



March 6, 2003

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  
SH 661:02 NEAR NORTHEAST BOUNDARY OF  
TOWN OF FT. ASSINIBOINE (NC14)  
2002 ANNUAL INSPECTION REPORT**

Dear Sir;

This letter documents the 2002 annual site inspection of a portion of Secondary Highway 661:02 located on the northeastern boundary of the Town of Ft. Assiniboine. The work was 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).

The site inspection was undertaken by Mr. Don Law, P.Eng of Thurber on May 31, 2002. The site visit was carried out in the presence of Mr. Rob Lonson, P.Eng., Mr. Mike Baik, Mr. Roger Skirrow, P.Eng. and Mr. Kip Hritzuk, P.Eng. of AT.

**1. BACKGROUND**

The slope has had a history of slope failure, and of drainage measures undertaken to mitigate the effects of groundwater on the slide area since the slide was first reported in 1978. A description of the slope instability and chronology of events as interpreted from the AT geotechnical files was provided in Section A of the site binder.

A summary of the background information including historical observations and remedial drainage measures undertaken prior to 1997 was provided in the 2001 report and hence is not repeated herein.

An assessment and recommendations for remedial measures were provided by AGRA Earth and Environmental (AGRA) in letter reports to the MD of Woodlands dated October 10, 1997 and January 22, 1999. These reports are included in Section G of the site binder.

A number of remedial measures were considered in the 1997 AGRA report, including a toe berm, slope flattening (i.e. vertical and/or horizontal grade change, and additional horizontal drains). The favoured alternative was to excavate and rebuild the slope with geogrid reinforced granular fill. A directionally drilled horizontal drain alternative was put forward in the 1999 AGRA report, however it was noted that there is some risk that the drains will be ineffective based on the past performance of horizontal slope drains at this site. These recommendations apply only to the mid-hill slide area, and not the area of instability noted uphill of this area.

Toe bulging in the mid-hill slide area had caused deflection of the walls of a house located at the toe of the failed slope, as documented in a letter to the MD of Woodlands by AGRA dated May 21, 1999. The house has since been removed from the site.

## **2. SITE OBSERVATIONS**

The highway roadway surface, back slopes and side slopes were inspected during the 2002 reconnaissance in the mid and upper hill areas of the site. The side slope in the lower portion of the hill was also inspected. Photographs of the site taken during the reconnaissance are included in Section F of the site binder.

Maintenance of the roadway has not been undertaken at the site over the past year, as confirmed by Mr. Rick Ellwyn, AT's MCI for the area.

The following features and observations were noted during the site reconnaissance. The approximate locations of these features are shown on the site plans, Figures NC14-1 (overview) and NC14-2 (detail of the mid-hill slide area), updated for 2002 and attached for inclusion in Section F of the binder. A stratigraphic cross section from the previous AGRA report has previously been provided as Figure NC14-3 in Section F.

### **Mid-Hill Slide Area**

- A 50 m section of roadway continues to be impacted by the mid-hill slide feature. This area is shown in detail on Figure NC14-2, and includes the approximate location of instrumentation installed previously. The crack pattern has not changed significantly since the 2001 site reconnaissance, however overall the area appears to have continued to subside over the past year. The differential height across the crack in the central/downhill portion of the crack feature has increased to a maximum of about 40 mm

from the 5-8 mm observed in 2000 and 30 mm observed in 2001, and extends further as shown on Figure NC14-2. In addition, the differential height across the uphill portion of the crack has also increased to between 5 mm and 12 mm since last year. The upslope lane (i.e. right hand lane as you travel uphill) still appears to be relatively unaffected by the slope movements.

- The water level in SP97-2 was estimated to be approximately 5 m to 6 m below the ground surface, based on a sounding undertaken with a pebble dropped into the pipe. This is lower than determined in 2001, and similar to the water level shown on Figure NC14-3 (measured in 1998 at about 5 m below ground surface).
- The slump feature first noted near the toe of the slope in 2001 had not significantly changed since last year's site visit. Some minor seepage was noted in the west end of the scarp and some seepage was also noted further up the slope, similar to that noted in 2001.
- Water was heard trickling through the existing collection well at the toe of the mid-hill slope, indicating that it is still functional.

### **Uphill Roadway Distress**

- The 30 m long shallow dip in the roadway shoulder and guardrail noted in the 2001 report, located approximately 100 m uphill from the mid-hill slide feature, does not appear to have changed since the last site visit. Some minor cracking was observed, similar to that noted in 2001. The bump first noted in 2001 approximately 30 m uphill from the shallow dip was also similar.
- The graben feature first observed in 2000 on the upper side slope adjacent to the dip and bump features was inspected. The limits of the graben appear somewhat more defined than last year, indicating that some further development of the graben feature may have occurred.
- The older scarp feature observed below (i.e. west) of the graben feature (first noted in 2001) had not significantly changed since the last site visit in 2001.

### **Other Areas**

- The sinkhole first noted in 2000 on the side slope approximately half way down the slope, located between the two instability areas (approximately as shown on the site plan) is approximately 600 mm deep and 3 m in diameter. There was no evidence of seepage or piping discharge from areas below the sinkhole feature during the 2002 site reconnaissance. The sinkhole

does not appear to have developed further since it was first observed during the 2000 site reconnaissance.

- The inactive scarp area noted in the lower portion of the slope during the 2000 site reconnaissance has not changed since then, and does not appear to be impacting the roadway at this time.

### **3. ASSESSMENT**

As noted in previous reports, it is expected that the active slope instability has resulted from high pore water pressures in the slope generated from the natural groundwater regime, possibly combined with placement of embankment fill materials at the time of roadway construction and/or upgrading. The visual observations indicate that the mid-hill slide area has moved somewhat during the past year, however less movement has likely occurred in the upper hill area. The lower hill area still appears inactive as of the 2002 site visit.

It is expected that, if no action is taken, the mid-hill (roadway scarp) and uphill (dip and bump) areas will continue to develop and cause further distress to the highway at these locations.

### **4. RISK LEVEL**

A risk level of 36 is considered applicable to the active slide areas of this site, based on a Probability Factor of 9 (active with moderate steady rate of ongoing movement) and a Consequence Factor of 4. This is the same risk level provided in our 2001 report. Other areas on the hill are considered to have a lower risk level.

### **5. RECOMMENDATIONS**

Based on review of potential options for remediation and discussion during the site visit, local realignment upslope of the current alignment is considered the most appropriate option at this time.

High groundwater levels appear to be the major cause of the instability at this site, however insufficient information is available on the source and distribution of the groundwater to allow detailed assessment of remedial measures. A hydrogeological assessment has been undertaken, and additional field work including geotechnical instrumentation installation and geometric assessment has been proposed to determine the feasibility of realignment of the roadway upslope of its present location. It is recommended that this work be undertaken in 2003 to allow for readings to be collected and design work to be initiated as appropriate.

Alberta Transportation

- 5 -

March 6, 2003

## **6. CLOSURE**

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

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

original signed by:

R. Clementino, E.I.T.  
Project Engineer

Attachments

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