August 10, 2007 File: 15-85-72

Alberta Infrastructure and Transportation
Room 301, Provincial Building
9621 - 96 Avenue
Peace River, AB T8S 1T4

Attention: Mr. Ed Szmata

PEACE REGION (PEACE – HIGH LEVEL AREA) GEOHAZARD ASSESSMENT
SHAFTSBURY TRAIL (NORTH SITE)
2007 CALLOUT INSPECTION REPORT

Dear Sir:

This letter documents the 2007 callout site inspection of an area of slope instability located below Shaftsbury Trail (Hwy 684:02) within the Town of Peace River. The site is located 1.7 km south of the intersection of Shaftsbury Trail and Highway 2.

Thurber Engineering Ltd. (Thurber) undertook this inspection in partial fulfillment of our Geotechnical Services for Geohazard Assessment, Instrumentation Monitoring and Related Work contract (CE047/2004) with Alberta Infrastructure and Transportation (AIT).

Simon Cullum-Kenyon, P.Eng. of Thurber undertook the inspection on July 5, 2007 with Ed Szmata of AIT and representatives of the Town of Peace River. Two sites were assessed at this time. The second site (designated as the South Site) is reported in a separate call-out letter.

1. BACKGROUND

This site has not been visited before, and no site binder currently exists. Cracking and loss of ground in the sidewalk adjacent to road at this location were reported to have developed over 3 weeks in June 2007, following several very heavy rainfalls.

2. SITE OBSERVATIONS

Selected photographs taken during the visit are attached.

In this area, Shaftsbury Trail runs north-south along the crest of a slope over a terrace of the Peace River, with several residences located on the terrace. The slope has a height of about 20 m and an overall slope angle probably steeper than 45º.

The upper portion of the slope (estimated as 8 m to10 m vertically) is comprised of a silty sandy clay, containing clasts ranging from gravel size to boulders observed up to 1.75 m in diameter. This portion of the slope had an angle of typically between 34º and 40º. Beneath this the slope was comprised of sandstone, forming a steep cliff over the remainder of the slope.

As shown in Photos 1 and 2, the failed area has impacted an approximate 8 m length along the sidewalk. The scarp in this area was 2 m to 2.5 m high and located 1.75 m from the guard rail at the time of the site visit. The slide appeared to be contained solely in the upper clay soils and the debris formed an apron of colluvium at the toe of the slope, typically at an angle of 30º and 32º, although some boulders have traveled beyond the apron toward the residences (See Photos 4 and 6).

Signs of the potential for similar failures, including slides below the road and cracks in the sidewalk were noted extending up to 25 m on either side of this failure, for a total potential failure length of 60 m.

3. ASSESSMENT

The slide is considered to have been triggered by either a temporary raise in groundwater or a concentration of surface water at this location. Either of these could have been caused by the reported heavy rainfall prior to the slide. The upper clay soils have lost strength and/or support and failed over the underlying sandstone cliffs. The sandstone appears to be relatively intact.

The main concerns at this site are:

- the potential for boulders or other debris falling either from an expansion of the slide or the existing slide area and reaching the yards and residences below the slope;

- retrogression and/or expansion of the slide could result in a loss of a portion of the highway; and

- a portion of the sidewalk has been lost and there is a hazard to pedestrians.

Site observations indicate an expansion and/or retrogression of the slide are possible. Therefore measures should be taken to protect the highway and the residences below.

There are no instruments currently installed at his site.

4. RISK LEVEL

The risk level for this site (relative to highway issues) has been assessed as follows:

PF(9) * CF(2) = 18

A Probability Factor of 9 is considered appropriate since the slide has recently occurred, the near vertical scarp will likely retrogress and additional movement could occur following heavy or prolonged rainfall. A Consequence Factor of 2 is considered appropriate since loss of a portion of the roadway is possible.

5. RECOMMENDATIONS

5.1 Short Term

To protect the residences below the slope a barrier should be installed to stop boulders or other debris reaching the property lines. In the short term it is considered that New Jersey Barriers would be a suitable option, placed approximately along where the snow fence has been installed (see photos).

The slide area along the sidewalk should be fenced and//or closed to keep pedestrians away from the slide.

The highway site should be regularly inspected by the MCI to monitor if the slide retrogresses and reaches the driving surface. If this occurs, partial closure of the road may be required.

5.2 Long Term

A repair of this slide will be required to protect the residences below the slopes for possible future failures and to protect the highway. Three main options are seen as possible to stabilize this site. Note that all of these assume that the lower sandstone slopes are stable, which is reasonable based on this assessment, but would need to be confirmed during the design of the stabilization option selected.

5.2.1 Slope flattening

The upper portion of the slope could be flattened, likely to an angle in the order of 3H:1V. Re-vegetation of the slope would be required and drainage improvements could be made. From a strictly construction perspective, this is likely the least expensive solution, with a ball park cost for removing the soil and re-vegetating of about $60,000. However, this would also require shifting the road to the west, which would have additional costs associated with land purchasing and re-construction of the road, which are very difficult to assess at this time, and are not included.

5.2.2 Block wall

The existing clay slope could be reconstructed using a reinforced block wall system (Magnum Stone for example). This could be stepped with plantings placed on the steps and drainage improvements could be made. The cost of such a system is estimated at $150,000, but would likely require temporary loss of the northbound lane on Shaftsbury Trail during construction and subsequent re-construction of the pavement section (which is not included in this cost estimate)

5.2.3 Pile Wall

A pile wall could be installed along the crest of the slope. This would likely be the most expensive option with a ball-park cost in the order of $450,000. However, the road could likely be maintained intact. This option may not fully protect the residences below the slope as soil beneath the wall could still fail, and it may be

prudent to construct a suitably designed barrier between the toe of the slope and the property line(s).

5.3 Investigation

A geotechnical investigation will be required to confirm the mechanism and depth of the failure and provide sufficient information for detailed repair design. As an initial investigation, we recommend drilling at least 4 test holes on the highway within the potential 60 m failure zone. The intent of this would be to characterize the upper soils, assess the depth of any groundwater and indicate the depth of the sandstone layer. Depending on the repair option selected, additional investigations, possibly including coring of the sandstone to confirm its stability, may be prudent

6. CLOSURE

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

Yours very truly,
Thurber Engineering Ltd.
Simon Cullum-Kenyon, P.Eng.
Review Engineer

Chris Workman, P.Eng.
Principal Engineer

Photo 1.
Looking south at scarp in the path along Shaftsbury Trail. Near vertical scarp is 2 m to 2.5 m high

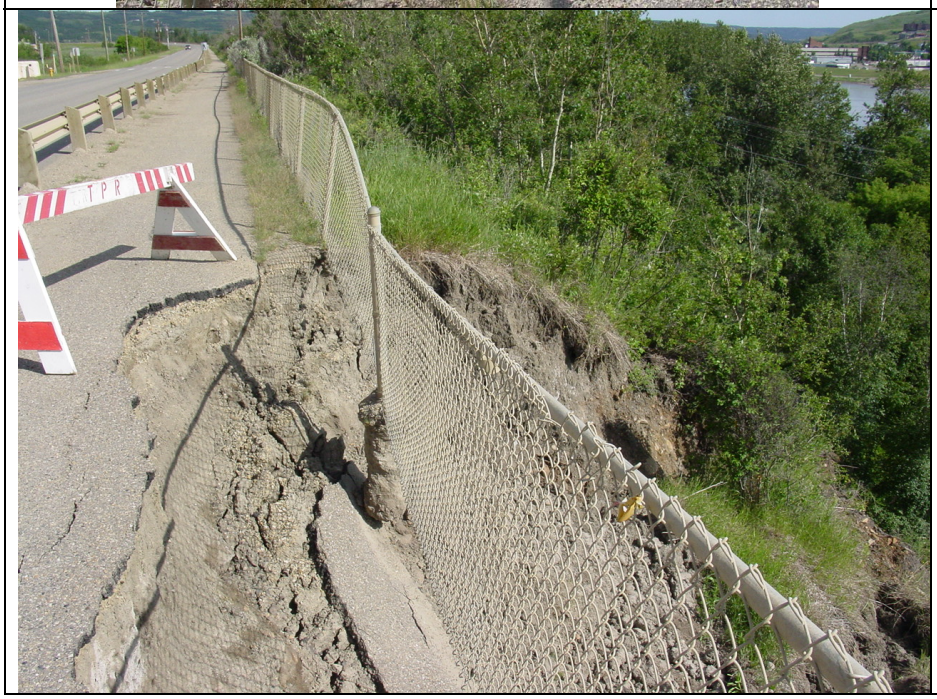

Photo 2.
Looking north at scarp in the path along Shaftsbury Trail.

Photo 3.
Debris in slide area.

	**Photo 4.** Looking down the slide area. Note boulders up to 1.75 m in size have traveled toward the residences.
	**Photo 5.** Slope in failed area. Note the stratigraphy is silty sandy clay with up to boulder sizes overlying sandstone, whioch forms the cliffs in the lower portion of the slope. Overall slope height is ~20 m. Note the surface failure just above the soil-rock interface to the north of the slide (right of picture)

Photo 6.
Debris at toe of slide area.

Photo 7.
Tilted fence and cracks in the path immediately south of the slide area. The telegraph pole in the middle distance doesn't show signs of tilting (the support wire isn't taut).

Photo 8.
Typical intact slopes south of the slide area.

Photo 9.
Typical slopes south of the slide area. There have been past failures in this area, and there is cracking near the crest of the slope.