CENTRAL REGION GRMP
SITE INSPECTION FORM

SITE NUMBER AND NAME: **C067 Kneehill Creek Slide**	HIGHWAY & KM: 21:14, 12.988	PREVIOUS INSPECTION DATE: June 23, 2021	INSPECTION DATE: **June 26, 2023**
LEGAL DESCRIPTION: 19-29-23-W4M	NAD 83 COORDINATES: UTM 12 Northing 5707671 Easting 344892	RISK ASSESSMENT: Site A: PF: 5 CF: 3 TOTAL: 15 Site B: PF: 9 CF: 5 TOTAL: 45	
AVERAGE ANNUAL DAILY TRAFFIC (AADT): 867 (south) and863 (north) (Ref No. 60211450)		CONTRACT MAINTENANCE AREA (CMA): 517	

SUMMARY OF SITE INSTRUMENTATION:	INSPECTED BY:
Operational: One slope inclinometer (SI) and standpipe installed in 2016 and five SIs installed in April 2017. LAST READING DATE: September 20, 2023	Chris Gräpel (KCB) James Lyons (KCB) Tony Penney (TEC) Rishi Adhikari (TEC) Pramaya Kannel (TEC)

PRIMARY SITE ISSUE: Two embankment slope failures along the west slope (southbound) lane of highway referred to as Site A and Site B.

APPROXIMATE DIMENSIONS: Site A is approximately 80 m wide, and Site B is approximately 40 m wide. The slopes at both sites are approximately 15 m high and sloped at approximately 4H:1V.

DATE OF ANY REMEDIAL ACTION: In April 2017, a 15-m-deep, 80-m-long H-pile was installed at Site A and a 16-m-deep, 42.5-m-long H-pile wall was installed at Site B.

ITEM	**CONDITION EXISTS**		**DESCRIPTION AND LOCATION**	**NOTICABLE CHANGE FROM LAST INSPECTION**	
	YES	NO		YES	NO
Pavement Distress	X		No pavement distress was observed at Site A (north site). There was pavement cracking and settlement observed at Site B (south site).	X	
Slope Movement	X		Pavement cracking and settlement at Site B indicate the slope is continuing to move as the H-pile wall is loaded.	X	
Erosion	X		Minor rill erosion was observed west of the Site B H-pile wall.	X	
Seepage		X	N/A – none observed during the 2023 inspection.		X
Culvert Distress		X	N/A – none observed during the 2023 inspection.		X

COMMENTS

Site A:

- The west (southbound) highway embankment is well vegetated, and no signs of slope deformation were observed during the 2023 inspection (Photo 5).
- No new pavement distress was observed upslope of the H-pile wall (Photo 6). Overall, there has been approximately 16 mm of movement in the Site A H-pile wall since July 2017, with current movement rates less than 5 mm/year. The relatively slow rate of movement, along with no new pavement distress being observed, indicate the H-pile wall is performing well.
- In 2023, since Site A appears to be performing better than Site B, TEC and KCB decided to assign different risk ranking to each subsite.

Site B:

- Pavement cracking was observed in the west (southbound) and extends into the east (northbound) driving lane (Photo 1 and 2). The pavement cracking appears worse than during the 2021 inspection. Pavement cracks were up to 25 mm wide during the 2023 inspection.
- Pavement settlement was observed in west (southbound) lane (Photo 1 and 2). The settlement was between approximately 15 mm to 40 mm and was near the center of the lane, not beneath the wheel path. This may be attributed to a soft spot or less likely, a void in the highway subgrade. Downstream of the pavement settlement, there is a shallow depressed area on the highway embankment slope (Waypoint 344).
- Overall, there has been approximately 25 mm of movement in the Site A H-pile wall since July 2017, with current movement rates less than 10 mm/year. There has been more movement recorded than at Site A, which may be reflected by the pavement distress (cracking and settlement).
- Two voids (approximately 150 mm in diameter) were observed in the west (southbound) shoulder (Photo 4). TEC and KCB suspect they formed due to guardrail removal during construction. If the voids increase in size, they should be backfilled, as they could impact the shoulder of the highway and become a hazard to highway traffic.
- The is a void located near a hazard sign near the west extent of the H-pile wall (Waypoint 345).
- Minor rill erosion was observed on the upper portion of the highway embankment, northwest of the H-pile wall (Waypoint 346).
- The condition of the high-tension cable barrier (HTCB) is good. However, some of the metal brackets holding the cables against the posts have been sheared off (observed in 2021 and 2023).

Maintenance/Repair/Monitoring Recommendations:

- The site should be regularly inspection by the Highway Maintenance Contractor (HMC) and sand and gravel should be added to the sinkholes above the H-pile wall in voids are observed.
- The site should continue to be inspected every two-years as part of the Central Region GRMP Section B inspections.

This report is an instrument of service of Klohn Crippen Berger Ltd. (KCB). The report has been prepared for the exclusive use of Alberta Transportation and Economic Corridors (Client) for the specific application to the Central Region Geohazard Risk Management Program (Contract No. CON0022160) and it may not be relied upon by any other party without KCB's written consent.

KCB has prepared this report in a manner consistent with the level of care, skill, and diligence ordinarily provided by members of the same profession for projects of a similar nature at the time and place the services were rendered. KCB makes no warranty, express or implied.

Use of or reliance upon this instrument of service by the Client is subject to the following conditions:

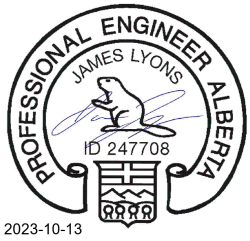
(i) The report is to be read in full, with sections or parts of the report relied upon in the context of the whole report.

(ii) The observations, findings and conclusions in this report are based on observed factual data and conditions that existed at the time of the work and should not be relied upon to precisely represent conditions at any other time.

(iii) The report is based on information provided to KCB by the Client or by other parties on behalf of the client (Client-supplied information). KCB has not verified the correctness or accuracy of such information and makes no representations regarding its correctness or accuracy. KCB shall not be responsible to the Client for the consequences of any error or omission contained in Client-supplied information.

(iv) KCB should be consulted regarding the interpretation or application of the findings and recommendations in the report.

(v) This report is electronically signed and sealed and its electronic form is considered the original. A printed version of the original can be relied upon as a true copy when supplied by the author or when printed from its original electronic file.



James Lyons, P.Eng.
Civil Engineer

PERMIT TO PRACTICE
KLOHN CRIPPEN BERGER LTD.

RM SIGNATURE: _____

RM APEGA ID #: 187607

DATE: 13 Oct. 2023

PERMIT NUMBER: P009196
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

Inspection Photographs

Photo 1 **At Site B, pavement distress (cracking and settlement) was observed in the west (southbound) lane, and the pavement cracking extends into the east (northbound) passing lane. The degree of pavement distress appears to have increased since the 2021 inspection. Photo taken June 26, 2023, facing southeast.**

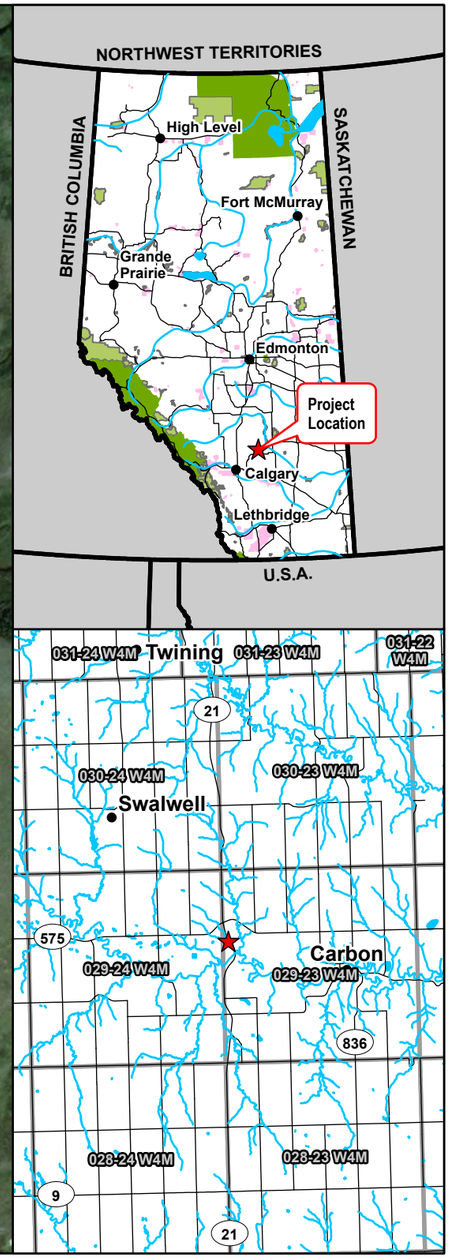
Photo 2 **At Site B, pavement cracking and settlement in the west (southbound) lane and east (northbound) passing lane. Pavement cracks were approximately 15 mm to 30 mm wide and settlement was up to approximately 40 mm. Photo taken June 26, 2023, facing northwest.**

Photo 3 **The west (southbound) highway embankment at Site B is well vegetated and appears to be in good condition. Photo taken June 26, 2023, facing northwest.**

Photo 4 **Voids are located along the Site B, most likely from guardrail post replacement during 2017 construction. Photo taken June 26, 2023, facing southeast.**

Photo 5 **The west (southbound) highway embankment at Site A is well vegetated and appears to be in good condition. Photo taken June 26, 2023. facing north.**

Photo 6 **The pavement and highway embankment slope at Site A appear to be in good condition, indicating the 2017 H-pile wall is performing well. Photo taken June 26, 2023, facing south.**



Legend

- GPS Waypoint (June 26, 2023)
- Slope Inclinometer (SI)
- Standpipe Piezometer (SP)
- H-Pile Wall
- Crack

0 150 Metres

NOTES:
1. HORIZONTAL DATUM: NAD83
2. GRID ZONE: UTM ZONE 12N
3. IMAGE SOURCE: 2023 MICROSOFT CORPORATION, 2023 MAXAR CNES, DISTRIBUTION AIRBUS DS
4. STRIKETHROUGH INDICATES INSTRUMENT IS INACTIVE

CLIENT: Alberta

Klohn Crippen Berger

PROJECT: CENTRAL REGION GEOHAZARD RISK MANAGEMENT PROGRAM

TITLE: Site Plan
C067 - Kneehill Creek Slide
Hwy 21:14, km 12.988

SCALE	PROJECT No.	FIG No.
1:3,500	A05116A02	1

File: Z:\AEDM\A05116A02 ABT Central Region GRMP400 Drawings\GIS\02_ProFiles\2023\Section B\ABT_Central_SectionB_230724\ABT_Central_SectionB_230724.aprx Date: Time: Creator: : aharrison