THURBER ENGINEERING LTD.

June 30, 2016 File: 13355

Alberta Transportation
3rd Floor, Provincial Building
9621 – 96 Avenue
Peace River, Alberta
T8S 1T4

Attention: Mr. Ed Szmata

GEOHAZARD ASSESSMENT PROGRAM
CALL-OUT INSPECTION
HWY 2A:54 EAST OF GUNNS CREEK

Dear Mr. Sir:

On June 16, 2016, Alberta Transportation (AT) noticed some cracks and slumping in the roadway surface of Highway 2A:54 at approximately km 17.6. Under the GeoHazard Assessment Program, Thurber was requested by Ed Szmata of AT to conduct a call-out inspection. The inspection was completed on June 23, 2016, by Mr. Don Proudfoot, P.Eng., Thurber in the presence of Mr. Szmata.

1. SITE CONDITIONS

The site is located on the south side of Hwy 2A:54 (the highway is oriented east-west) about 700 m east of the Gunns Creek culvert (GeoHazard site SH26). There were two areas of distress observed on either side of a 900 mm-diameter centerline culvert as shown on the attached Drawing 13355-1. The embankment is approximately 2.5 m in height at this location with sideslopes inclined at 3H:1V. The surrounding terrain is flat agriculture fields with no obvious drainage patterns and ponded water located on the south side of the embankment at the west edge of the areas of distress. There had been significant rainfall in the area in the preceeding few weeks. Selected photographs taken during the site inspection are attached to this letter.

The west slide area had been covered with uncompacted crushed gravel by the Maintenance Contractor to restore the pavement surface. The length of the gravel patch was approximately 48 m. A scarp was visible through gravel approximately over the existing edge of asphalt. A toe roll was visible at the bottom of the slope.

The east slide area affected approximately 15 m of the paved highway surface with cracks extending up to 1.2 m into the east-bound lane. Differential heights across the cracks were between 25 mm to 50 mm. A secondary, 300 mm high scarp was observed partway down the slope and a toe roll was visible at the bottom of the embankment.

THURBER

2. ASSESSMENT

There was no record of previous instability at this location. Based on recent precipitation patterns, it is likely that the embankment and/or foundation soil material became saturated reducing the strength of the material allowing failure of the embankment.

The assessed risk level for this site, based on AT's guidelines is 26, based on a Probability Factor of 13 (active with a high rate of movement) and a Consequence Factor of 2 (Moderate fill where the slide is affecting use of roadway and safety of motorists, but not requiruing closure of the roadway). However, if left untreated the landslides are expected to continue to move creating additional cracking and deformations in the highway and a higher risk level factor.

3. RECOMMENDATIONS

It is understood that there is an ongoing construction project at the SH26 Gunns Creek site to the west and that AT plans to repair this site under the same contract as an Extra Work Order. It is alos understood that the schedule for this work does not allow sufficent time to complete a geotechnical investigation or to acquire additional right-of-way, which eliminates using a toe berm to repair the site. On that basis, a gravel wedge replacement is likely the most-practical repair option for these two slumps.

Using the observed pattern of cracking, a preliminary stability analysis conducted assuming the groundwater at the ground surface determined a back-analysed friction angle for a uniform embankment and foundation clay soil of 15°. This friction angle is relatively conservative for soils in the area.

A preliminary assessment completed as part of this callout determined that replacement of the slumped material with a gravel wedge and shear key was sufficient to improve the estimated factor of safety to 1.3.

Recommenadtions for the construction of this wedge are as follows and shown on the attached drawing and cross-section:

- The gravel wedge should extend to the centreline with the east-west extents to be 5 m beyond the edge of visible cracks and toe bulges.
- The excavation slopes should be inclined no steeper than 1H:1V. The excavation should extend to 0.5 m below the surrounding ground surface. A shear key should be excavated an additional 1 m deep with slopes at 1H:1V and a base width of 1.5 m.
- To reduce the risk of a further slope failure into the westbound lane, the width of the excavation should be limited to 20 m open at one time witheach section backfilled prior to commencing excavation of the adajcent section. Drainage measures such as sumps and pumps may be necessary to keep the excavation dry.
- The excavation should be backfilled with Designation 2, Classification 20 gravel with a non-woven geotextile placed below the gravel. The gravel should be packed in 150 mm thick lifts to at least 95% of SPMDD, except for the top 300 mm of the subgrade, which should be packed to 100% of SPMDD.

THURBER

- The roadway should be rebuilt using the same pavement structure as will be used at the nearby SH26 slide repair. A 200 mm thick clay cap should be placed on the side slope surface (but not over the pavement GBC) and covered with a layer of topsoil and seeded.

A ballpark cost for this work is in the order of $300,000.

4. CLOSURE

We trust this is the information you require at this time. If you have any questions, or if you require further information or recommendations, please contact us at your convenience.

Yours very truly,
Thurber Engineering Ltd.
Don Proudfoot, M.Eng., P. Eng.
Review Principal

PROFESSIONAL ENGINEER ALBERTA
KENNETH E. FROESE
Jun 30/16

PERMIT TO PRACTICE
THURBER ENGINEERING LTD.
Signature Don Proudfoot
Date June 30 2016
PERMIT NUMBER: P 5186
The Association of Professional Engineers, Geologists and Geophysicists of Alberta

Ken Froese, M. Eng., P. Eng.
Project Engineer
/ell

Attachments:
- Photos
- Drawing 13355-1

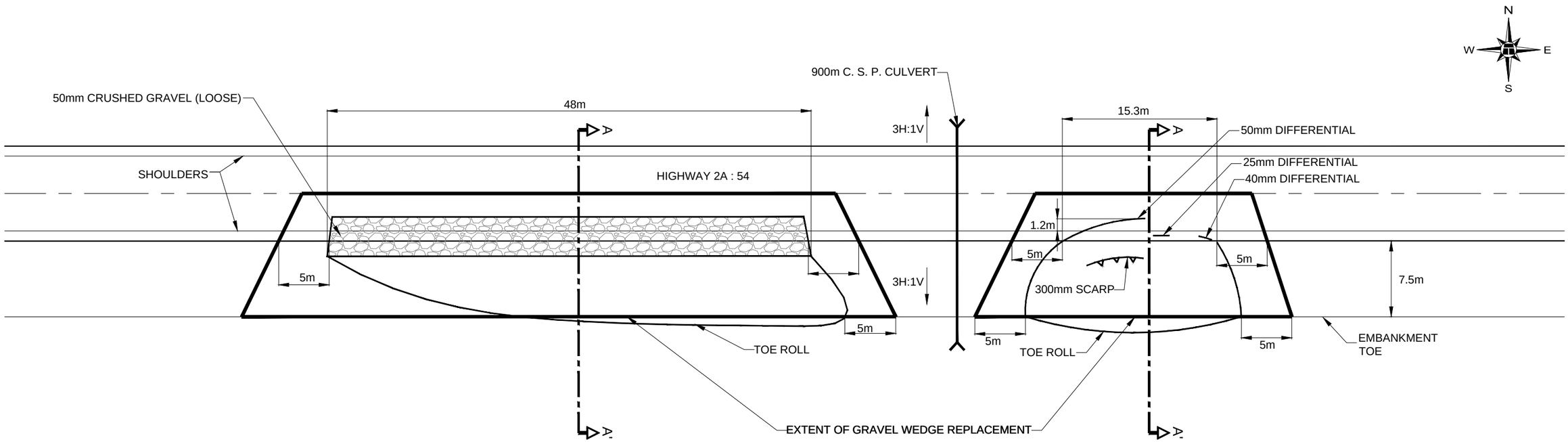
Photo 1: Looking west along south shoulder of Hwy 2A:54. Note crack of east slide at edge of asphalt and gravel placed over west slide.

Photo 2: Looking west at east slide. Note scarp near top of embankment and toe roll at the bottom.

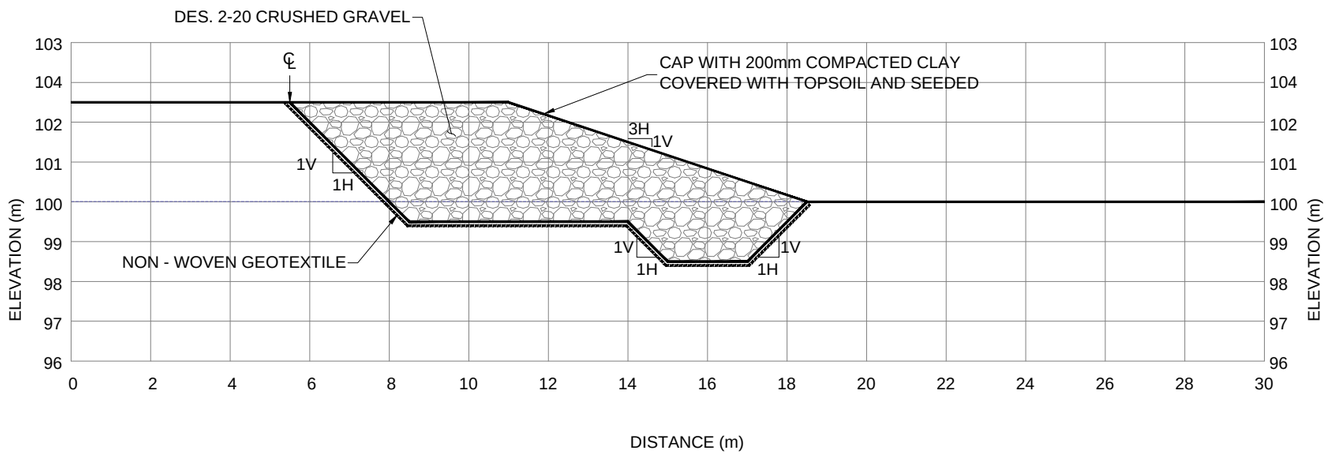
Photo 3: Looking east at east slide. Note cracks in the asphalt of the eastbound lane.

Photo 4: Looking south at west slide. Note crack through temporary gravel in line with the buried edge of asphalt.

Photo 5: Looking east from west side of west slide. Note ponded water adjacent to embankment and lack of drainage.



SITE PLAN
SCALE: 1:400



CROSS - SECTION A - A'
SCALE: 1:150

NOTE:
SITE DIMENSIONS WERE ESTIMATED DURING JUNE 23, 2016 SITE INSPECTION.

0 5 10 15 20 25m
SCALE 1:400

Alberta Transportation

HIGHWAY 2A:54 CALLOUT

SITE PLAN AND CROSS - SECTION A - A'

DWG No. 13355-1

DRAWN BY	ML
DESIGNED BY	KEF
APPROVED BY	DWP
SCALE	AS SHOWN
DATE	JUNE 2016
FILE No.	13355

THURBER ENGINEERING LTD.