

S12 – SPRAY LAKES ROAD

Background

The Spray Lakes Road site is located on Secondary Highway 742:02 in Canmore, AB, northwest of the junction between the Spray Lakes Road and Three Sisters Parkway. This segment of SH742 connects the Highway 1/the town of Canmore to the Canmore Nordic Centre and the Spray Lakes Valley, both prime tourist and recreational areas.

This segment of the highway is oriented roughly east/west across a cross-slope down to the north. There is higher ground to the south with a small cutslope exposing bedrock along the south ditch. There is a bench (possibly an old road alignment) immediately north of the existing road. The area further to the north slopes steeply down towards the town of Canmore on the floor of the Bow River valley.

Underground coal mining operations were performed in this area in the late 1800's and early 1900's. A series of underground mine workings were developed below the site area in order to exploit four steeply dipping coal seams. The Spray Lakes Road was constructed in more recent years. In the late 1980's, a "sinkhole" developed on the south shoulder of the road and was backfilled without further investigation. A small cavity/sinkhole was also encountered in the south ditch of the road during the construction of a water main in 1993. In 2000, a ground penetrating radar (GPR) survey was performed for Alberta Environment as part of a mine mitigation program on the lands adjacent to the Spray Lakes Road. The results of this work indicated the potential for cavities below the road surface and a preliminary borehole drilling program was performed along the south shoulder of the road in December 2002. Open cavities were encountered at depths as little as 3.5 to 4 m below road surface. Please refer to Section A of the site binder for further discussion.

The first annual assessment of this site was performed by AT and AMEC personnel in July 2003.

Site Assessment

The site assessment was performed on May 28, 2004. The weather at the time of the site assessments was partly cloudy and calm.

The site assessment covered the road surface, the slope immediately adjacent to the north shoulder of the road and the slope above (south) of the road.

Observations

The following points summarize the observations made during the site assessment. Please also refer to Appendix S12 for annotated photographs.

- The were no visible signs of new settlement or cracking along the road surface in the area where the December 2002 borehole drilling identified cavities below the road

surface. Photos S12-1, S12-2 and S12-4 show general views of the road surface at the site.

- Subsidence and depression features were observed in the area approximately 30 m upslope (south) of the road alignment. There were signs posted on the trees adjacent to these depressions that indicated that they were related to “Mine No. 1, Seam No. 2”.

Discussion

The report on the December 2002 borehole drilling at this site listed “Mine No. 1, Seam No. 2” as one of the coal seams that were mined below the road. This is the same mine and seam number that was noted on the signs adjacent to the depression features in the treed area to the south of the site.

Assessment and Risk Level

There are no visual signs of cracking or settlement of the road surface in advance of collapse into the underlying mine workings in the area of the previous borehole drilling. However, as noted in the report on the 2003 site assessment, this does not indicate the lack of significant risk at this site. The risk level at this site is relatively high due to the lack of complete information on the extent of the voids and cavities underlying the road surface, the inability to disprove that any collapse of the road surface will be rapid and without warning, and the high public and tourist visibility of any problems along the Spray Lakes Road. The subsidence and depression features related to “Mine No. 1, Seam No. 2” and noted in the treed area to the south of the road illustrate the potential risk to the road.

Therefore, AMEC recommends that the Risk Level factors for this site be kept the same as recommended after the 2003 site assessment, namely:

- The Probability Factor for this site should be set at 7. This value reflects the high probability of some road subsidence/collapse at some point in the future, with the associated high uncertainty with respect to the timing and extent of such collapse.
- The Consequence Factor for this site should be set at 9. This is a very high level on the Consequence Factor scale, however it is recommended because the development of a collapse feature on or immediately adjacent to the road would almost certainly require at least temporary closure of the road.

Therefore, the recommended Risk Level for this site is 63.

Recommendations

AMEC recommends the following future work for this site:

AT should consider implementing the recommendations for further investigation and the design and implementation of a cavity filling program from the Norwest January 2003 report. As requested during the site assessment, AMEC will submit a proposal and cost

estimate for an investigation and the development of a remedial measures design (including a cost estimate).

The concept of using dynamic rockfall barrier nets and geotextile to span the segment of the road potentially underlain by cavities should be considered. AMEC is aware of similar applications of this method at other sites underlain by cavities/sinkholes. This concept would be an innovative option that may be cost-competitive, and would likely provide a greater degree of cost certainty, than the more traditional grouting of cavities. The further investigation recommended above would still be required in order to estimate the extent of the road segment that is potentially underlain by cavities and the design effort for this method would include determine what strength of netting would be required to support the road base and vehicle loads and installation methods to secure the netting in the horizontal plane.

Maintenance personnel should perform frequent, detailed assessments of the road surface condition. Personnel should walk the road in this area on a weekly/monthly basis to check for any signs of cracking or subsidence that may develop. If any are noted, AT geotechnical personnel should be notified immediately. AMEC recommends that a field "checklist" be developed in order to ensure that the necessary observations are made in a recorded, repeatable manner. A field checklist will also help to ensure a consistent approach to inspecting the site.

The annual assessments should be continued.