

## **S3 – COCHRANE**

### **Background**

The Cochrane site is located on Highway 22:16, approximately 1 km south of the bridge across the Bow River, immediately south of Cochrane.

The slope instability at this site appears to be relatively shallow, however is affecting an area measuring approximately 50 m by 50 m downslope (northeast) of the highway. At this location the highway traverses a steep slope above the Bow River and the sliding is likely largely natural movements possibly with some contribution by side cast fill placement from the highway. Slope movements of up to 20 mm per year have been recorded in the slope inclinometers, however movements at various locations are sporadic (starting and stopping between successive SI readings). The timing and rates of movements are also likely sensitive to surface water running from the highway ditch to the slide area.

Site assessments, installation and monitoring of slope inclinometers has been conducted at this site since late 1991. Please refer to Section A of the site binder for a more detailed discussion of the site background.

### **Site Assessment**

The site assessment was performed on May 28, 2004. The weather at the time of the site assessment was clear with a light breeze.

Please refer to Appendix S3 for a site plan illustrating the layout of the site. The highway surface and the slope face below the road were inspected. The ground traverse extended to just below the fenceline downslope of the road.

### **Observations**

The following points summarize the observations made during the site assessment. Please also refer to Appendix S3 for a site plan and annotated photographs illustrating key observations.

- There appeared to have been additional movement in the slope below the road since the July 2003 assessment. The upslope extent of the shallow movement appeared to have retrogressed a few metres since July 2003 and the tension cracking at the head of the sliding now extends to approximately 1 m upslope of SI #3A. Photos S3-1 to S3-3 illustrate key features of this shallow instability. The remaining functioning SI's at this site are all upslope of the active movement area and the Spring 2004 readings of these instruments only indicated continued minor downslope movement in the upper 2 to 3 m of each instrument. Note that SI #3A sheared off at approximately 4 m depth in the spring of 1997 – therefore previous movement at depth was noted in that area but there is currently no subsurface monitoring.

- The recommended repairs to the ditch berm have not been implemented since the July 2003 assessment. Photos S3-4 and S3-5 illustrate this area. There is still a low spot in the berm along the downslope edge of ditch between SI #2 and SI #5 and it may be possible for surface runoff during peak runoff times to leave the ditch and flow downslope into the shallow instability area below SI #3A. Otherwise, the ditch appears to be in good condition.
- The previously-noted cracks in the northeast shoulder of the road do not appear to have changed significantly since the July 2003 assessment, as shown in Photos S3-6 and S3-7.

Based on discussions on site, AMEC understands that there is an upcoming functional planning study that includes this segment of Highway 22 that may include the possibility of twinning the highway through this area.

### **Assessment and Risk Level**

As noted in previous assessments, the slope instability below the road at this site is largely a natural process for the overall valley slope. However, surface runoff from the highway may be overtopping the low point in the ditch berm between SI #2 and SI #5 and contributing to the ongoing shallow slope movement that has retrogressed to just upslope of SI #3A in the past year.

Therefore, AMEC recommends the following Risk Level factors for this site:

- Probability Factor of 9 in order to reflect the ongoing slope movement observed in the area around and downslope of SI #3.
- Consequence Factor of 2 given that a continuation of the shallow slope movement observed around and downslope of SI #3 as well as the shallow movements measured in several of the SI's will not significantly impact the highway in the short term. The recommended visual monitoring of the retrogression of the shallow sliding around SI #3 as well as continued monitoring of the SI's at this site is judged to be sufficient to provide early warning of potentially more significant impacts on the highway.

Therefore, the current recommended Risk Level for this site is equal to 18. This is unchanged from the 2003 assessment. The recommended Risk Level for this site after the 2001 and 2002 assessments was 14.

### **Recommendations**

AMEC recommends the following future work for this site:

**The semi-annual monitoring of the SI's should be continued.  
Annual assessments at this site should be continued.**

The most effective geotechnical risk management strategy for this site is still considered to be a continuation of the instrument monitoring and periodic assessments of the slope condition. The existing SI's (#2, #4 and #5) adjacent to the downslope edge of the road should provide some warning of significant slope movements retrogressing back to the downslope edge of the road in time to further assess the situation and plan any necessary mitigative measures.

**The previously-recommended repairs to the downslope berm along the ditch should be implemented.** The downslope berm height between SI #2 and SI #5 should be restored and if possible the carrying capacity of the ditch increased. Both of these measures will help to prevent surface runoff from reaching the unstable area around and downslope of SI #3A.