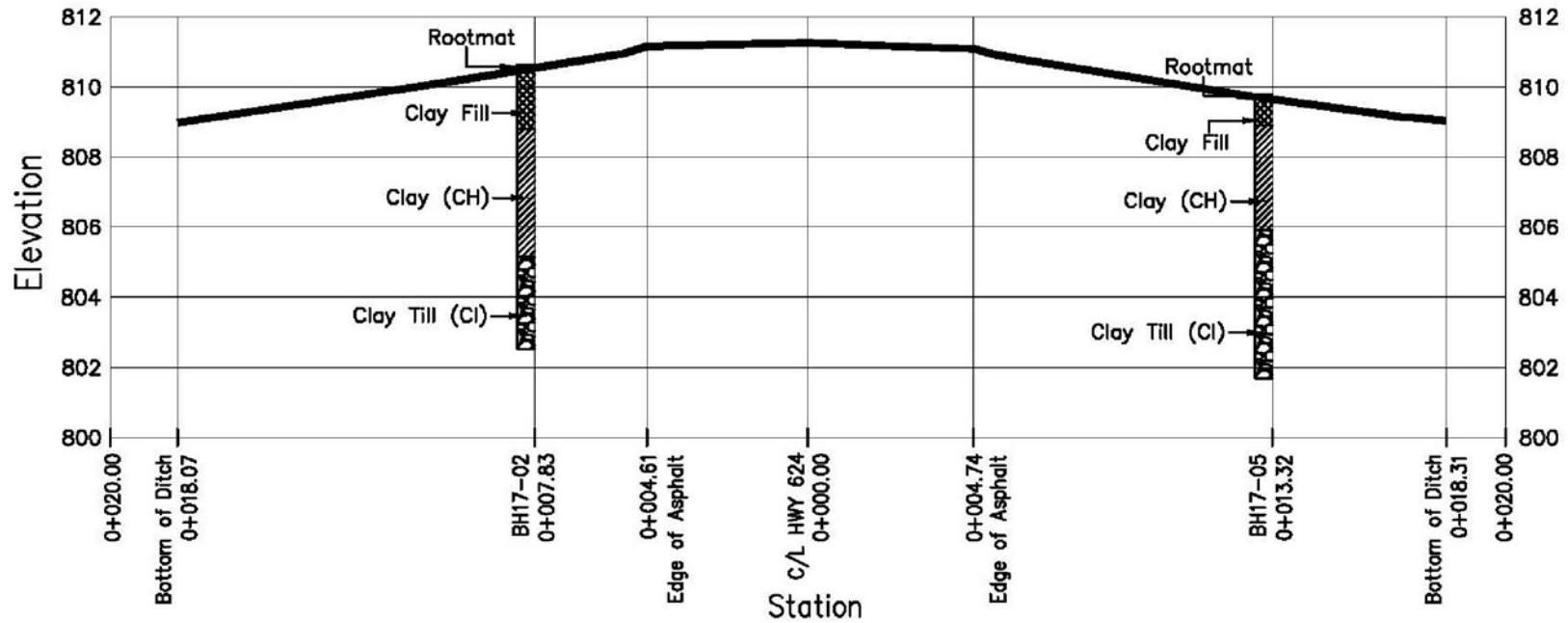
Client/Project
 Alberta Transportation
 Geohazard Monitoring Program
 NCS7 Embankment Failure on Hwy 624

Figure No.
 1

Title
 Site Plan



Section 'A'
 Hor Scale: 1:200
 Vert Scale: 1:200



Project Location: Hwy 624, 2.5 km East of Hwy 22, Alberta
 Prepared by AK on 2021-09-01
 Quality Review by LC on 2021-09-14
 Independent Review by CM on 2021-09-14

Client/Project: Alberta Transportation
 Geohazard Monitoring Program
 NC57 Embankment Failure on Hwy 624

Figure No. 2

Title: Cross-Section A

- Notes**
1. Coordinate System: NAD 1983 UTM, Zone 11U
 2. Base Features: Geogratis, ©Department of Natural Resources Canada. All rights reserved.
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