

LANDSLIDE RISK ASSESSMENT  
SOUTHERN REGION

**SITE S8: FISHER CREEK**

LEGAL LOCATION: LSD 12-11-21-4 W5M

REFERENCE LOCATION  
ALONG HIGHWAY: Approximately 2 km north of Junction with SH 549.  
Approximately 900 m north of the Fisher Creek bridge.

UTM COORDINATES: 5627300 N 678900 E (NAD27)  
NTS Map Sheet 82 J/16 (Priddis)

AI FILE: SH762:02

AI PLAN & PROFILE: Need mapsheet name, sheet x of x etc.

Date of Initial Observation: May, 1988

Date of Last Inspection: September, 1991

Instruments Installed: November, 1988 – 7 standpipes (nested within 3 holes)

Instruments Operational: 5 standpipes (as of September, 1991)

Risk Assessment: PF(9) \* CF(2) = 18

Last updated by: AGRA Earth & Environmental Limited, May 2000

Comments:

## **Location**

The area of instability is located between Sta. 1+800 and Sta. 1+900 on SH 762, approximately 2 km north of the junction with SH 549. The site is approximately 12 km west of Millarville, AB (measured along the road).

## **General Description Of Instability**

The road is oriented north-south through the area of instability. There is a hill to the east of the road. The area to the west of the road is lower in elevation. Surface drainage from the hill to the east is collected in the road ditch that drains to the south. Surface drainage to the west flows downslope and away from the road.

Settlement and cracking of the road surface was first noted in May, 1988. A 50 mm wide diagonal crack (oriented northwest/southeast) had developed across the road, along with up to 100 mm of settlement of the road surface. A patch/overlay was placed in July, 1988 to repair the settlement and cracking, however when the site was re-inspected in August, 1988 the patched area had settled up to 50 mm and the diagonal crack had reopened. In addition, the fenceline approximately 10 m west of the road had displaced approximately 150 mm downslope and there was a slight bulge in the slope face approximately 25 m west of the centerline of the road.

A series of three test pits were excavated on the east and west sides of the road by AI geotechnical personnel in August, 1988. It was concluded that the settlement and cracking of the road surface was the result of drainage from the road and the adjacent west slope percolating through the surficial fill and into an underlying layer of organic matter. This buried organic layer was not exposed in the slope face to the west of the road, therefore the groundwater pressure within the organic layer built up and caused the overlying fill to slide to the southwest. This movement caused the road surface to crack along the scarp of the slide. The open crack allowed for greater infiltration of surface drainage from the road into the organic layer and triggered further movement. The failure did not appear to extend into the native clay underlying the organic layer.

## **Geological Setting/Geotechnical Conditions**

The stratigraphy exposed in the test pits along the edges of the road consisted of (from top to bottom):

- Soft to firm, silty clay fill with organic inclusions (ranging in thickness from 0 m at the east side of the road to 2 m at the west side of the road)
- An approximately 0.2 m thick lens of saturated organic matter.
- Medium to high plastic, stiff, silty clay with gravel inclusions.

Based upon these test pit results, it was inferred that the organic matter represented the original ground surface that was covered with the clay fill during road construction.

The stratigraphy encountered in the boreholes in the July 2001 geotechnical investigation consisted of a sequence of fill underlain by clay, which was in turn underlain by clay till extending beyond the completion depth of each of the boreholes. The fill consisted of intermixed sand, gravel and clay with occasional organic matter inclusions. The clay was high plastic and likely glaciolacustrine. The clay till was medium plastic.

### **Chronology**

Table A1 provides the Chronological Background of the slide.

### **Past Investigations**

Aside from the 1988 test pits excavated by AI geotechnical personnel, no other geotechnical investigations have been conducted at this site aside from periodic inspections by AI personnel.

A more detailed investigation appears to have been proposed in 1991 (see Appendix B), however, whether the investigation was carried out and its results are not documented in the file.

A geotechnical investigation was carried out by AMEC in July, 2001. This investigation consisted of drilling 3 boreholes along the west shoulder of the road and 1 borehole approximately midway between the west shoulder of the road and the fence at the toe of the slope below the road. Two slope inclinometers and two standpipe piezometers were installed in these boreholes. As of May 2002, one slope inclinometer (on the slope face below the road) was still accessible for reading.

A second geotechnical investigation was carried out by AMEC in September, 2002. This investigation focused on the southern end of the site, around cracking in the road surface that was first noted in the May 2002 site inspection. Three slope inclinometers and two pneumatic piezometers were installed in this area.

### **Remedial Measures**

A series of lime/gravel columns were installed in November, 1989 in order to stabilize and reinforce the subgrade by:

- Transferring a portion of the load of the fill onto the underlying native clay.
- Replacing poor quality fill material with high quality granular material possessing superior shear strength.
- Drying the subgrade due to the heat liberated from the lime/cement reaction in the columns.

A total of 61 columns were installed in 5 rows within the patched area. The columns were 0.75 m in diameter and installed at a 2 m center-to-center spacing. Each column penetrated the organic layer and into the underlying native clay.

After the installation of the columns, two test holes were drilled along the east side of the road and one test hole was drilled on the west side of the road. A total of 7 standpipes were installed in these test holes in order to monitor the groundwater level within the remediated area.

### **Monitoring Results**

Records from two site inspections were found in the site file. One inspection was performed at an unspecified date and it was noted that minor slumping had occurred and that minor patching of the road surface had recently been performed. The second inspection was performed in September, 1991. Up to 100 mm of settlement was noted in the southbound lane of the road between Sta. 1+840 and 1+860. In addition, it was noted that cracks of 50 to 60 mm width had formed in the road surface since sealing and patching earlier in the summer of 1991.

The standpipes along the west side of the road were reported to have been destroyed at the time of the 1991 site inspection.

The SI's installed in the north end of the site by AMEC in July 2001 measured downslope movement along the base of the road fill, prior to shearing off (Fall 2002) and/or being paved over (Fall 2001).

The SI's installed in the south end of the site by AMEC in September 2002 measured downslope movement towards the southwest. The shear surfaces are within the native clay underlying the road fill. Monitoring of these instruments continues.

### **Additional Comments**

In addition to the investigation at this landslide site, records of slope instability at two nearby sites on SH 762 were located in the AI files. These other sites are briefly described as follows:

#### **Backslope failure, SH762:02, Sta. 9+240**

- Landslide occurred in 1986. Subsequently repaired and 3 slope inclinometers were installed.
- Reactivated in 1987, with the toe of the slide filling the east ditch of the road.
- It was proposed to excavate the slide mass down to bedrock, benching the exposed face and reconstructing the slope with an underlying drainage blanket.
- No records of remedial work performed or follow-up monitoring.

#### **Road failure, SH762:02, Sta. 17+680 to 17+760**

- Landslide occurred in 1986.
- Reactivated in 1987.
- Slide area was excavated and reconstructed in 1987 with an underlying drainage blanket.
- Subsequent monitoring/status unknown.

**Table A1**  
**S8: Fisher Creek - Chronological Background**

YEAR	MONTH	DESCRIPTION
1988	May	A 50 mm wide diagonal crack (oriented northwest/southeast) across the road was noted, along with up to 100 mm of settlement of the road surface.
	July	Patch/overlay placed in settlement area to restore grade. Patched area measured approximately 10 m by 50 m.
	August	<ul style="list-style-type: none"> <li>Up to 50 mm settlement noted in patched area. Diagonal crack re-opened. Fenceline approximately 10 m west of the road displaced approximately 150 mm downslope and a slight bulge was noted in the slope face approximately 25 m west of the centerline.</li> <li>Three test pits excavated along the east and west sides of the road.</li> </ul>
	November	<ul style="list-style-type: none"> <li>61 lime/gravel columns installed within the unstable area to stabilize and reinforce the subgrade.</li> <li>A total of 7 nested standpipes installed at three locations along the east and west edges of the road.</li> </ul>
1989 (?)		"Minor slumping" and "minor patching" reported at this site, with an indication that ongoing monitoring would be carried out in the future.
1991	Summer	Sealing/patching of pavement cracks at the site.
	September	<ul style="list-style-type: none"> <li>Site inspection performed and remaining 7 standpipes read.</li> <li>Cracks up to 50 to 60 mm wide had developed since the sealing and patching earlier in the summer of 1991.</li> <li>The southbound lane between Sta. 1+840 and 1+860 had settled approximately 100 mm.</li> </ul>
	November	Additional investigations proposed. Apparent difficulties obtaining approval from adjacent landowners. File does not indicate if additional works carried out or not.
2001	May	Site inspection by AMEC and AT personnel.
	July	Geotechnical site investigation by AMEC, including the installation of two slope inclinometers and two standpipes.
	Summer	Instrumentation readings by AMEC.
	September	Fall 2001 instrumentation readings by AMEC.
	October	Site repaved on October 12 <sup>th</sup> after additional cracking and settlement of the road surface.
2002	April	Slope inclinometer on slope face below road read by AMEC in order to confirm movement depth prior to detailed design of remedial measures for this site. Continued movement along a shear zone between 3.5 and 4.3 m depth. Slope inclinometer and two standpipes along the west shoulder of the road no longer accessible due to repaving in October 2001.
	May	Slope inclinometer on slope face below road read by AMEC. No additional movement since the April reading. Annual inspection by AMEC and AT personnel. New cracking noted approximately 80 m south of July 2001 site investigation area.
	September	3 slope inclinometers and 2 pneumatic piezometers installed in the south end of the site, around the new cracking noted during the May 2002 site inspection.

	October	Instrumentation read by AMEC. Slope inclinometer in AMEC BH-1 on the slope face below the settlement and cracking area in the westbound lane at the north end of the site found to be sheared off around the depth of previously noted movement at the base of the road fill.
	December	Instrumentation at the south end of the site read by AMEC.
2003	May	Instrumentation read by AMEC.
	July	Annual site inspection by AMEC and AT personnel. South end of the site repaved on July 8, 2003.