Highway 742 – Grassi Lakes Area, ~Km 3.3 to ~Km 6.1

The Grassi Lakes Area segment of Highway 742 extends from approximately 3.3 to 6.1 km southbound from the junction between Highway 742 and Three Sisters Parkway in Canmore, AB.

Site Description And Background

This segment of the highway is constructed as an unpaved, sidehill cut and fill across the lower east slopes of Mount Rundle and above the Canmore Creek/Grassi Lakes valley. Figure A5 in Appendix A shows an oblique aerial view of this segment of the highway and its position relative to Mount Rundle and other local geographic features. The road surface is relatively narrow along this segment of the highway, and as little as 6 to 8 m wide in places. Km 3.3 is the approximate end of the pavement a short distance southbound from the Canmore Nordic Centre. Km 6.1 is the service road pullout at North Whiteman's Dam in the gap between Mount Rundle to the northwest and Ha Ling Peak to the southeast, a short distance northbound from where the highway enters the Goat Creek valley.

A general description of the geological and climatic conditions in this area is presented in Sections 3 and 4.2 of this report.

AMEC has performed the following geohazards related work for AT along this segment of Highway 742 in recent years:

- An October 2003 call-out site inspection between approximately Km 3.3 and 6.1 that was focused on the risk to personnel and equipment from rockfall along the cut slopes during upcoming guardrail maintenance and replacement work. Please refer to AMEC's October 2003 report[1] for further details.

- An August 23, 2007 call-out site inspection and follow-up annual site inspection in June 2008 of a gabion wall along the downslope side of the highway around Km 5.9. The westernmost end of this gabion wall had collapsed earlier in the summer of 2007. Please refer to AMEC's report on the August 2007 site inspection[2] for further details, as well as the subsection "~Km 5.9 Gabion Wall Site" in this report.

Aside from the above-noted work, AMEC is not aware of any previous geohazard reviews along this segment of the highway.

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[1] AMEC report "Highway 742:02, Spray Lakes Road, Observations and Recommendations From October 9, 2003 Site Visit", submitted to AT on October 16, 2003, AMEC project number CG25132.D.

[2] AMEC report "August 23, 2007 Call-Out Request, Highway 742 Gabion Wall, Near Canmore, AB", submitted to AT on August 28, 2007, AMEC project number CG25239/CG25263.

October 2008 Site Inspections

This segment of the highway was inspected on October 18, 2008 by Mr. Andrew Bidwell, P.Eng. of AMEC. A number of geohazard locations and other hazards along the highway were noted, and are described in the following subsections.

The Km references for each site are approximate. The approximate site locations on illustrated on Figures A1 to A4 in Appendix A. The co-ordinates of each site were recorded with a handheld GPS (typically accurate to within roughly +/-7 m) and are listed in Table A1 in Appendix A.

~Km 3.3 To ~Km 3.6 Cut Slopes

Site Observations

- The cut slope along the upslope side of the road is typically 6 to 7 m high and exposes silt till soil with occasional gravel to cobble sized particles. The cut slope angles are typically around 32 to 34°, however in places they are up to approximately 45°. Photos 742-1 and 742-2 show one of the areas with an approximately 45° cut slope and without a ditch.

- The upslope ditch along this segment of the highway is undersized and in places of negligible size and capacity. The ditch is typically 1 to 1.5 m wide and 0.3 to 0.5 m deep, however there are segments where there is no upslope ditch at all.

- Despite the undersized or absent upslope road ditch, at the time of the October 2008 inspection there were not any large rocks on the road that appeared to have eroded out from the cut slope and spilled out from the ditch.

- There was little indication of erosion of the road surface due to runoff along the road, either from ditch flow spilling onto the road or from flow along the road where there is no ditch.

Assessment

The upslope ditch appears to be undersized relative to the size and inclination of the cut slopes along this segment of the highway. In places, there is a negligible to no ditch along the toe of cut slopes up to 45° inclination. There is a risk that cobble-sized, and possibly up to boulder-sized, rocks within the silt till could erode out from the cut slope and then slide or roll downslope onto the road surface without being contained by the ditch. It is also possible that without timely maintenance, eroded material and slope wash from the cut slopes (consisting of fines to gravel and cobble sized rocks) could easily fill the existing ditch to capacity and limit the ability of the ditch to contain surface runoff from the road.

Notwithstanding the above, at the time of the October 2008 site inspection, the road surface along this segment of the highway was clear of debris and there appeared to be little to no consequence from the undersized upslope ditch (at least with the apparent frequent road grading as part of the regular maintenance in this area).

For reference, the rockfall catch ditch design chart attached as Figure C1 in Appendix C suggests that for rock cut slopes of this height and inclination, the ditch should be in the order of 3 to 4.5 m wide and around 1.3 m deep. The ditch along this segment of the highway is typically much smaller and in places there is no ditch at all. It should be considered that the rockfall catch ditch design chart was developed for rock cut slopes

rather than the soil cut slopes like the ones at this site, however it does provide some guidance regarding suitable ditch sizes to prevent debris from slope erosion from spilling onto the road.

Risk Level

It is judged that AT's general geohazard risk matrix is applicable to this site, because the primary hazard to the highway is from rocks eroding out of the cut slope and rolling or sliding downslope rather than rockfall due to erosion of the cut slope.

The recommended Risk Level for this site, based on AT's general geohazard risk matrix, is as follows:

- Probability Factor of 9 to reflect the apparently steady erosion of material from the cut slope.

- Consequence Factor of 2 to account for a possibility of eroded material from the cut slope spilling out from the ditch and onto the road surface.

Therefore, the current recommended Risk Level for this site is 18.

The recommended Consequence Factor of 2 is judged to be slightly conservative based on the observations during the October 2008 site inspection. However, a lower Consequence Factor of 1 (and corresponding Risk Level of 9) cannot be confirmed solely on the October 2008 observations.

Recommendations

The Risk Level for this site could be reduced by increasing the ditch size along this segment of the highway to provide a greater ditch capacity that would reliably contain eroded material from the cut slope and accommodate surface runoff from the road surface. This would reduce the dependence on timely maintenance to clear any debris from the cut slope that spills onto the road surface.

However, it is not recommended that the ditch be re-sized at this time. The Risk Level is likely 18 or less, as described above, and the effort and follow-up maintenance to increase and maintain the ditch size is judged to outweigh the benefit of the possible reduction in the Risk Level at this site. Furthermore, it is understood that there is a buried telephone cable along the upslope ditch that would likely need to be buried deeper or relocated in order to accommodate a deeper ditch.

Hwy 742 – ~Km 3.3 to ~Km 3.6 Upslope Ditch

Photo 742-1 (top) – Facing southbound along the road from around Km 3.5. Note the lack of upslope road ditch adjacent to the cut slope exposed rocky silt till soil at up to 45° inclination. Despite the lack of ditch, there was little to no evidence of debris from the cut slope spilling onto the road nor of surface runoff eroding the road surface.

The Km 3.7 Fill Embankment site is visible in the left background.

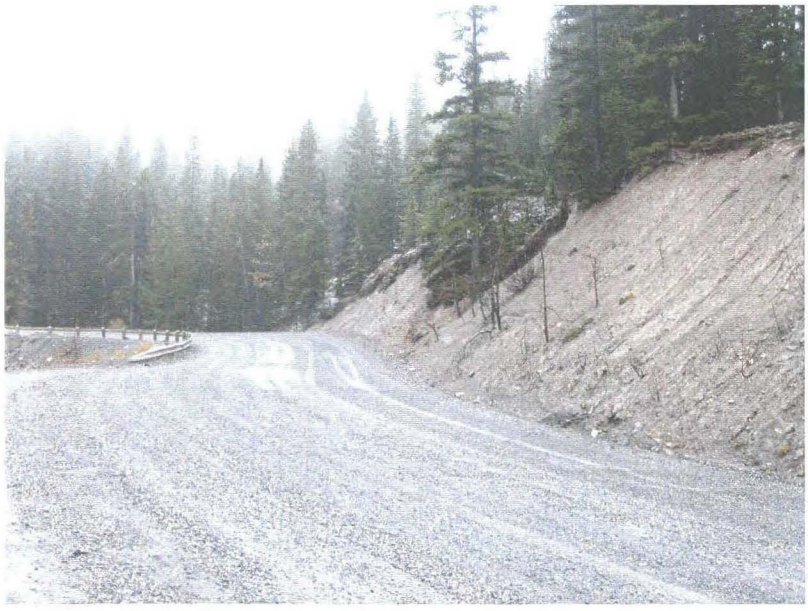

Photo 742-2 (bottom) – Another view facing southbound around Km 3.5.