

LANDSLIDE RISK ASSESSMENT
SOUTHERN REGION

SITE S4: WILLOW CREEK LANDSLIDE

LEGAL LOCATION: **LSD 13-14-20-09-26 W4M**

REFERENCE LOCATION
ALONG HIGHWAY On the east side of Highway 2, 4.7 km north of the bridge
over the Oldman River

UTM COORDINATES: **N 5514200 E 320200** (NAD27)
NTS Map Sheet 82 H/14 (Monarch)

AI FILE: **H02:08**

AI PLAN & PROFILE:

Date of Initial Observation: March, 1993

Date of Last Inspection: Inspected July, 2003
Instruments read May, 2003.

Instruments Installed: 1994 - 16 Slope Inclinometers, 12 Pneumatic Piezometers,
23 Standpipe Piezometers

Instruments Operational: 10 Slope Inclinometers, 2 Pneumatic Piezometers

Risk Assessment: **PF(11) * CF(2) = 22 – but will increase over time**
(Long-term increase still anticipated.)

Last updated by: AMEC, August 2003

Comments: Instrumentation shows relatively little movement, however
slide appears active down slope of SI sites. Recent
movement was noted north/northeast of SI #10. Possible
impact to highway unlikely in near future, but will be a
concern at some point and mitigative measures should be
considered.

Location

The slide is located on an outbend of Willow Creek adjacent to the northbound lanes of Highway 2, North of Fort Macleod in Southern Alberta. Specifically, the site is 4.7 km north of the bridge over the Oldman River.

General Description of Instability

Based on the file information and site inspections, the Willow Creek Slide is associated with lateral erosion and migration of the creek. At the site, the highway is located on the upland terrain adjacent to a relatively steep, about 20 m deep valley slope. An outbend of Willow Creek is located at the toe of the slope and is actively eroding the area. The erosion is causing retrogression of the slope crest, primarily in the form of successive rotational block failures.

No impact to the highway has occurred to date.

Geologic Setting

Based on the borehole logs, the soil conditions appear to consist of a surficial layer of silts, ranging up to 8 m deep, underlain by a varying sequence of till, sands and gravels. The bedrock was encountered below the tills at depths in the order of 25 to 30 m. The bedrock is of the Willow Creek Formation, typically comprising a mixture of shales and sandstones.

Available groundwater data suggest that the groundwater table is in the order of 10 to 15 m below the upland level

Chronological Background

Table A1 provides the Chronological Background of the slide.

Past Investigations

AI initiated a monitoring program for the site in March, 1993. It appears that detailed stability work and consideration of remedial works have not been undertaken. Monitoring has been ongoing since the instruments were installed in 1994.

Golder Associates performed annual inspections and semi-annual instrument readings from at least 1997 to 1999.

AMEC began reading the instrumentation on a semi-annual basis and performing annual inspections in May, 2000.

Mitigative Measures Taken

No mitigative measures undertaken to date.

Monitoring Overview

Annual inspections conducted with in the past few years have indicated that there has been movement of blocks of material in the lower portions of the slope. This has been confirmed by several slope inclinometers that have been sheared off.

Slope inclinometers behind the crest of the slope show very little movement, however visual observations indicate ongoing crest retrogressions. A new slide block was noted to be forming north/northeast of SI #10 in May 2002.

Standpipes have not been read since 1995. Their condition is unknown and should be checked. Only two pneumatic piezometers are currently being read. The status of the remaining instruments should be checked.

A survey of the slope crest position was performed in July 2003.

Table A1 –S4 – Willow Creek - Chronological Background

YEAR	MONTH	DESCRIPTION
1989/90		Northbound lane of Highway 2 constructed.
1993	March	Project initiated by AI. There was some concern in the department that the slide/erosion area could be a future concern. No impact to the highway had occurred. Surface survey monitors previously installed by AI.
1994	June/July	16 Slope Inclinometers, 12 Pneumatic Piezometers, 23 Standpipe Piezometers installed
1995	August	Several piezometers reported damaged. Two SI's near lower bench close to being sheared off.
1998	May	Instruments read by Golder Associates. No significant movements.
	June	Annual Inspection by Golder Associates. Block failures on lower bench. No retrogression of crest.
	October	Instruments read by Golder Associates. No significant movements.
1999	May	Instruments read by Golder Associates. No significant movements in SI's, some cracks developing at crest of slope.
	June	Annual Inspection by Golder Associates. Block failures on lower bench. Possible threat to a buried telephone cable due to crest retrogression noted.
	Sept.	Instruments read by Golder Associates. No significant movements in SI's, same cracks at crest of slope noted.
2000	May	Instrumentation read by AMEC. No significant movements in SI's.
	June	Annual Inspection by AMEC. No retrogression of crest, but continuing block failures on lower bench.
	Sept.	Instrumentation read by AMEC. No significant movements in SI's.
2001	May	Instrumentation read by AMEC. No significant movement in SI's. Annual inspection by AMEC and AT personnel.
	October	Instrumentation read by AMEC. No significant movements in SI's.
2002	May	Instrumentation read by AMEC. No significant movement in SI's. Recent movement and development of slide blocks noted north/northeast of SI #10. Annual inspection by AMEC and AT personnel.
2003	May	Instrumentation read by AMEC. No significant movements in SI's.
	July	Annual inspection by AMEC and AT personnel. Survey of crest position performed.

S4 – Willow Creek

The Willow Creek site was visited on July 9, 2003. Photographs from this site visit are included in Appendix S4, along with a site plan, air photograph, and a detailed discussion of the visit. This discussion has also been submitted in separate unbound sheets for inclusion in Appendix B of the Willow Creek binder. The following is a brief summary of the assessment.

The overall landslide in the valley wall continues to be active. Additional retrogression of the landslide crest since the October 2002 instrument readings was noted, where the crest had retrogressed to the fence line immediately east of SI #8. In addition, the new landslide block on the north flank of the slide area, north of SI #10, has shown visible displacement since the May 2002 inspection. Aside from these areas of recent movement, the overall landslide situation observed in the previous annual assessments has not changed significantly.

As noted in the previous annual assessment reports, the crest of the slide is currently approximately 25 m from Highway 2. It is not considered likely that the crest of the slide will retrogress across this distance in the short term (i.e. one to five years). However, in the longer term, significant measures will be required to protect the highway at its current location. Please refer to the discussion in Appendix S4 for further information.

The Risk Level at this site was kept at 22 for the present location of this slide. Note that this value will increase as the slide area moves closer to the highway. AMEC recommends that the annual assessments and semi-annual monitoring at this site be continued, along with GPS surveys of the crest position. Please refer to Appendix S4 for further discussion.