

December 12, 2001

File: 15-76-11

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

Attention: Mr. Rob Lonson, P.Eng.

**NORTH CENTRAL REGION LANDSLIDE ASSESSMENT  
HWY 43:16 WHITECOURT EAST HILL (NC1)  
2001 ANNUAL INSPECTION REPORT**

Dear Sir:

This letter documents the 2001 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 25, 2001 by Mr. Don Law, P.Eng of Thurber. The reconnaissance was carried out in the presence of Mr. Roger Skirrow, P.Eng., Mr. Fred Cheng, P.Eng. and Mr. Stephan Zitterer of AT. In addition, Mr. Darryl Yagos of AT (MCI, Whitecourt) attended during a portion of the site visit.

**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&U 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. 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 2001 INSPECTION**

### **2.1 Roadway**

The highway 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+800 to 1+900. This distress was first observed in 1998.

The crack pattern is shown on the site plan, Figure NC1-2 (Section F) which has been updated with the information from the 2001 site visit. The crack pattern is also shown in photographs taken of the area (Section F). No difference in the west crack pattern or differential height across the cracks was noted from that observed in 2000. The slight depression noted in 2000 was not as noticeable in 2001. Some minor crack development was noted in the east crack area. The locations of the new cracks are shown on the site plan. The new cracks have not opened up and no differential height was noted across them.

As recommended in the 2000 Inspection Report, a new slope inclinometer (SI01-2A) was installed in the spring of 2001 at a location approximately 25 m north of the highway median centreline at about Station 1+825. No definitive movement has been measured in this SI, however there is indication of possible movement at a depth of 8.5 m based on readings undertaken between May and September, 2001. Additional readings are required to confirm movement at this depth, however the rate of movement if any appears to be relatively slow. A pneumatic piezometer was installed in conjunction with the SI, with its tip at a depth of 10.7 m below ground surface.

An older instrument (SI#12) located approximately 75 m down slope from SI01-2A showed no significant movement between May and September, 2001. Historical movements at a depth of about 4.5 m have been recorded in this instrument.

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.

### **2.2 Toe Berm and Backslopes**

The toe berm area below (i.e. north of) the highway at Station 1+700 to 1+800 was inspected. The back slope and side slope areas above and below the highway (Station 1+750 to Station 2+100) near the top of the east hill were also inspected. No visual evidence of slope movement (i.e. cracking, slumping, seepage) was noted at these locations.

Ongoing movements have been measured since the Fall of 1999 within Slope Incliner (SI) #5 located on the southwestern corner of the toe berm. A movement rate of about 10 mm per year has been measured at a depth of 13 m in the SI over the period from May to September, 2001. This is an increase in rate from about 5 mm per year measured in 1999-2000. Continued monitoring as programmed should be undertaken to confirm the movement rate does not continue to accelerate. All other inclinometers monitored in this area of the site showed negligible slope movement since the Fall of 1999.

In the spring of 2001, a new slope inclinometer (SI01-1A) was installed in the back slope between two non-functioning instruments (SI#16 and #17). No definitive movement has been measured in this SI, however there is indication of possible movement at a depth of 13 m based on readings undertaken between May and September, 2001. Additional readings are required to confirm movement at this depth, however the rate of movement if any appears to be relatively slow. A pneumatic piezometer was installed in conjunction with the SI, with its tip at a depth of 13.6 m below ground surface.

Local erosion (gulying) was noted in the side slope approximately 5 m to 10 m north of the edge of pavement of the west bound lanes, at a location adjacent to the eastern edge of the utility corridor in the vicinity of Station 1+920. This erosion feature was first noted during the 2000 site reconnaissance. A photograph is included in Section F.

### **2.3 Culverts at Station 1+680**

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 is intended to flow over the lip of the half-round culvert.

As noted initially during the 2000 site visit, the concrete work has dropped and separated from the half round pipe located between the two culverts. Photographs of the culvert from the 2001 visit are included in Section F. Water from the south ditch upslope of the area still appears to be entering under the half round pipe, creating the potential for water to travel on the outside of the centreline culvert. In addition, washout of sand from behind the concrete work has occurred which has partially blocked the half round culvert (see photographs).

## **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 bin wall profile appears relatively uniform; no significant bulging or deformation was observed (see photos in Section F).

The slopes above the wall appear intact with no signs of instability observed. Movements in SI's #30 and #31 located in the backslope above the bin wall have been negligible since the Fall of 1999. Movements in SI #32 (also located in the backslope area above the bin wall) were negligible as of the Spring 2001 readings, however the SI probe would not pass below a depth of about 4.9 m below ground surface at the time of the Fall 2001 readings. This depth corresponds to a zone of previous movement, and hence the impass may indicate that the SI instrument has sheared at this elevation. Alternatively, debris may have been placed in the pipe and become lodged at the previous shear location.

## **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 ongoing development of the roadway surface cracking in the vicinity of Station 1+800 to 1+900 appears to have slowed down since that observed between the 1999 and 2000 site visits. 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 hence continued visual monitoring of this area is recommended.

There is no surface expression of movement in the vicinity of the bin wall near the bottom of the slope. In addition, movement was not observed in SI#30 and #31. On this basis the inability to read SI#32 in this area is not likely to be related to a significant slope movement.

## **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), based on a Probability Factor of 6 (active but slow, indeterminate movement pattern) and a Consequence Factor of 3. Other areas of the site are considered to have a lower risk rating.

## 5. RECOMMENDATIONS

It is recommended to continue with future monitoring at this site as presently programmed. It is not recommended to replace or attempt to repair SI#32 at this time.

A separate study is currently underway to assess potential remedial measures should the signs of movement in the vicinity of Station 1+800 to 1+900 develop such that they impact the roadway surface.

Recommendations for maintenance at the Whitecourt East Hill site were provided on site to Mr. Yagos and were outlined in a fax document to Mr. Terry Carter, P.Eng. of AT (Edson) dated July 11, 2001 (attached). The maintenance consisted of repair of the concrete areas around the subdrainage outlet and culvert inlet at Station 1+680, and repair of the erosion gullies in the highway sideslope near Station 1+920. In addition, recommendations were provided to extend and armour the culvert outlet located on the north side of the highway between approximate Stations 1+700 and 1+750 (actual chainage not known). It is understood from Mr. Yagos that this work was to have been undertaken during the week of November 19, 2001.

As noted in the 2000 report, 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. Hence ongoing maintenance will be required to maintain flow of water into the lower culvert at this location. Alternatively, a buried (and possibly insulated) piping solution may be considered for the intersection of these water sources to reduce the likelihood of piping occurring around the lower culvert inlet.

## 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

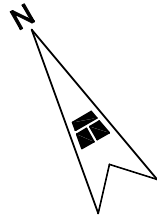
D.J. Law, P.Eng.  
Project Engineer

Attachments

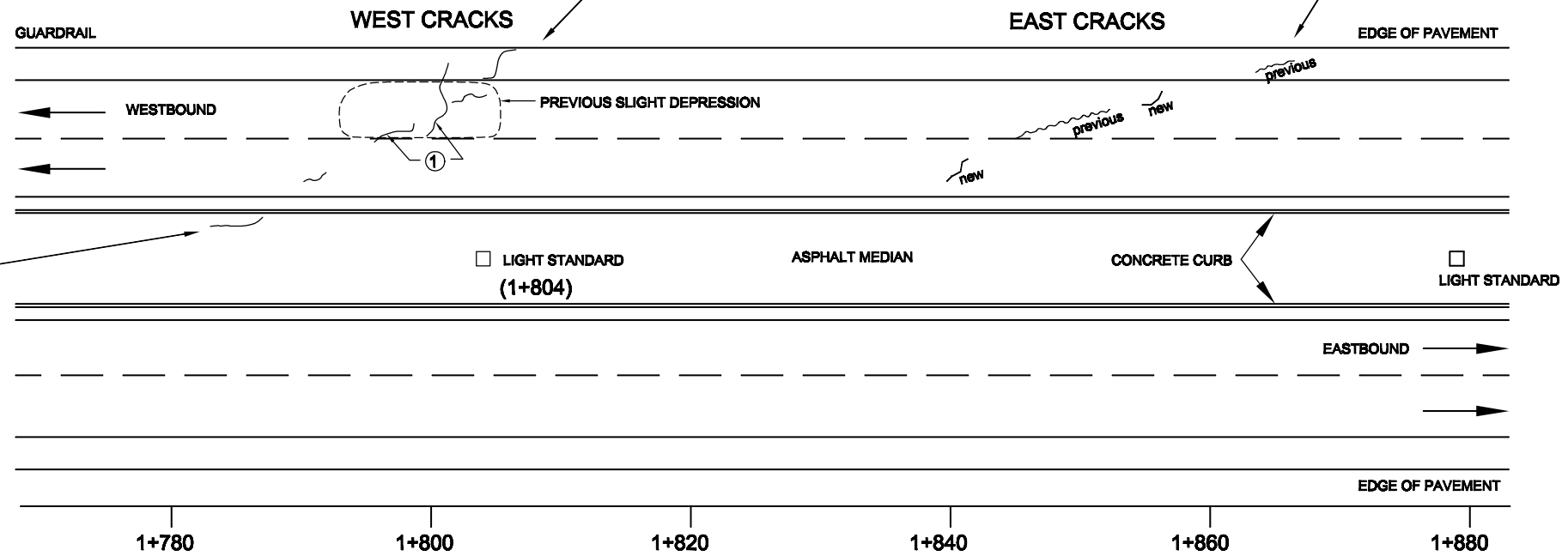
cc: Mr. Roger Skirrow, P.Eng., Director of Geotechnical Services, AT



SI01-2A (LOCATION APPROX.)



GRAVEL ACCESS ROAD



**LEGEND**

- ① 3-5mm DIFFERENTIAL DOWN TO THE NORTH
- ⊕ SLOPE INCLINOMETER

LOCATIONS OF FEATURES ARE APPROXIMATE  
WIDTH OF ROADWAY EXAGGERATED  
SCALE 1:500 ALONG ROADWAY ALIGNMENT

|          |          |
|----------|----------|
| ENGINEER | DJL      |
| DRAWN    | ZD       |
| DATE     | NOV 2001 |
| APPROVED |          |
| SCALE    | AS SHOWN |

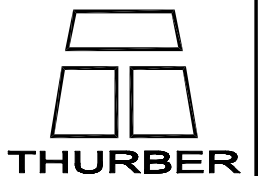
ALBERTA TRANSPORTATION

**CRACK PATTERN IN PAVEMENT  
STATIONS 1+780 TO 1+880**

NORTH CENTRAL LANDSLIDE ASSESSMENT

NC1  
WHITECOURT EAST HILL

THURBER PROJECT #15-76-11A



DRAWING No. **FIGURE NC1-2**



LOOKING WEST AT EAST CRACKS NEAR STATION 1+860



LOOKING NORTHEAST AT EAST CRACKS NEAR STATION 1+860



LOOKING WEST AT WEST CRACKS NEAR STATION 1+800



LOOKING NORTHEAST AT WEST CRACKS NEAR STATION 1+800



LOOKING EAST AT UPPER GUARDRAIL



EROSION GULLIES NEAR STATION 1+920



SUBDRAIN AND CULVERT OUTLETS NEAR STATION 1+680  
(SOUTH OF HIGHWAY)



BIN WALL, STATION 1+200 LOOKING NORTHEAST



BIN WALL, STATION 1+200 LOOKING WEST