ALBERTA TRANSPORTATION AND ECONOMIC CORRIDORS
GEOHAZARD ASSESSMENT PROGRAM
NORTH CENTRAL REGION – ATHABASCA &
FORT MCMURRAY DISTRICTS
2023 SITE INSPECTION

THURBER ENGINEERING LTD.

Site Number	Location	Name	Hwy	km
NC097	Fort McMurray	Parsons Road Overpass/Hwy 63	686:20	
Legal Description		**UTM Co-ordinates (NAD 83)**		
SW7-90-9-W4		12V N 6,293,600 E 473,700		

	Date	PF	CF	Total
Previous Inspection:	June 25, 2021	7	3	21 (Landslide basis)
Current Inspection:	May 18, 2023	11	4	44 (Landslide basis)
Road WAADT:	4,640		**Year:**	2022
Inspected By:	José Pineda, Tarek Abdelaziz (Thurber) Kristen Tappenden, Arthur Kavulok (TEC)			
Report Attachments:	☑ Photographs ☑ Plans ☐ Maintenance Items			

Primary Site Issue:	A crack formed across both traffic directions along the top of the Parsons Road overpass (BF85178), ~6 m west of the west abutment (along the western edge of the approach slab); settlement of west approach slab causing a dip behind the west abutment.
Dimensions:	The cracks are across eastbound and westbound lanes (26 m long), dip is within the boundaries of the approach slab (26 m wide x 6 m long).
Site History:	Based on information provided by TEC and an examination of the as-built drawings, weak soil overlying limestone bedrock existed at this overpass location. An instrumented test fill was built at the east headslope, supported on a wick drain perforated foundation soil. Based on the performance of that test fill it was determined that in order to meet the construction schedule demands the weak soils had to be completely excavated from the west headslope area (up to 7 m in depth), and the portion of the east headslope not covered by the instrumented test fill (up to 5 m in depth). Engineered fill, mainly consisting of clay shale, was placed to restore the grades, and then the headslope fills were constructed overtop original grade level (up to 13 m in height). The west headslope fill was built with geogrid reinforcement clay shale. An extensive instrumentation program consisting of slope inclinometers, piezometers and settlement cells were installed to monitor construction activities, control fill placement rates, and provide post construction information. Thurber is currently monitoring these instruments as part of the GRMP geohazards contract.
Maintenance:	ACP Patch was placed in 2020 and 2022 on eastbound and westbound lanes

Observations:	Description	Worse?
☑ Pavement Distress	After the ACP Patch was placed in 2022, cracks up to 140 mm wide x 150 mm deep x 26 m long crack reflected through the patch along the western edge of the west approach slab, about 6 m west of the west abutment; 35	☑

	to 40 mm dip on the eastbound and westbound lanes west of the Finger Plate Joint.	
☑ Slope Movement	Bridge head slope moved laterally by about 300 mm and had a drop of 300 (causing further separation of the sheet metal parging on the west abutment)	☑
☑ Erosion	Erosion along south face of the fill slope adjacent to the west wingwall and headwall slope, caused by runoff from the end of the southwest drain trough; two sandbags placed adjacent to the southwest drain trough	☐
☐ Seepage		☐
☑ Bridge/Culvert Distress	Cracks observed at the interfaces of both the north and south drain troughs and wingwalls (35 to 40 mm wide); 200 mm of head slope settlement along the faces of the wingwalls; no visible cracks on abutment walls, wing walls, and abutment slope concrete facing; bridge bearing plates movement maxed out	☑
☐ Other		☐

Instrumentation: (6 SIs, 31 VWs, 4SCs)

Readings from selected Instrumentation closest to the existing Crack (between spring 2022 and spring of 2023):

SI14-05 located at the toe of the headslope is moving at 1.6 mm/yr over 4.6 and 9.4 m depth; The total lateral movement recorded in SI14-05 since 2014 is 100 mm; the increases in settlement values since the spring of 2022 in operational settlement cells are: SC14-09=17mm, SC14-12=191mm, SC15-04=13mm, and SC15-06= 24 mm.

Assessment (Refer to attached Figure):

The site condition has deteriorated significantly since the 2021 site inspection visit.

The site observations and instrumentation monitoring results indicate “excessive” vertical and lateral movements of the west approach fill. The cracks and the dips noted on the driving lanes are reflections of the ongoing slope movement of the approach fill. The movement of the fill appears to have created voids below the approach slab.

The ACP patch placed in 2022 improved the situation temporarily but conditions deteriorated quickly creating a rough driving conditions and TEC maintenance crew is considering some mill and fill repairs in 2023.

The movement will likely continue to occur, and the situation may get worse with time. The voids below the approach slab and the abutment seat will likely get bigger in size and additional movement may impact the integrity of the highway and the bridge. Furthermore, surface water infiltration into open cracks on the road will likely saturate and soften the high plastic approach fill, resulting in further softening of subgrade below the slab and may eventually impact the stability the slope.

Minor erosion, noted during previous inspections, is still visible within the south side slope to the west of the south drain trough. Runoff from the end of the drain trough has also created minor erosion along the south headslope by the south wingwall. It appears that runoff does not flow through along the gravel filled geocell channel due to insufficient channel cross-sectional depth (it is almost flat). The eroded surfaces are not currently severe and are in the order of 0.2 m wide and 0.1 m deep. However, severe erosion may occur within the side slope and headslope if erosion issues are not dealt with in the near future.

Recommendations:

It is recommended that this site be visited annually, starting in 2024, until the end of the current GRMP Contract.

At least one slope inclinometer should be installed at the crest of the head slope within the pavement distress areas to west of the finger plate joint to assess the potential depth of headslope movement. Consideration should also be given to installing extensometers/settlement cells within the severely impacted areas of the approach fill to fully characterize the bridge headslope movement.

A structural engineer should be consulted in the near future to (a) examine the condition of the bridge and assess whether the structure is performing as per the original design, and (b) provide recommendations for rehabilitation/repairs if needed.

Short Term:

The local MCI should periodically monitor the cracks and dips developed on the highway surface. The bridge abutment walls and seat; and bridge approach fill slopes should also be monitored for any signs of additional movements.

The crack surfaces should be milled (as needed) and sealed, and ACP patch should be placed to eliminate the existing hazard. As recommended in the past it is ideal to drill a few holes within the slab to and inject grout in the holes to fill any voids below the slab.

The gaps developed between drain troughs and wingwalls and below the abutment seat under the bridge should be filled with low strength fillcrete. The sheet metal parging on the west abutment should also be reinstated to function as intended.

A few more sandbags should be placed along the east edge of the southwest concrete drain trough and runoff channel to divert surface runoff from going eastwards down the slope. The sandbags should extend at least 5 m southwards along the channel, or until the point where the existing channel has sufficient cross-sectional depth to carry the flow. The eroded section of the slope immediately to the west of the gully should be repaired though excavating all loose material (no deeper than the underside of the trough) and re-building this area using clay to match adjacent grade. This could be considered as a temporary measure to re-establish flow along the channel and reduce future erosion issues.

Medium to Long Term:

If the sandbags are not effective at re-directing the flow southwards along the gravel filled geocell channel, the medium-term recommendation is to remove the upper approximate 5 m reach of the existing gravel/geocell extending from the end of the drain trough. This portion of the channel area should then be properly graded to re-establish a sufficient cross-sectional geometry size to carry surface runoff, and then relined with new geocell and gravel infilling.

Preliminary engineering is recommended to assess the cause of the observed movements and provide potential remedial measures and associated “A” estimates. New geotechnical instrumentation should be installed and monitored to complete this assessment.

Closure

It is a condition of this letter report that Thurber's performance of its professional services will be subject to the attached Statement of Limitations and Conditions.

Tarek Abdelaziz, Ph.D., P.Eng.
Principal | Geotechnical Review Engineer

PROFESSIONAL ENGINEER ALBERTA
JOSÉ G. PINEDA CARDENAS
July 10, 2023
ID 93452

PROFESSIONAL ENGINEER ALBERTA
TAREK ABDELAZIZ
ID 91085
July 10, 2023

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
RM SIGNATURE: ____________
RM APEGA ID #: 91085
DATE: July 10, 2023
PERMIT NUMBER: P005186
The Association of Professional Engineers and Geoscientists of Alberta (APEGA)

José Pineda, M.Eng., P.Eng.
Associate | Senior Geotechnical Engineer

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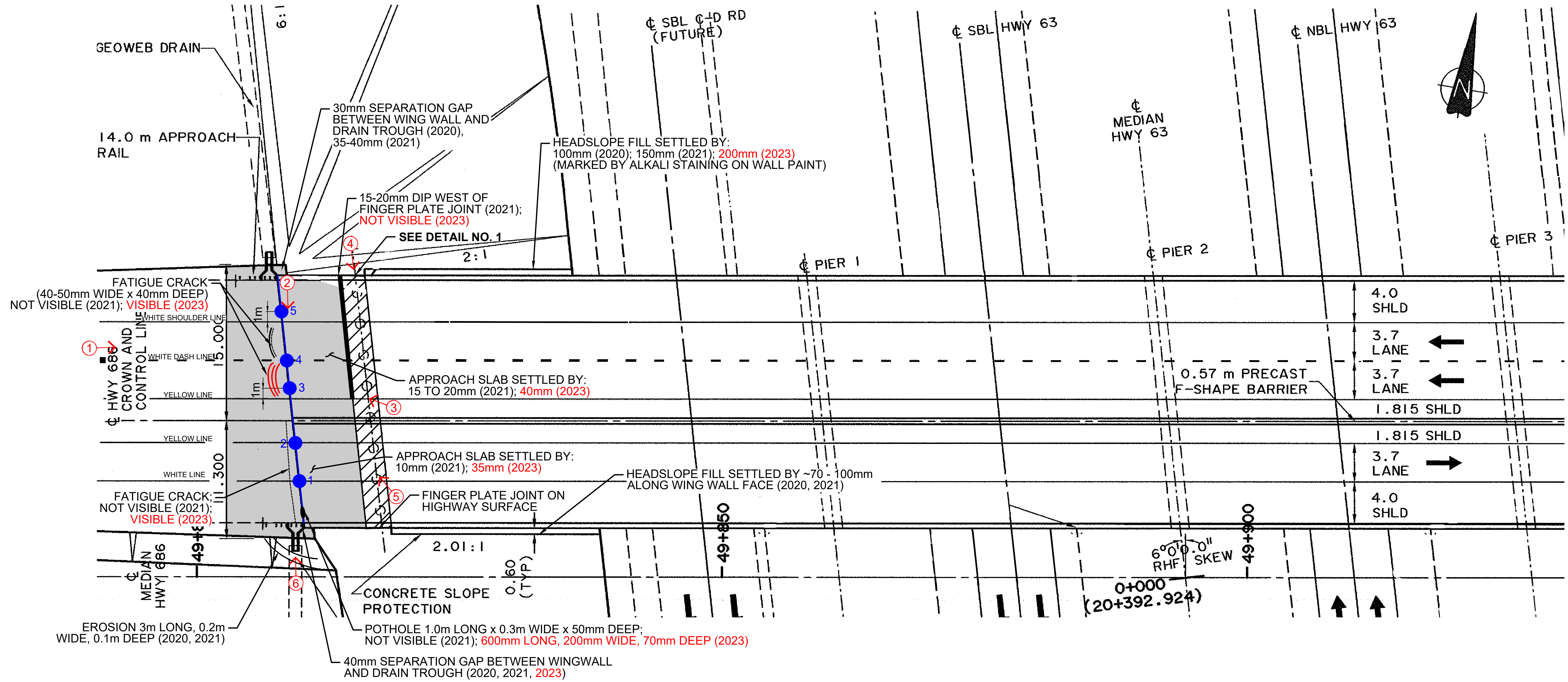


LEGEND

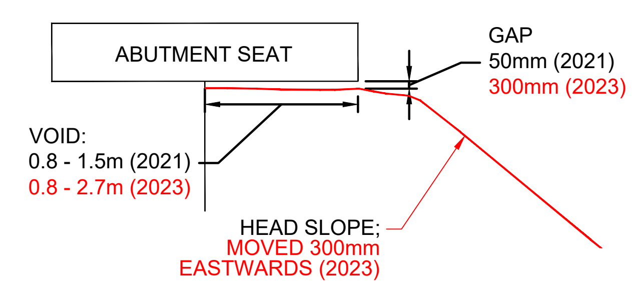
- CRACK MEASUREMENT LOCATION
- CRACK LOCATION
- PHOTOGRAPH NUMBER, AND APPROXIMATE DIRECTION AND LOCATION
- ACP PATCH PLACED IN 2022

NOTE:

MAY 17, 2023 SITE OBSERVATIONS ARE SHOWN IN RED.

CRACK LOCATION	JUNE 24, 2021			MAY 17, 2023		
	WIDTH (mm)	DEPTH * (mm)	DROP (mm)	WIDTH (mm)	DEPTH * (mm)	DROP (mm)
1	20	30	0	30	70	20
2	20	15	16	140	150	40
3	20	15	15	40	100	30
4	5	5	5	100	100	20
5	5	-	5	30	70	20

* SAND AND SALT WERE NOTED WITHIN BOTTOM OF CRACK.



DETAIL NO. 1
(NTS)

0 5 10 15 20 25m
SCALE 1:400

BASE PLAN 37507-C FROM ALBERTA TRANSPORTATION

Alberta

NORTH CENTRAL REGION
(ATHABASCA AND FORT MCMURRAY DISTRICTS)
2023 GEOHAZARD ASSESSMENT

NC097: HWY 686 (PARSONS ROAD OVERPASS) / HWY 63
SITE INSPECTION PLAN

FIGURE 1

DRAWN BY	KLP
DESIGNED BY	JGP
APPROVED BY	TSA
SCALE	1:400
DATE	JUNE 2023
FILE No.	32122

THURBER ENGINEERING LTD.

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Photo No. 1 – Looking east at the bridge westbound lanes. The cracks are across both traffic lane directions and has formed between the approach slab and the pavement, about 6 m west of the west abutment fingerplate; note ACP patch placed in 2022 and the dip to the west of the expansion joint.

Photo No. 2 – Looking south at the crack developed across the westbound lanes towards the median. The main crack is 30 to 100 mm wide x 70 to 100 mm deep.

Photo No. 3 – Void under abutment seat. Head slope dropped by up to 300 mm and moved eastward by up to 300 mm

Photo No. 4 – Looking south at head slope movement (300 mm vertical drop x 300 mm lateral shift towards east); Void under abutment seat ranges from 0.8 m to 2.7 m.

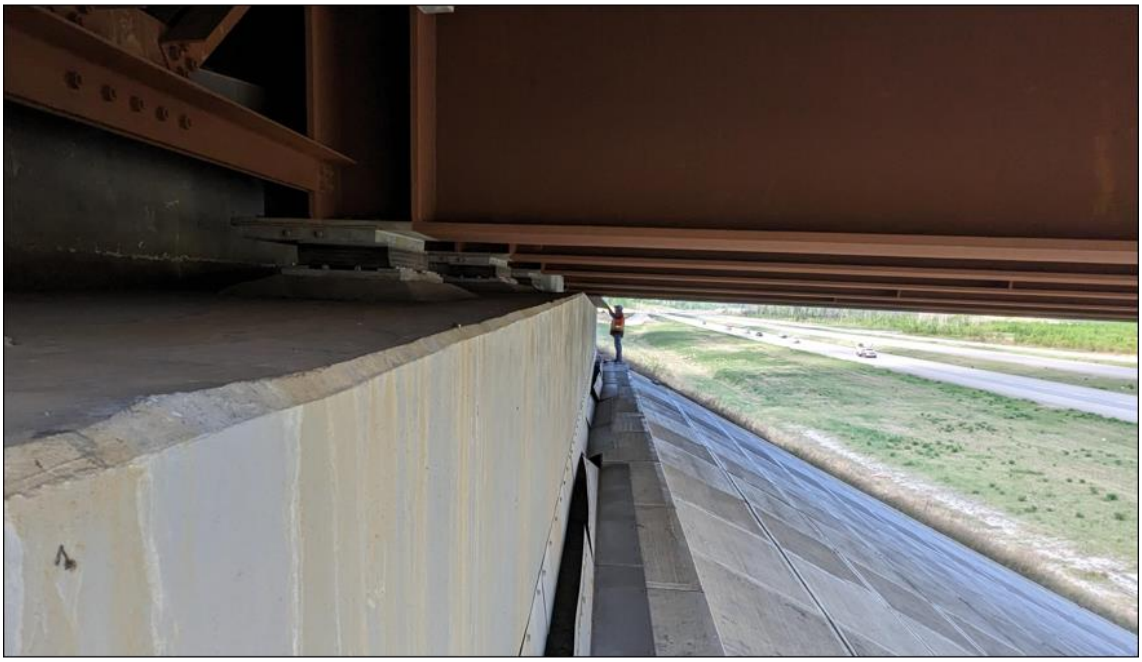

Photo No. 5 – Bridge bearings appear to have maxed out.

Photo 6 – Drain trough. Note the cracking between the drain trough and wingwall.