KARLENG Karl Engineering Consultants Ltd.

File: 2008-1002a (Site Summary) (GP#30a) Date: April 2009

# BRIEF SITE SUMMARY AND RISK ASSESSMENT

1. Site (GP#30a) — Hwy 43:12 Iosegun River – West backslope Catch water ditch
2. Reference Location along Highway — Hwy 43:12 Iosegun River Southbound lane at about 0.8 km north of Bridge
3. Legal Description — Section 35, Twp 61, Rge 18, W5M
4. UTM Coordinate — N 6,018,278 E 526,877
5. AT File
6. Alberta Transportation Plan and Profile
7. General Description of Instability

The backslope slide failure is located along the eastbound lane at about 800m west of the Iosegun River Bridge. The backslope is about 20-25m in height and at 3H:1V slope. The slope was excavated with the twinning (2002) construction of the new eastbound lane. A shallow catchwater ditch was excavated along the top of the backslope to intercept surface water flow from back-country and to divert it to flow north towards the Iosegun River.

The sliding of this excavation backslope was observed to have occurred about 3 years ago (2006/2007). It is likely that slope failure can be the result of overspilling of surface water from the catchwater ditch at top of the backslope which subsequently caused the wetting/saturation of slope with time. A semi-circular slippage failure mechanism within overburden soil (glaciolustrine clay) can be likely occurring. Clay till with silt/sand seams or lenses likely constitutes the glaciolustrine clay overburden soils. The existing catchwater ditch is considered inadequate in its grade (too flat) and channel width to discharge the collected flows. This inadequacy needs to be corrected with ditch regrading and/or steepening (or other designs) to provide sufficient grade and flow capacity.

8. Date of Initial Observation

   2005- 2006 (Slide Tour)

9. Date of Recent Observation

   2008 July 2008 Slide Tour

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10. Instrumentation Installed

None

11. Instrumentation Operational

None

12. Risk Assessment

PF (9) * CF (4) = 36

PF (9)

- Rate of movement is steady and possibly increasing

CF (4)

- Slide runout may block ditch but highway should not be affected as the existing width of ditch and shoulder can be sufficient to provide some storage space in the event of earth movements.

*Note:*
*The risk assessment is provided based on a categorization of Hazard Probability Factor (PF) and Consequence Factor (CF) as provided by AIT's RFP 2000.*
*PF 1 to 20 scale*
*CF 1 to 10 scale*

13. Geotechnical Conditions

The site is situated on the west backslope of the Hwy 43 alignment at the Iosegun River Crossing. The site is situated on the west valley slope of the Iosegun River Valley. From a previously repair slide site just adjacent and soil logs of this cut slope, it is assessed the cut slope entails clay till soils with some wet sand/silt lenses.
From published soil information in the vicinity area,

- The bedrock stratigraphy is the Paskapoo Formation: grey to greenish grey, thick-bedded, calcareous, cherty sandstone; grey to green siltstone and mudstone; minor conglomerate, thin limestone, coal, and tuff beds; non-marine.
- The bedrock elevations in the vicinity of the site vary between 820 and 855 m, and the surficial elevations range between 820 and 870 m. From exposures of very soft sandstone in cutslope adjacent, it can be assessed that the site likely intercepts the bedrock stratigraphy of weak sandstone in the lower portions of the slope.

14. Chronology

2001 Completion of cut slope
Failure of an adjacent cutslope occurred and was repaired with reconstruction of a granular wedge at toe of slope using free draining concrete sand in the form of slots of buttress drains carved into the slope. Water seepage at interface of bottom weak sandstone and top overburden CH clay till was cause of failure.
2002 Completion of twinning of highway and start of road operation
2006 Over spillage of back slope catchwater ditch

END

**LANDSLIDE RISK ASSESSMENT** September, 2006
**BRIEF SUMMARY**

1) **SITE:** **GP-31**
**Hwy 43:12 Iosegun River**
**- Major Instability and Distress Areas:**
**i) Slide at south backslope (eastbound lane) at approximately 0.5km west of bridge**
**- Other Distress Areas**
**ii) Catchwater ditch drainage at top of above south backslope at west of bridge**
**iii) Permanent Erosion Control Installations along Median Ditch on east side of bridge**
**iv) High approach fill embankment over soft channel deposits on west side of bridge**

2) **REFERENCE LOCATION** along Highway:
Hwy 43:12 @ Km 17.171 at east and west of Iosegun River bridge
The site location is shown in Figure 1.

3) **LEGAL DESCRIPTION:** SE35 61-18-W5M

4) **UTM COORDINATE:** N54.314753 E-116.588593

5) **AI FILE:**

Hwy 43:12 Highway Twinning (7 km stretch from east to west of Iosegun River crossing)
A) Design Mosaics for Highway Twinning (i.e. Eastbound Lane)
B) Geotechnical Assessments for Highway Twinning for
- Gradeline design (March 2000 EBA Ref: 907-99-21101)
- Interim Instrumentation Report (for Approach fill Monitoring)
(March 2002 EBA Ref: 907-21101.008)
- Slide remediation design for south cutslope (on 0.5km west side of Iosegun River)
(2001 EBA Ref:21101. ??)
- Approach Fill Embankment Design for Highway Twinning Construction
- Slide Remediation for South Backslope (eastbound lane) at approxi. west of bridge
-Erosion of median ditch along east side of bridge

6) **AIT PLAN AND PROFILE:**

Design Mosaics for Highway Twinning (i.e. Eastbound Lane)

7) **GENERAL DESCRIPTION OF INSTABILITY**

**i) Slide at backslope (west of bridge)**

During the 2001-2002 twinning construction of existing highway (i.e. present eastbound lane), a slide occurred at the cutslope (15-20m high) located 0.5km west of the bridge. Cause of sliding was found to be strong groundwater seepage along interface between the top overburden clay till and weak sandstone below. Substantial groundwater influence from the grounds (south and north of this crossing) at back and south of this crossing was assessed to cause instability of the excavation slope along the 2002 twinning construction. Using free draining coarse sand as construction material, the slide was remediated with the design of a toe key and buttress drains. The toe key was constructed (using coarse sand) in the form of a toe wedge to key to sandstone layer below and the toe key was connected to buttress drains slotted at close intervals (10m spacings along the toe) into the slope. A weeping tile system was installed along the back of toe key and daylighted (east towards the river) at a lower elevation towards the catchwater ditch which runs along the top of slope. The remediated slope shows no obvious signs of reactivating movement since the slope reconstruction in 2001-2002.



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It is advisable to inspect this remediated backslope at yearly intervals. Adverse influence from groundwater regime (including surface flow along catchwater ditch as described below) may affect stability of slope and will require review.

**ii) Vertical downcutting of catchwater ditch at top of backslope (at top of remediated backslope slide)**

Surface drainage flow from catchment area at south hinterland above the backslope was intercepted by a catchwater ditch located at top of backslope. The captured flow was substantial enough to cause a breach of the catchwater ditch channel (nominal 0.5 to 1.0m deep) and required deepening/grading improvements around Summer 2002.

However, at subsequent years since 2002 (completion of twinning), substantial flow along the ditch was observed to rapidly downcut the ditch at steep grade location. Due to disposition of this catchwater ditch along the head of the backslope (which has previously slided and repaired) and its rapid downcutting (as well as continually steepening of this catchwater ditch channel), the flow along this ditch can potentially incise/erode a "steep tension crack channel" at the head of the backslope . It maybe a concern as constant channel flow along "the steep tension crack channel" will invoke infiltration into back of slope and aggravate seepage into reconstructed backslope.

It is essential to observe future condition of the catchwater ditch with regard to channel upgrade and any adverse impact to stability of the backslope below.

**iii) Erosion and Sedimentation Control Overviews for Iosegun River Valley:**

- a) Median ditch (7% grade) erosion repair works (2002) on east side of River
- b) Sedimentation Ponds at both sides of River
- - Free board of weir (filtration gabion) outlet may decrease due to accumulation of silt with time
- - Removal of silt from sedimentation pond may not be necessary as a level of vegetation growth has established to provide a "wetland environment". The operational disturbance created by machinery during removal of silt will cause more environmental damage to "wetland environment" already established over the sedimentation ponds' surface areas. It will be preferable to leave the silt accumulation in place as wetland vegetation environment has already established.
- - Source of silt supply has been virtually stopped because excavation slopes and other areas (disturbed by 2001-2002 grading) have been successfully re-vegetated. Additional gabion drop structures have been added to ditches at certain locations.

**8) DATE OF INITIAL OBSERVATION:**

| | |
|---|---|
| i) Backslope Slide (west of bridge) | Summer 2001 during excavation of slope |
| ii) Erosion of Median Ditch | Spring 2002 first snow melt event after construction of new median ditch |
| iii) Sedimentation buildup at Sedi. Ponds | 2001-2003 observed buildup of siltation level<br>2003-2005 observed a decreased level of siltation buildup possibly due successful re-vegetation of upstream disturbed areas.. |

**9) DATE OF LAST INSPECTION:**

Inspected in June 2005
- i) Backslope (remediated slide) west of bridge
- iii) Sedimentation ponds

Not inspected in June 2005
- ii) Backslope catchwater ditch



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## 10) INSTRUMENT INSTALLED:

(Refer to EBA March 2002 Interim Instrumentation Report Ref:0907-98-21101.008)
At approach fill on west side of bridge (eastbound lane i.e. 2002 twinning)
1 horizontal slope indicator (SI-1) at headslope on west side of bridge
4 vertical slope indicators - west side of bridge (SI-2 & SI-3)
- east side of bridge (SI 4 & 5)
Various piezometers at vertical SI locations

## 11) INSTRUMENT OPERATIONAL:

As of Oct 2004
SI-1 (horizontal SI)
SI-4, SI-5 (vertical SI)

## 12) RISK ASSESSMENT:

**Backslope slide (remediated in 2002) on west side of bridge**

**PF ( 3 ) * CF ( 4 ) = 12**

- **PF = 3**
  - Slide was stabilized with a granular toe key and buttress drains in 2002
  - No obvious movement was visually observed since 2002 and performance of slide stabilization was considered successful
  - The reconstructed slope is considered inactive in slide movement, low probability of remobilization
  - However, adverse groundwater influence on this slope can be substantial and future stability of slope will be dependent on performance of the drains. A portion of the groundwater will exit through the slope face along the frontage of the toe key and it Is important to observe if any signs of seepage flow with exit force that can scour through granular toe key. Though this breaching of toe key is considered unlikely (as angular coarse sand was used as construction material), it is advisable to observe any sign of seepage exit along the slope face.
  - A weeping tile was constructed along the toe key and daylights eastward (toward the Iosegun River) to connect to the backslope catchwater ditch. This daylight point of weeping tile should be reviewed to ensure easy daylighting of captured flow.

- **CF = 4**
  - Cutslope is 15-20m height and connect to a bridge crossing
  - Partial closure of highway may be required as a result of slide remobilization

**Note**: This Risk Assessment rating is based on Scheme proposed by AI in the Request for Proposal. (2000)
Probability Factor (PF) : 1 to 20 scale
Consequence Factor (CF) : 1 to 10 scale

## 13) GEOTECHNICAL CONDITIONS

The upland topography consists of generally rolling terrain and hummocks and doughnut shaped mounds with surficial ground/hummocky moraine deposits of clay till. The underlying bedrock is generally sandstone of the Cretaceous Age. The Iosegun River Valley is identified as a glacial lake spillway carved in sandstone by historic glacial action. Clay till material at the bottom of the inferred spillway could be positioned from a subsequent glacial advance and the top portion of the spillway was partially infilled with recent deposits of soft unconsolidated to normally- consolidated alluvial and/or glaciolacustrine material.



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**14) CHRONOLOGY (Table)**

- 2001-2002 Twinning Construction of highway (i.e. eastbound lane)
- Construction of high approach fill (14m) over deep depth of soft unconsolidated alluvial channel deposits of the losegun channel floor. This was accomplished by ground improvement design of wick drains and staged fill placement as well as surcharge preloading. In general, the footprint of approach fills was constructed with a sand blanket and geotextile over soft channel deposits investigated.

Sliding failure of cutslope occurred at excavation gradeline on west side of bridge crossing. This slope was reconstructed in Summer 2002 with design of toe key and slot buttress drains.

to traffic.

Median ditch channel on east side of crossing was reconstructed due to severe flow from a substantial snow-melt event. Ditch repair was carried out with new construction of gabion drop structure and riprap lining of channel.

- **END –**