

ALBERTA TRANSPORTATION GEOHAZARD ASSESSMENT PROGRAM PART A: FILE REVIEW

PEACE REGION – PEACE-HIGH LEVEL

PH32 JUDAH HILL – MAKEOUT SLIDE

| | |
|------------------------------|---|
| Legal Location: | NE¼20-083-21 W5M |
| Nearest Landmark: | 1.6 km south of the CN Rail crossing on Hwy 744 |
| Highway Control Section: | Hwy 744:04 |
| Date of Initial Observation: | 1984 |
| | Recent movement - 2001 |
| Date of Last Inspection: | 2008 |
| Last Inspected By: | Thurber Engineering Ltd. |
| Instrumentation Installed: | 8 Inclinometers 3 Standpipe Piezometers |
| Instrumentation Operational: | None |
| Risk Assessment: | PF = 10 |
| (as of last inspection) | CF = 3 |
| | Risk = 30 |

1. INTRODUCTION

The site is located 1.6 km south of the CN rail level crossing (km 59.6) on Hwy 744 near the town of Peace River. The site covers the road between km 57.9 and km 58.2 and the downslope stabilisation works.

Highway 744 runs south from Peace River through Marie-Reine to Highway 683 and on to Highway 49 near Girouxville. For the first 2 km south of the town of Peace River, it climbs roughly 200 m up the valley wall of the Peace River to prairie level at elevation 545 m.

This site encompasses the north flank of a 300 m wide old slide bowl, with the south flank of the slide bowl encompassing the Michelin Slide (PH 31). The site was repaired in 2005-2006, which included shifting the road alignment north and east and re-grading and flattening the down slope portion. South of the repairs, a series of 1 m to 4 m high scarps have developed, just down slope of a pile wall.

The location of the site is shown on Figure 1, while site details are shown on Figure 2, based on the last inspection.

This section is a review of files made available by Alberta Transportation regarding this site, and has been conducted to update the previous Part A review, which covered all the Judah Hill sites.

2. BACKGROUND

2.1 Bedrock Geology

Based on the AGS 1:1,000,000 bedrock geology map of Alberta, the following bedrock units occur in the valley slope down to the Peace River:

- Dunvegan Formation – fine sandstone with hard calcareous beds, laminated siltstone, silty shale.
- Shaftsbury Formation – silty shale and shale, ironstone beds, bentonite partings, thin silty and sandy intervals.
- Peace River Formation – silty shale, fine sandstone, silty interbeds.

No rock is exposed at the immediate site – cross-sections presented on the published hydrogeological maps suggest a considerable thickness of surficial materials overlie the rock.

2.2 Surficial Geology

AGS Map 291 (Surficial geology of the Grimshaw area) indicates a local veneer of eolian sand and silt overlying glaciolacustrine fine sand, silt and clay on the upland, with mixed colluvial materials on the slopes. Coarser sand and gravel deposits have been noted in road cuts locally along Hwy 744.

2.3 Hydrogeology

The ARC 1:250,000 Hydrogeological map of Peace River does not show springs or flowing wells (mainly completed within glacial deposits) in this area. Perched aquifers are expected locally, associated with local pockets of sand and gravel. Such pockets can become confined where covered by colluvium or fill on slopes.

2.4 Geomorphology

The site is below the crest of the east valley slope of the Peace River, on a ridge formed between the Peace River and Heart River. Highway 744 runs down the west side of the ridge as it decreases in height and narrows northwards, towards the town of Peace River. The sides of the Peace River and Heart River valleys are characterised by extensive landslide activity. Common landslide mechanisms in this region include:

- Earthflows caused by sudden saturation of surficial material.
- Landslides with a base in the weak Shaftsbury Formation shales.
- Landslides within weak glaciolacustrine silts and clays.

At this site, other factors that might influence landslide occurrence include saturation of downslope road fill, and drainage off the impermeable road surface. There are concerns about slide activity extending to the base of the slope, based on the irregular slope topography and observation of slides at the toe of the slope, including the 101 Street slide (see Barlow, McRoberts and Tenove 1990 “Stabilization of Urban Landslides in Peace River”).

The Makeout Slide corresponds to Zone D1 in reporting prior to 2005, and is at the northern flank of an old slide bowl that encompasses the Michelin Slide to the south (Zone D2). Slide movement at various points within the north flank of this slide bowl have been noted since 1994. Types of slide movement include rotational and/or translational on weak planes at depth, as well as shallower earth flows and debris flows. Debris from the various slides at Makeout and Michelin coalesces downslope, moving westwards towards the river.

3. HISTORIC INFORMATION

3.1 Summary

Movement appear to have occurred first at the southern end of the Makeout Slide, near the boundary with the Michelin Slide (August 1994), prompting investigation and installation of inclinometers. Movement appears to have been relatively deep (18 m), and in 1997 appears to have expanded. A concrete caisson wall was constructed in this area in late 1997, which is now becoming exposed. In 2001, subtle signs of movement were noted at the north end of the site (km 58.15), including downslope debris flows and cracking across the road. Cracking and settlement worsened, culminating in major slide movement in April 2005, which closed the road. Repair work for this slide included slope re-grading and shifting the road alignment to the east (into the slope). Some cracking began to appear downslope of the road at the southern margin of the repair work in 2007, with significant scarps developing by June of 2008. Scarps also developed around the drain outlet downslope of the road at km 58.05.

3.2 Chronology

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|----------------|---|
| May 1984 | Hwy 744 first paved. |
| September 1988 | Geotechnical investigation along Hwy 744. Worst conditions noted at 57+760 to 58+000 (Michelin and Makeout Slides). Cement stabilised stone columns proposed. |
| September 1992 | SI-13 installed at 57+967 |
| August 1994 | Slide 20 m downhill from road – appears to be within the Makeout Slide area (location is not clear – movement is noted in SI-13 at 18 m depth). |
| September 1994 | SI-32 to SI-34 and SI-40 to SI-43 installed downslope of |

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|----------------|--|
| | Makeout slide. |
| September 1994 | SI-42 and SI-43 installed downslope of Michelin slide. |
| 1996 | Ditch on uphill side of the road established. |
| September 1996 | SI-60 to SI-64 installed (between Makeout Slide and Michelin Slide). |
| January 1997 | Report on 180 m wide slide (inferred to be Makeout Slide area) – slide activity extends down to base of valley, so toe berm not considered. Proposed fix includes pile wall, light-weight backfill and shifting road alignment into the slope. |
| | Installation of culvert in upslope ditch through the slide area. |
| September 1997 | Anchored concrete caisson wall installed from 1.3 km to 1.5 km south of CN Rail crossing (within Makeout Slide). Re-alignment of road from km 57.5 to km 58.2. |
| October 1999 | Hwy 744 re-paved |
| May 2001 | Cracking and settlement of pavement at 58+200 |
| May 2002 | Worsening of cracking and settlement (approx. 50 mm) at 58+200 – a slide appears to be developing. Slope downhill is steep (35 degrees) and 25 m high. A debris flow had originated from the slope apparently in the late 1990's. Movement beyond the toe of the Michelin Slide repairs occurs at the toe of the slope where recent movement was noted. |
| May 2003 | Worsening of cracking and settlement at 58+200. Road was patched. Cracking indicates slide extends across road – no space for a detour. |
| June 2004 | Cracking and settlement at 58+200 has worsened to a 40 m wide slide feature that cuts across both lanes and into the upslope ditch. Several small slumps downslope of the road. |
| March 2005 | Test hole and test pit investigation (reported in May 2005). |
| April 2005 | Major slide movement causing closure of the road. Temporary repair work included unloading of the upper portion of the slope and re-grading, installation of a temporary bridge on driven steel piles across the slide area, installation of culverts in the upslope ditch. A scarp developed near the toe of the slide. Seepage was noted from various areas on the slope, including sandy silt beds at elevation 485 m to 490 m near the |



- north end of the slide.
- June 2006 Repair work being completed. Repairs included significant re-grading, including shifting the road alignment eastwards (i.e. towards the slope) from km 57.95 to km 58.25. Culvert in upslope ditch permanently extended through slide area. To the south of the downslope re-grading, at km 58.0, an area that had previously showed scarps and movement was already showing renewed movement. Some areas of seepage noted on the re-graded slope.
- May 2007 Scarps appeared on the re-graded slope between km 58.0 and km 58.1, at the elevation of the drain outlets. From km 57.9 to km 58.0, within 10 m to 15 m of the road, larger scarps (from 1 m to 4 m high) have developed in the area that was beginning to show cracking at the edge of the work area in June 2006 (i.e. outside the area where the slope was re-graded). A toe roll has developed downslope from these features.
- June 2008 Scarps from km 57.9 to km 58.0 have worsened, and water is ponded on the debris downslope. A 500 mm high scarp has developed around the drain outlets at km 58.05 defining a 30 m wide slide. The concrete pile wall from km 57.9 to km 58.0 has become more obvious.



NOTES:

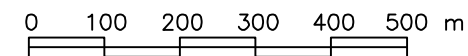
1 LOCATION DATA RECORDED USING HAND HELD GPS RECEIVER. ALL LOCATIONS ARE APPROXIMATE AND ARE FOR ILLUSTRATIVE PURPOSES ONLY.

Alberta Transportation

PEACE REGION (PEACE RIVER/HIGH LEVEL)
JUDAH HILL

KEY PLAN

FIGURE 1



| | | | |
|----------|---------|-------------|------------------|
| DRAWN BY | ICB | DESIGNED BY | APPROVED BY |
| SCALE | 1:10000 | DATE | OCTOBER 29, 2008 |
| | | FILE No. | 15-16-213A-C1A |



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