

June 2, 2009

Alberta Transportation
Central Region
#401, 4902 – 51 Street
Red Deer, Alberta
T4N 6K8

**Mr. Dennis Grace, P.Eng.
Construction Engineer**

Dear Mr. Grace:

**Central Region Geohazard Assessment Site C22
H22:20 Pavement Settlement
May 2009 Instrumentation Monitoring Report**

Alberta Transportation has initiated a process of risk management at specific geohazard sites that includes a document control system. This Annual Instrumentation Monitoring report forms Section C of the document control system for the above site. The instrumentation was read by Ms. Danelle Stutt, EIT, of Klohn Crippen Berger Ltd. on May 25, 2009.

This report was prepared by Klohn Crippen Berger Ltd. for Alberta Transportation Central Region under Contract No. CE101/2008.

1. PROJECT BACKGROUND

Over approximately the last 10 years, two gentle dips have been observed across the full width of Highway 22. The dips are about 150 m apart and are located approximately 12 km south of Highway 54 or about 5 km north of the intersection with Highway 587. The highway was built in 1989 with a 50 mm thick lift of cold mix and, in 1993, a 110 mm thick layer of asphalt concrete pavement was added. The highway is currently scheduled for resurfacing in the near future. The two areas of settlement were first observed in 1996 and have progressively settled since that time. No patches have been placed in order that the settlement is not accelerated by the increased weight of pavement.

The areas of settlement coincide with natural depressions about 10 m to 15 m deep that were infilled during the road construction. The bases of the depressions are typically wet with standing water. The dips are about 150 m apart and have a maximum differential settlement of about 200 mm to 250 mm.

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Four solid stem auger holes (designated as SI03-01, AH03-02 to AH03-04) were drilled on July 23, 2003 at the two settlement sites. Typically, the embankment fill material comprised low plasticity, stiff to very stiff silty clay with occasional pockets of sand and silt. The fill thickness ranged from about 3 m to 11 m thick and was observed to have an average moisture content of about 20%. Underlying the fill, organic zones were encountered and are assumed to be original lakebed deposits. The organic layers were observed to be about 1 m to 3 m thick and comprised fibrous and woody, partially decomposed material. The observed moisture content varied from 330% to 390%. The organic material was underlain by low to medium plasticity, stiff clay till.

The site is illustrated on Figure 1.

2. SITE OBSERVATIONS

The following data plots are provided for Section D of the document control system for SI03-01:

- Cumulative and incremental displacement in A direction on same page.
- Cumulative and incremental displacement in B direction on same page.
- Resolved single movement vector plot.

Comments on the SI data obtained on May 25, 2009 are provided below:

SI 03-01

Horizontal displacement is apparent in the embankment approximately 2 m below the pavement surface within the highway fill. Approximately 5 mm of total cumulative movement has been recorded since August 2003. The horizontal displacement observed appears to be associated with vertical settlement and buckling of the slope inclinometer casing rather than horizontal shear movement.

3. SLIDE ASSESSMENT

It is believed that sections of the highway fill have been settling since construction, but were not noticeable until 1996. It is considered that the consolidation of the organic sediments is very slow due to confinement provided by the low permeability of the fill above and clay till below, and decomposition of the organic material. Simple consolidation analyses based on published typical parameters indicate a likely total settlement at Dip 1 of about 500 mm and at Dip 2 a total settlement of about 850 mm. The amount of total settlement versus the observed differential settlement is unknown. It is considered that the settlements will continue due to creep as the organic soils decompose.

There is no indication of a deep-seated failure of the embankment. The observed horizontal movement is likely a result of buckling of the casing due to vertical settlement of the surrounding soil.

Due to the gradual nature of the dips, they do not at present form a dangerous hazard to vehicles traveling at the posted speed limit.

Based on the risk level criteria provided by Alberta Transportation, a risk rating of 27 has been assigned to this site. This is based on a probability factor of 9 for an active feature, and a consequence factor of 3 due to the possible affect on the safety of highway traffic.

4. RECOMMENDATIONS

Based on the very slow nature of the settlement, it is recommended that the highway grade be restored in the dip areas with asphalt as required, or addressed in a future overlay project.

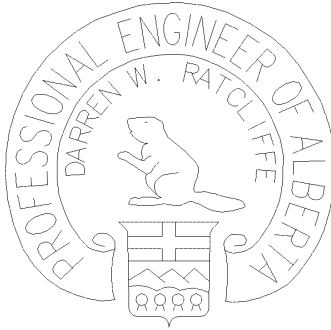
The areas should be monitored by AT Operations personnel to observe further settlement or lateral spreading. Any significant changes should be reported to AT Construction staff for review. As such, it is recommended that this site be deleted from the annual site inspection tour, and instrumentation monitoring should be discontinued.

June 2, 2009

Please contact the undersigned if you have any questions regarding this report.

Yours truly,

KLOHN CRIPPEN BERGER LTD.



Darren Ratcliffe, P.Eng.
Project Manager

APEGGA Permit to Practice No. 9196