THURBER ENGINEERING LTD.
Suite 200, 9636 - 51st Avenue
EDMONTON, Alberta T6E 6A5
Phone (780) 438-1460
Fax (780) 437-7125

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 LANDSLIDE ASSESSMENT
HWY 43:16 WHITECOURT EAST HILL (NC1)
2003 ANNUAL INSPECTION REPORT

Dear Sir:

This letter documents the 2003 annual site inspection of the Hwy 43:16 Whitecourt East Hill site undertaken by Thurber Engineering Ltd. (Thurber) in partial fulfillment of our Geotechnical Services, Monitoring and Assessment of Instrumentation and Landslides contract with Alberta Transportation (AT) under CE Agreement 144/2000.

The site reconnaissance was undertaken on June 12, 2003 by Mr. Tamer Elkateb, Ph.D., Mr. Don Proudfoot, P.Eng., and Don Law, P.Eng of Thurber. The reconnaissance was carried out in the presence of Mr. Roger Skirrow, P.Eng., Mr. Mike Baik 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, 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 2003 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 some cracking noted in the vicinity of Station 1+900. This pavement distress was first observed in 1998.

The crack pattern is shown on the site plans, Figures NC-1-1A and NC-1-2 (Section F), which have been updated with the information from the June 2003 site visit. 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. However, differential height up to 5 mm was observed across both the west and east cracks in the westbound lanes. This is different from the 2002 site visit where differential height across surface cracks was limited to the west crack.

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 between Stations 1+760 and 1+780, roughly in line with the west crack.

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 at these locations.

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 encountered down slope of the roadway and southeast of the toe berm, as shown on Figure NC-1-1.

Ground movements measured by the slope inclinometers installed at the site can be summarized as follows:

- Small ongoing movement has been measured in Slope Inclinometer SI01-2A, located down slope of the roadway in the vicinity of the cracking. A movement rate of about 1 to 2 mm per year has been recorded in this SI at a depth of about 8.5 m below ground surface. Movements further down slope (SI #12, located approximately 75 m down slope of SI01-2A) have increased since October 2002, where a movement rate of 1 to 2 mm per year has been recorded in this SI at a depth of about 4.5 m.

- No noticeable movement has been recorded by Slope Inclinometer (SI) #5 located on the southwestern corner of the toe berm. Historical movements at a depth of about 13 m have been recorded in this instrument with movement rates up to 10 mm per year, as recorded over the period of 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 west of the toe berm, located approximately 20 m north of the highway, as shown on the site plan (Figure NC-1-1). It was noted in the June 2003 visit that that gully had been treated with riprap, as shown on the photographs in Section F.

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 recommended after the 2001 site visit and an inspection of this maintenance was carried out during the 2002 site visit and was found adequate. Upon inspection in 2003, it was assessed that the maintenance measures had been working effectively. A photograph of the area from the June 2003 site visit is included in 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. A crack was noted at the top of the back slope above the bin wall and extended from a point 2 m east of SI # 30 to a point 7 m west of SI # 30. In addition, some slight bulging was noted in the east side of the bin wall.

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 to negligible.

The increased differential settlement across the east crack of the roadway surface, the higher rates of slope movements in SI # 12, and the leaning trees southeast of the toe berm indicate potential instability in the vicinity of the roadway surface cracks. This could be a result of not extending the toe berm far enough to stabilize the area east of Station 1+780. The remainder of the roadway side slope, where the toe berm exist, seems to be in a stable condition.

The crack development is not affecting the trafficability of the roadway surface at the present time. Ongoing movements in this area may however be expected, and may coincide with heavy or prolonged precipitation events. Continued visual monitoring of this area is recommended.

The crack encountered in the back slope above the bin wall together with the bulging in the wall may indicate some potential instability in that area. It is worth noting that SI # 30 in the vicinity of the observed crack could not capture any soil movement as the potential slide back scarp was found in front of the slope inclinometer.

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 2001 site visit. Other areas of the site are considered to have a lower risk rating.

5. RECOMMENDATIONS

Potential mitigative and remedial measures for the potentially instable soil mass in the vicinity of Stations 1+800 and 1+900 and east of the existing toe berm can be summarized as follows:

1. Short term measures include installation of more instrumentation in this area in accordance with our proposal dated March 7, 2003. The proposed additional instrumentation will consist of 2 slope inclinometers and 9 piezometers. The slope inclinometers will be used to monitor future lateral movement, map the location of slip surface, and determine the extent of the sliding mass. The piezometers will be used to investigate groundwater conditions at the site and assess whether or not some remedial measures, such as subdrains, will be feasible at the site.

2. Medium term measures include the installation of horizontal subdrains below the roadway to drain subsurface water away from the potentially instable east area.

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3. Long term measures include the extension of the toe berm to the east to buttress the slope at the location of the potentially instable area.

Hand infilling of the crack in the back slope above the bin wall is also recommended as a maintenance measure. The wall and the retained soil should continue to be visually monitored 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+680. Ongoing maintenance will be required to maintain water flow into the lower culvert in a controlled manner at this location.

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.W. Proudfoot, P.Eng.
Review Principal

T. M. Elkateb, Ph.D.
Project Engineer

/slp

Attachments

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