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Explanation:

Aerial Reconnaissance of fracture in cliffs west of Castle Gate.

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FILE #2 ACT/007/004

Project:			Requesting Agency:
Aerial reconnaissance of fracture in cliffs west of Castle Gate, Price Canyon, Carbon County			Emergency Response
By: Mike Lowe	Date: 7/27/1992	County: Carbon	Job No: 92-14
USGS Quadrangle: Standardville (877)			

INTRODUCTION

On July 21, 1992, I participated in an aerial reconnaissance of a fracture in cliffs in Price Canyon west of Castle Gate, Carbon County (NW¼ SE¼ section 35, T. 12 S., R. 9 E., SLBM; attachment 1). The fracture was brought to the Utah Geological Survey's attention on July 20, 1992, by Mike Royce, Chief Pilot, Utah Department of Public Safety Aero Bureau, who noticed the fracture while flying down Price Canyon. The purpose of the aerial reconnaissance was to assess potential slope-failure hazards associated with the fracture. The scope of investigation consisted of the aerial reconnaissance in a light airplane piloted by Mr. Royce, an examination of 1963 1:20,000-scale aerial photographs, and computer simulation of possible rock-fall runout paths. Albert Spensko and Archie Hamilton, Utah Department of Transportation District Four Office, also participated in the aerial reconnaissance.

The fracture, which is readily visible and appears quite fresh from the air, is oriented north-south and crosses sandstone cliffs which form the point of a ridge. The fracture is vertical and is visible on the top and on both sides of the ridge point. It was not possible to estimate the width of the fracture from the air. A lineament, presumably the fracture, is visible at this location on 1963 1:20,000-scale aerial photographs of the area, but I could not determine the freshness or width of the fracture. Thus, the current apparent freshness of the fracture may indicate recent opening of a pre-existing crack. Doelling (1972) indicates that the mined-out portion of a coal mine is located beneath the ground surface below the crack, and subsidence in this mine is one possible cause of the widening of the fracture, if widening has indeed occurred.

Doelling (1972) maps the sandstone cliff as Castlegate Sandstone of the Cretaceous Mesaverde Group. The Castlegate Sandstone is overlain by less-resistant sandstone, shaly sandstone, and shale of the Price River Formation, and is underlain by less-resistant sandstone, shale, and coal of the Blackhawk Formation, which are also units of the Cretaceous Mesaverde Group (Hintze, 1988). Several fresh scars were visible on the cliff face indicating recent mass wasting. Other fractures, which did not appear as wide or fresh, are visible in other cliffs in the area, where slopes are covered with sandstone blocks which indicate that rock falls, topples, and slides are the predominant form of mass wasting.

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If the fracture widens and the ridge point fails as a rock slide, topple, or fall, the principle risk is to U.S. Highway 6 to the east in Price Canyon. The Denver and Rio Grande Railroad tracks are located across the Price River farther to the east. The fractured point is approximately 1,200 feet from the highway for rocks rolling into a small canyon on the north side of the point, and approximately 2,000 feet from the highway for rocks rolling into a larger canyon on the south side of the point (attachment 1). The approximate elevation of the highway is 6150 feet. The fractured ridge point has an elevation of approximately 7200 feet.

The Colorado Rock-fall Simulation Program (Pfeifer and Higgins, 1988) was used to assess the potential for rock falls from the fractured ridge point reaching the highway. Three potential rock-fall paths (attachment 1) were chosen for the simulation and slope profiles were constructed from U.S. Geological Survey 7.5-minute topographic quadrangle maps (Standardville and Helper). Values for rock-fall clast and slope characteristics (rock shape, surface roughness, and tangential and normal coefficients) were estimated based on observations from the air. Rock radii chosen for the simulations were 5 and 10 feet. Boulders of this size were observed on mountain slopes in the area. For path 1 (attachment 1), no rocks with a radius of 5 or 10 feet rolled to the highway. For path 2, the 5-foot-radius boulders generally did not reach the highway but the 10-foot-radius boulders did. For path 3, both 5- and 10-foot-radius boulders reached the highway. Based on the computer simulation, it appears that large boulders could reach U.S. Highway 6 if the fractured ridge point fails, either as a large slide or as a continuing series of individual rock falls and topples.

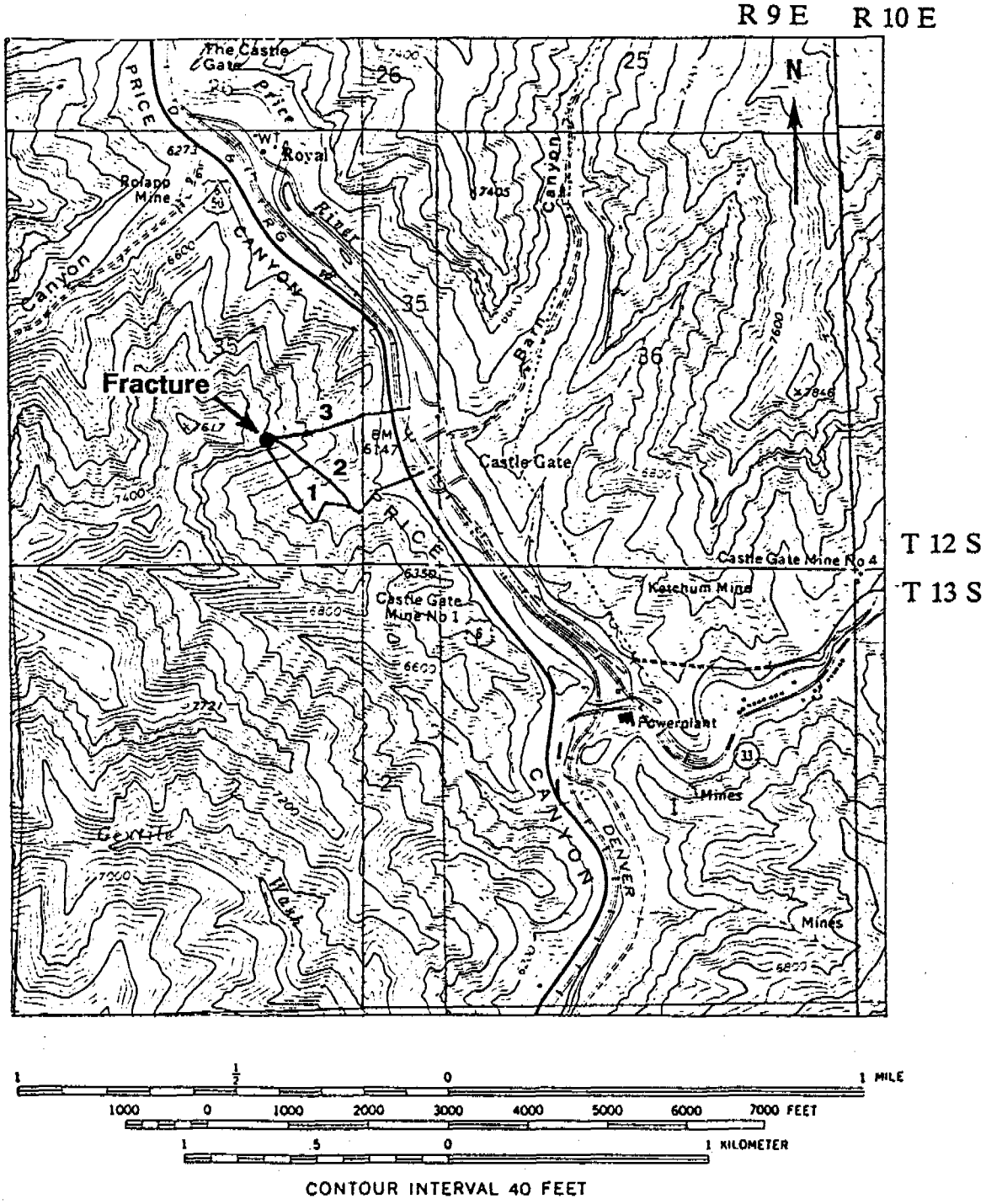
At this time, the likelihood and probable mechanism of failure, and need for hazard-reduction measures, is undetermined. Such a determination will require ground studies such as monitoring of crack width, measuring of fracture spacing in the sandstone cliff, and more accurate modeling of rock-fall runout. Christian Rohrer, Utah Department of Natural Resources Division of Oil, Gas, and Mining, has been notified of the possible mine subsidence, and will perform field investigation to further evaluate this possibility (Christian Rohrer, verbal communication, July 29, 1992). Mr. Spensko (verbal communication, July 29, 1992) indicates that the crack is visible from Highway 6 and that personnel from the Utah Department of Transportation District Four Office will visually monitor the cliff and fracture from the highway. Mr. Royce (verbal communication, July 29, 1992) indicates that he and other Department of Public Safety Aero Bureau pilots will monitor the cliff and fracture from the air when flying over the area. If any activity is noted, further study is warranted.

References Cited

Doelling, H.H., 1972, Central Utah coal fields--Sevier-Sanpete, Wasatch Plateau, Book Cliffs and Emery: Utah Geological Survey Monograph Series No. 3, 571 p.

Hintze, L.F., 1988, Geologic history of Utah, a field guide to Utah's rocks: Brigham Young University Geology Series Special Publication 7, 202 p.

Pfeiffer, T.J., and Higgins, J.D., 1988, Colorado rock-fall simulation program users manual: Final report prepared for the Colorado Department of Highways, 107 p.



Attachment 1. Location map showing potential rock-fall runout paths 1, 2, and 3.