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THURBER

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Alberta Transportation
Room 223, Provincial Building
4709 – 44 Avenue
Stony Plain, AB T7Z 1N4

Attention: Mr. Rob Lonson, P.Eng.

NORTH CENTRAL REGION GEOHAZARD ASSESSMENT
HWY 43:16 WHITECOURT EAST HILL (NC1)
2004 ANNUAL INSPECTION REPORT

Dear Sir:

This letter documents the 2004 annual site inspection of the Hwy 43:16 (km 1.9) Whitecourt East Hill site. The legal land description is 26-59-12-W5M. The work was undertaken by Thurber Engineering Ltd. (Thurber) in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE046/2004, Section B) with Alberta Transportation (AT).

The site reconnaissance was undertaken on June 2, 2004 by Mr. Don Law, P.Eng of Thurber. The reconnaissance was carried out in the presence of Mr. Roger Skirrow, P.Eng. and Mr. Darryl Yagos of AT.

1. BACKGROUND

The Whitecourt East Hill has been experiencing distress over many years. High ground water levels within the hill have been identified in the past by AT as a significant destabilizing factor. The highway was twinned in 1995 at which time approximately 3000 m of subdrain piping was installed in the back slope and side slope over a 700 m length of the hill to alleviate ground water pressures.

In addition, a toe berm was placed on the north (down slope) side of the highway alignment in the upper portion of the hill, and a bin wall was constructed near the bottom of the hill on the south (up slope) side of the highway adjacent to the McConnell property. The design layout and profile are shown on Figure NC1-1 provided in Section F. A contour plan of the upper hill area showing site features is provided on Figure NC1-1A, and a cross-section through the crack area is provided on Figure NC1-1B, both in Section F. Further details of the history of the

slide and chronology of events are provided in the Geotechnical File Review, Section A of the site binder.

2. RESULTS OF THE 2004 INSPECTION

2.1 Roadway

The roadway surface was inspected during the reconnaissance along the full length of the hill. As in previous years, no distress to the pavement surface was noted except for two cracks noted in the vicinity of Stations 1+850 and 1+900. This pavement distress was first observed in 1998.

The approximate locations of the cracks are shown on the overall site plan, Figure NC-1-1A, and the crack pattern is shown on Figure NC-1-2 (Section F). The crack patterns are also shown in photographs taken of the area (Section F).

No noticeable additional crack extension has been observed over the past year. A differential height up to about 5 mm was observed across both the west and east cracks in the westbound lanes, which is similar to that observed last year. However, the bump experienced during driving across the cracks is somewhat more developed than that observed during the 2003 site visit.

No other significant cracking was noted in the asphalt surface along the length of the hill. The guardrails appeared straight at the time of the site visit, indicating that no gross slope movement is occurring at the guardrail locations.

A gentle dip was noted in the surface of the eastbound lanes during the June 2003 site visit between Stations 1+760 and 1+780, roughly in line with an extension of the existing west crack. No further development of the dip was noted during the June 2004 site reconnaissance.

2.2 Toe Berm, Side Slopes and Back Slopes

The toe berm area below (i.e. north of) the highway at Stations 1+600 to 1+800 was inspected. No visual evidence of slope movement (i.e. cracking, slumping, and seepage) was noted in this area.

The back slope and side slope areas above and below the highway (Station 1+600 to Station 2+100) were also inspected. No visual evidence of slope movement (i.e. cracking, slumping, and seepage) was noted at these locations.

Some leaning trees were observed within a treed area located down slope of the roadway and southeast of the toe berm, as shown on Figure NC-1-1A. No tension crack development was noted, and no signs of seepage were observed in the ground in this area. This area appears visually unchanged from previous site visits.

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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. The rate of movement since the previous reading is about 6 mm per year, which is a reduction from the 10 mm per year rate measured over the previous interval (Spring to Fall 2003) and is less than half of the maximum movement rate previously recorded (12.7 mm per year between May to September, 2001).
- No definitive movement has been recorded in the remainder of the slope inclinometers at the site.

During the 2002 site visit, local erosion (gullying) was noted in the side slope on the west flank of the toe berm, located approximately 20 m north of the highway near Station 1+600, as shown on the site plan (Figure NC-1-1A). It was noted during the June 2003 visit that that gully had been infilled with riprap. The gully appears to be stabilized and overgrown with vegetation, and as such is considered fully repaired.

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. Upon inspection in 2004, it was confirmed that the maintenance measures are still working effectively. A photograph of the area from the June 2004 site visit is included in Section F.

Some minor erosion rilling was observed in the head slope over the lower culvert outlet, located approximately as shown on the site plan (Figure NC 1-1A, Section F).

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 has been paved with asphaltic concrete since the site visit in 2003.

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Three tension cracks were noted in the trail above the east end of the bin wall, indicating some slope movement in this area. The easternmost crack was open to 50 mm, while the other two cracks were closed. There was no differential height over the cracks.

The tension crack noted in the back slope above the bin wall near SI# 30 during the 2003 site visit was not seen during the June 2004 reconnaissance, and may have been filled in during the trail paving operations. The slight bulging noted in the east wing of the bin wall has not changed since the first site reconnaissance undertaken for this contract by Thurber.

Photographs of the tension cracks in the asphalt pavement and of the bin wall are included in Section F of the binder.

3. ASSESSMENT

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

The increased apparent “bump” across the east and west cracks of the roadway surface indicate that the slope instability in the vicinity of the roadway distress is continuing at a slow rate. The reason instability is occurring 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 adversely 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 coincide with 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.

The cracks encountered in the trail located on the back slope above the bin wall may indicate some potential instability in that area. These cracks are located upslope of SI #30 however no movement was recorded in the SI, which is consistent with no visible changes noted in the bin wall or in the slope between the SI and the wall. It is therefore likely that the slope movements associated with the observed cracks are very shallow and do not affect the overall integrity of the back slope in this area.

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4. RISK LEVEL

A risk level of 18 is considered applicable to the area of distress on the roadway in the upper portion of the hill (Stations 1+800 to 1+900) and to the bin wall area at Station 1+200, based on a Probability Factor of 6 (active but slow, indeterminate movement pattern) and a Consequence Factor of 3. This risk level is the same as that applied for the previous three site visits. Other areas of the site are considered to have a lower risk rating.

5. RECOMMENDATIONS

5.1 Geotechnical Investigation

Further geotechnical investigation is recommended in the vicinity of Stations 1+800 and 1+900 and east of the existing toe berm, including test hole drilling and installation of instrumentation as discussed in our preliminary conceptual design recommendations (letter dated March 10, 2003). The additional instrumentation proposed at that time consisted of 2 slope inclinometers (SI's) and 9 piezometers. The SI's will be used to monitor future slope movements, determine the location of slip surface, and estimate the extent of the sliding mass. The locations of the SI's have been selected to help confirm if global slope movements involving the south back slope are acting to destabilize the roadway at this location. The test holes (including piezometers) will be used to investigate soil and groundwater conditions at the site and allow assessment of the feasibility of drainage as a remedial measure for this site.

The two previously recommended slope inclinometers targeted the west crack area only. As discussed on site it is recommended to install two additional slope inclinometers during the field investigation (i.e total of four). The first additional slope inclinometer (SI-3) should be installed at a location down slope of the east crack (i.e. approximately 50 m east of SI01-2A, on the east edge of the pipe line corridor) to confirm movement depths and rates at this location. The second additional slope inclinometer (SI-4) should be located near the presumed toe of the instability area (about 50 m east of SI#12) to help define the extent of the slide. The recommended locations and depths of these proposed additional SI's are shown on the site plan, Figure NC1-1A in Appendix F, along with the previously recommended instrumentation. The monitoring should be undertaken in conjunction with the existing geotechnical instrumentation monitoring program (semi-annually). A revised proposal and cost estimate reflecting the additional recommended scope of work can be provided upon request.

5.2 Potential Remedial Measures

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:

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- A potential short term 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.

- 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. Further information regarding the extent of the slide is required to allow design of the toe berm.

5.3 Maintenance and Further Monitoring

Patching/filling of the cracks in the asphalt trail located in the back slope above the bin wall near Station 1+200 is recommended as a maintenance measure. The wall and the retained soil should continue to be visually monitored (annually) to record any future sign of instability.

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. Ongoing maintenance will be required to maintain water flow into the lower culvert in a controlled manner at this location. The rilling observed on the head slope above the lower culvert outlet at Station 1+650 is considered minor and may self heal, hence no action is recommended at the present time. This area should be reviewed again during next year's site visit.

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.

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6. CLOSURE

We trust this assessment meets with your needs at this time. Please contact the undersigned should questions or concerns arise.

Yours very truly,
Thurber Engineering Ltd.
D. Papanicolas, P.Eng.
Review Principal

D.J. Law, P.Eng.
Project Engineer

/slp

Attachments

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