

## Site 25 – Elbow Pass Cut Slope

This site is located along the east side of the highway and approximately 600 m southbound from the parking area at the Elbow Pass trailhead. There is a warning sign (“Watch For Fallen Rock”) posted for northbound traffic approaching this site.

This site consists of two areas of concern along the cut slope above the highway.

### Soil and Rock Cut Slope

There is a soil and rock cut slope approximately 600 m south of the parking area at the Elbow Pass trailhead (Photo 1). The cut slope has a total height of approximately 6 to 8 m and consists of two distinct components:

- The upper portion of the cut slope exposes rocky soil at an angle of approximately  $42^\circ$  and over a vertical height of approximately 4 to 5 m.
- The lower portion of the cut slope is near-vertical and approximately 2 to 3 m high. The bedrock dips near-vertically and down towards the west, therefore the lower portion of the bedrock exposes the bedding plane.

The majority of the rockfall debris from this cut slope appears to originate from the rocky soil in the upper portion of the cut slope. The size of the rockfall debris varies from gravel to boulders. Some segments of the cut slope had significant volumes of rockfall debris accumulated in the ditch. There was no rockfall debris on the road at the time of the inspection in September 2005, however some of the debris in the ditch was within 1 m of the edge of the pavement (Photo 2).

The ditch between the cut slope and the highway is typically 4 to 5 m wide and about 1.25 m deep. The ditch meets the sizing criteria for an 8 m high,  $45^\circ$  cut slope as shown in Figure B1 in Appendix B.

AMEC recommends the following Risk Level factors for this site using the rockfall frequency-severity matrix:

- Probability Factor of 14 based on the visual evidence of many rockfalls (possibly near-ongoing) at this site.
- Consequence Factor of 2 based on the potential for rockfall debris being deposited onto the edge of the northbound lane under the current ditch conditions.

Therefore, the recommended Risk Level for this site is 28.

AMEC recommends that the accumulated rockfall debris be cleared from the ditch in order to restore the full capacity of the ditch. The Consequence Factor could then be reduced to 1 and the corresponding Risk Level reduced to 14 if the ditch capacity is maintained with future clearing as necessary.

### Soil Cut Slope

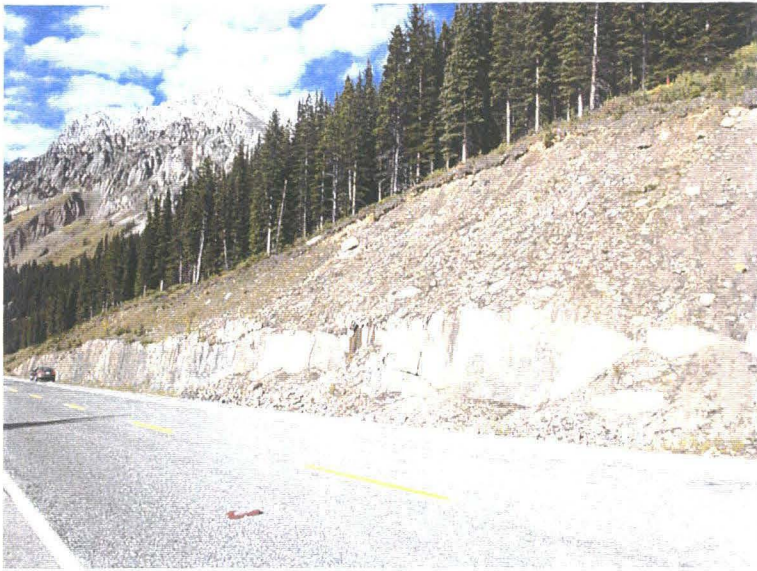
The soil cut slope approximately 630 m south of the parking area at the Elbow Pass trailhead is approximately 8 m high at a slope angle of around 40°. A slump has occurred in the soil slope and nearly blocked the ditch with debris along with almost burying a culvert inlet (Photos 3 and 4). It appears that this slump has been triggered by groundwater seepage in the cut slope and has been occurring on an ongoing basis in recent years.

AMEC recommends the following Risk Level factors for this site using AIT's general geohazard frequency-severity matrix:

- Probability Factor of 9 based on the apparent ongoing slumping in the cut slope.
- Consequence Factor of 1 based on the deposition of debris into the ditch but without any immediate impact to driver safety.

Therefore, the recommended Risk Level for this site is 9.

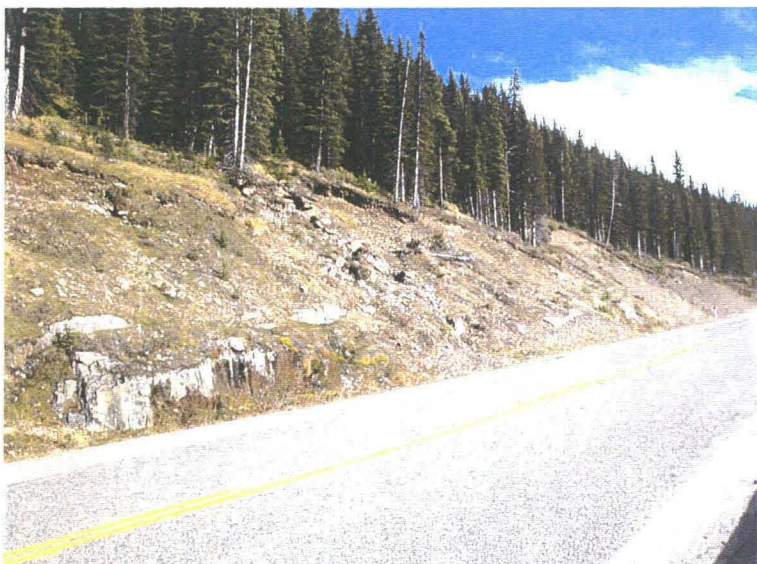
It is recommended that the slump debris be cleared from the ditch in order to restore the ditch gradient and keep the culvert inlet open. The debris should be excavated down to the elevation of the culvert inlet. Slump debris should be cleared from the ditch as necessary in the future to keep the ditch and culvert inlet clear.



**Photo 1** (top) – Facing north across the rock cut site to the south of the Elbow Pass hiking trail parking area. The majority of the rockfall debris is generated from the exposed rocky soil in the upper portion of the cut slope.



**Photo 2** (middle) – Facing north along the ditch. The rockfall debris from the cut slope is contained within the ditch. As the volume of debris in the ditch builds up, some of the larger rocks roll closer to the edge of the pavement. At the time of the September 2005 inspection there were some cobble-sized rocks within 1 m of the edge of the pavement.



**Photo 3** (middle) – Approximately 30 m south of the area shown in Photos 1 and 2 the cut slope is entirely in soil. At this location, a slump has occurred in the soil slope. The debris from the slump has blocked the ditch and nearly buried a culvert inlet. It appears that this slump has been triggered by groundwater seepage in the cut slope and has been occurring on an ongoing basis in recent years.



**Photo 4 (top)** – Another view of the cut slope slumping shown in Photo 3.