THURBER ENGINEERING LTD.
GEOTECHNICAL ▪ ENVIRONMENTAL ▪ MATERIALS

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Alberta Infrastructure and Transportation
2nd Floor, Provincial Building
111 – 54 Street
Edson, Alberta
T7E 1T2

Attention: Mr. Cliff Corner

NORTH CENTRAL REGION GEOHAZARD ASSESSMENT
HWY 43:16 WHITECOURT EAST HILL (NC1)
2006 ANNUAL INSPECTION REPORT

Dear Sir:

This letter documents the 2006 annual site inspection of the Hwy 43:16 (km 1.9) Whitecourt East Hill site at legal land description 26-59-12-W5M (Figure NC1-1A, Section F). Thurber Engineering Ltd. (Thurber) undertook this inspection in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE141/2006) with Alberta Infrastructure and Transportation (AIT).

Mr. Don Law, P.Eng. and Mr. Ken Froese, P.Eng., of Thurber undertook the inspection on June 5, 2006, in the presence of Mr. Roger Skirrow, P. Eng., and Mr. Cliff Corner of AIT.

1. BACKGROUND AND RECENT WORK

Thurber last visited the site in May 2005 and the site conditions at that time are described in our Part B assessment letter in the site binder. Additional information of the site is provided in the Geotechnical File Review in Section A of the binder.

The additional investigation recommended for this site was undertaken in March 2006 and was summarized in a data report to Mr. Arthur Kavulok of AIT dated May 2, 2006.

2. SITE OBSERVATIONS

The changes in condition since last year are shown on the attached site sketch plan and cross-section, provided for inclusion in Section F of the site binder. Selected photographs taken during the visit are also attached.

2.1 Roadway

The roadway surface was inspected during the reconnaissance for the full length of the hill. According to Mr. Corner, the entire roadway was microsealed during 2005. The two main cracks (vicinity of Stations 1+850 and 1+900) have subsequently reflected through the sealing although the height differential across the cracks observed in 2005 was not present.

The approximate locations of the cracks are shown on the site plan (Figure NC1-1A, Appendix F) with a closer view of the crack patterns given in Figure NC1-2. Photographs of the cracks are attached.

A 4 m extension of the west crack was observed at the time of the site visit. The extension appeared in the median and arced back towards the westbound lanes. No differential was observed across the crack or the extension. No changes were observed in the east cracks.

No other significant features were noted during the reconnaissance. The guardrail alignment appeared smooth indicating no gross slope movements through that area at this time.

2.2 Toe Berm, Side Slopes and Back Slopes

The toe berm area north of the highway at Stations 1+600 to 1+800 exhibited no signs of slope movement (such as cracking, slumping, or seepage). In addition, no visual evidence of slope movement was noted in the back and side slope areas on either side of the highway.

As noted in previous years, some leaning trees were observed within a treed area located downslope of the highway and southeast of the toe berm (see Figure NC1-1A). However, no tension cracks or seepage were observed in this area and no significant changes were noted from previous site visits. Clearing had been undertaken to allow installation of new instrumentation in this location.

In March 2006, Thurber supervised the installation of four slope inclinometers and eight standpipe piezometers. In addition, SI12 was repaired at that time. The details of the installation were submitted in a letter dated May 2, 2006, and are

included in Appendix G of the site binder. The cross-section through the site (Figure NC1-1B) has been updated to include the stratigraphic information and groundwater level measurements from the new slope inclinometers and standpipe piezometers.

The ground movements measured by the slope inclinometers installed at the site are summarized as follows:

- Movement has been recorded at a depth of about 13 m in SI #5 located on the southwestern corner of the toe berm as shown on the site plan. There was no discernable movement since the previous reading which is a reduction from the 5 mm per year rate measured over the previous interval (Spring to Fall 2005) and is significantly less than the maximum movement rate previously recorded (12.9 mm per year between May to September, 2001).

- Minor movements have also been noted in SI01-1A and SI01-2A, located as shown on the site plan, at depths of about 13 m and 8 m, respectively. The current rate of movement at SI01-2A is about 3 mm per year compared to the maximum movement rate of 13.1 mm/year in 2001. The water level in the pneumatic piezometers installed at SI01-2A was 10.3 m below ground surface. Both SI01-1A and the associated piezometer were damaged and could not be read in Spring 2006.

- The joint separation at SI12 was repaired in March 2006 and a new baseline reading was established at that time. Previous movement patterns (at 4 m depth) have not yet been confirmed.

- Minor ongoing movement was recorded in the two operational instruments located in the back slope in the vicinity of the bin wall near the bottom of the hill (SI#30 and SI#31, located approximately as shown on Drawing No. NC1-1 included in Section D of the binder). Movement rates of less than 2 mm per year were recorded, which is similar to past movement rates.

- No discernable movement has been detected in the series of slope inclinometers installed in March 2006.

2.3 Culverts at Station 1+650

Inspection was undertaken of the two culverts at this location; an upper culvert directing surface water from above the walking path to the ditch on the south side of the highway, and a lower centerline culvert which transmits the water across the highway right of way to the base of the toe berm fill located north of the highway. A

half-round culvert connects the outlet of the upper culvert to the inlet of the lower culvert. The outlets of two subdrain pipes discharge into the half-round culvert, and the ditch flow from upslope areas flows onto a concrete spillway and over the lip of the half-round culvert.

Maintenance of the concrete spillway was undertaken in 2001. Based on the results of the 2006 inspection, the subdrain and ditch water appear to be entering the centreline culvert in a controlled manner and the asphalt patch between the spillway and half-round culvert is in good shape. The two small sinkholes first observed in May 2005 have subsequently been repaired. Flow from the east subdrain was estimated at 1.5 l/min and the west subdrain was dry (as per previous observations). Flow at the culvert outlet (north of the highway) was estimated at 8.5 l/min.

Other sinkholes were observed beside the asphalt path at some of the small diameter culvert crossings below the path. It is understood that maintenance of the path and associated culvert crossings is the responsibility of the Town of Whitecourt.

2.4 Bin Wall Area (Station 1+200)

The bin wall and backslope area above the bin wall near the bottom of the east hill were inspected. The bin wall is located between the access road to the McConnell property and the highway, near Station 1+200 at the bottom of the hill. The trail above the bin wall was paved with asphaltic concrete in 2003.

The three tension cracks noted during the 2004 site visit in the trail above the east end of the bin wall had not widened or extended noticeably as of the June 2006 visit, and there was no differential height across the cracks. The cracks were filled with sealant recently (likely Spring 2005). However, two additional cracks, each approximately 1 m long and adjacent to the older cracks nearest the bin, were noted during the recent site visit as shown on the site pictures.

The slight bulging noted in the east wing of the bin wall has not changed since first observed by Thurber.

Photographs of the tension cracks in the asphalt pavement and of the bin wall are attached.

3. ASSESSMENT

The observations made during the site reconnaissance and the recent slope inclinometer readings from the pre-2006 instrumentation indicate that slope movements at this site remain relatively minor.

Microsealing undertaken in 2005 has removed the differential height across the east and west cracks; however, the cracks reflected through the seal within the year indicating some movement is still occurring which is consistent with the continued creep observed in the slope inclinometers. The reason for continued slope movements at this location may be a result of not extending the toe berm far enough to the east during twinning operations to stabilize the area east of Station 1+780. The remainder of the roadway side slope, where the toe berm exists, appears to be stable at the present time. Unfavourable groundwater conditions may also be a significant contributing factor to the instability at the location of the highway distress.

The crack development is not significantly affecting the trafficability of the roadway surface at present. Ongoing movements in this area may however be expected, and an increased rate of movement may follow shortly after heavy or prolonged precipitation events. The ongoing movement may result in a reduction in the ride quality in this section of the roadway in the future, possibly to the extent where trafficability and safety are compromised.

Although additional cracking was noted in 2006 in the trail located on the back slope above the bin wall, there are no signs of significant movement that would affect the overall integrity of the back slope in this area. Slope inclinometer movements in this area remain small.

It is anticipated that the observed sinkholes in the trail on the backslope above the highway are a result of piping of soil around the culvert outlets. The source of water may be from infiltration of water from above or leakage from the culverts.

4. RISK LEVEL

The risk level for this site has been assessed as follows:

PF(6) * CF(3) = 18

This risk level is considered applicable to the area of distress on the roadway in the upper portion of the hill (Stations 1+800 to 1+900). A Probability Factor of 6 is considered appropriate since the slide is active but with a slow, indeterminate movement pattern. A Consequence Factor of 3 is applicable since the embankment is relatively high and a partial closure of the road may be required as a result of slide movement. This risk level is the same as that applied in previous years. Other areas of the site are considered to have a lower risk rating.

5. RECOMMENDATIONS

5.1 Short Term

No short-term measures have been identified at this time.

5.2 Long Term

The following remedial measures are postulated, based on the current information available. The applicability of these measures will depend on the results of the geotechnical investigation:

- A possible long term measure is the extension of the toe berm to the east to buttress the slope at the location of the slope movement, potentially in conjunction with subsurface drainage. However, further information regarding the extent of the slide is required to allow design of a toe berm option.

- A potential additional remedial measure is the installation of horizontal subdrains below the roadway to drain subsurface water away from the area and lower piezometric levels, should this prove to be an appropriate remedial measure. This measure would be undertaken in conjunction with a toe berm to improve the long term performance; however, it is not considered a long term remedial measure on its own due to the potential for plugging with time.

Based on previous similar projects the cost for the construction of the remedial measures is expected to be in the order of $400,000 to $600,000.

5.3 Investigation

No additional investigation is required at this time.

5.4 Maintenance and Future Monitoring

As noted in previous annual reports, it is expected that frost action will continue to have a negative effect on the concrete and half round culvert in the vicinity of Station 1+650. Although the asphalt patch is currently maintaining the flow, maintenance of this facility will likely be required in future years.

As per previous reports, it is recommended that crack sealing be continued regularly to reduce water flow into the slide area through the pavement

surface.The cracked section should be monitored routinely in case the differential across the cracks noticeably reduces ride quality.

It is recommended to continue monitoring the existing instrumentation on a semi-annual basis, and to undertake annual geotechnical inspections as currently programmed. In addition, the quality of the ride over the west and east cracks in the west bound lanes should be monitored at least monthly by the MCI, and if significant changes occur an interim engineering site reconnaissance and assessment should be undertaken.

6. CLOSURE

We trust this assessment and recommendations meet with your needs at this time. Please contact the undersigned should questions arise or if the site conditions worsen.

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

Ken Froese, P.Eng.
Project Engineer
/dw

Attachments

cc: Mr. Roger Skirrow, P.Eng., Director of Geotechnical Services, AIT