

4.23 S26 – HIGHWAY 41 – ELKWATER

Background

This site is located at south of Elkwater, AB. Please refer to Figure S26-1 in Appendix S26 for an illustration of the site location.

AMEC had previously inspected this site as a call-out request by AIT in March 2007. The purpose of the call-out request was to inspect landslide damage along two segments of the highway at this site. A summary of the observations and conclusions from the March 2007 site inspection is as follows:

- There is visible landslide terrain upslope and downslope of the highway at this site and widespread signs of landslide damage along two segments of the road. Photo S26-2 in Appendix S26 shows a typical view of the landslide terrain immediately upslope of the highway. It appeared that numerous patches and overlays had been placed to maintain the road grade through the landslide areas, however there remained extensive bumps, dips and cracking of the road surface indicating that the landslide movement and damage was continuing.
- The landsliding had been investigated and assessed by AIT between the early 1970's and late 1980's and some monitoring instrumentation and possibly some trench drains had been installed.
- The landsliding appears to consist of slumping seated in the Ravenscrag Formation bedrock underlying the valley slope. The main cause of the landsliding was judged to be the ongoing downcutting of the creek channel at the base of the valley. The load of the highway embankment across the lower portion of the slope likely also contributes to the landslide movement to a lesser degree.
- The ongoing landslide damage to the highway can continue to be treated as maintenance issue, however it may be more cost-effective over the long term to install some horizontal drains to try to reduce the rate and magnitude of landslide movement and corresponding damage to the road surface.

The June 2007 site inspection by AMEC and AIT personnel was the first since the March 2007 site inspection and the first annual inspection as part of the Southern Region GRMP.

Site Assessment

The site assessment was performed on June 21, 2007. The weather at the time of the site assessment was sunny and clear. The inspection consisted of a ground traverse of the landslide-damaged segments of the highway and selected areas on the slope below the highway.

Observations

The following points summarize the key observations made during the site assessment. Please also refer to Appendix S26 for annotated photographs.

- No significant changes from the site conditions observed during the March 2007 site inspection were noted. Photos S26-1, 3 and 4 show typical views of the site.
- The landslide damage to the two segments of the highway surface was still evident and it did not appear that any further patching or overlays had been applied since March 2007. Photos S26-3 and 4 show typical views of the previous, multiple overlays that have been placed at this site to restore the road grade after previous landslide damage.
- Some relatively fresh looking cracking and downdrop of a semi-circular portion of the southbound (downslope) lane in the landslide area at the south end of the site was noted (Photo S26-5).
- The groundwater seepage from the cut slope above the road at the south end of the site appeared to be ongoing.

Assessment and Risk Level

The assessment of the risk to the highway at this site is unchanged from the March 2007 site inspection. In summary, the landsliding that is damaging the road surface is naturally occurring as a result of the ongoing downcutting of the creek channel in the valley. The landsliding will continue in the future with year-over-year variations in the rate and magnitude of landslide movement likely connected to variations in annual precipitation, i.e. high precipitation years will trigger relatively higher levels of landslide movement.

Due to the size and depth of the overall landslide mass, it is likely not practical to stabilize the overall landslide or even just the road embankment to prevent further landslide damage to the road surface. As discussed in the report on the March 2007 call-out to this site, the most effective strategy to reduce future damage to the road surface is to try to lower the groundwater levels in the landslide mass and thereby increase the resistance to further movement along the existing landslide failure surfaces.

The following Risk Level factors are recommended for this site:

- Probability Factor of 13 to reflect the active and relatively high rate of movement of the landslide, as evidenced by the amount of maintenance required to maintain a trafficable road surface.
- Consequence Factor of 4 to reflect the ongoing damage to the road surface that requires significant maintenance work and the potential (however low) for a relatively large

increment of landslide movement to require a partial closure of the road and/or immediate work to establish a temporary running surface through the landslide area.

Therefore, the recommended Risk Level is 52. This is unchanged from the recommendations in the report on the March 2007 site inspection. The recommended Consequence Factor of 4 is probably slightly conservative if timely maintenance can be relied upon.

Recommendations

The recommendations for this site are unchanged from the report on the March 2007 site inspection and are summarized as follows:

1. Continue applying patches and overlays as necessary to maintain the road surface through the landslide-damaged segments of the highway.
2. Raise the segment of the guardrail in the northern end of the site where the numerous overlays that have been applied to the road surface have reduced the effective height of the guardrail.
3. Perform the following work to evaluate the applicability of horizontal drains to reduce the landslide movement:
 - a. A series of geotechnical boreholes to install piezometers and SI's at several locations within Area A and Area B. Also consider a trial application of the Measurand "ShapeAccelArray" product at this site to compare with the data from the conventional SI's.
 - b. Follow-up readings of the above-noted instruments.
 - c. A topographic survey of the site (slope topography, highway and right-of-way locations, previous borehole locations etc.).

AMEC will submit a proposal and cost estimate for this additional work recommended under Item 3 above under separate cover.

This site should also be added to the annual Southern Region geohazard site inspection tour for at least 2008 in order to visually check the settlement areas.