



PROJECT BRIEF

Abandoned Mine Subsidence Investigation – Void Detection Country Club Circle (CCC), Colorado Springs, Colorado

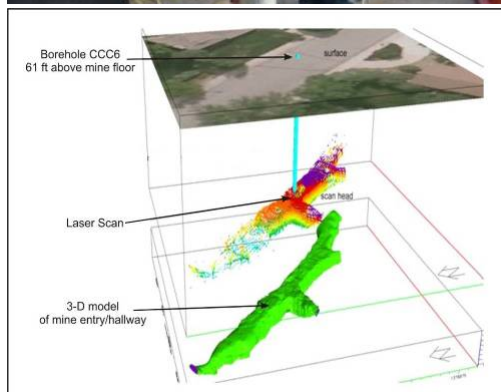
Project Owner: Colorado Department of Natural Resources, Division of Reclamation, Mining, and Safety (CDNR-DRMS)

ZAPATA performed several mine subsidence investigations for DRMS in support of its Inactive Mine Reclamation Program (IMRP). These projects provided invaluable information for DRMS to design and implement a mitigation program.

ZAPATA implemented a comprehensive engineering – geophysical program and void mapping, delineating the location and extent of remaining coal mine workings at respective depths of 55 and 100 ft beneath the residential area of the CCC neighborhood. Key tasks, highlighting void mapping and ground stabilization, performed:

Void Mapping: Conducted downhole laser and video camera surveys in real time. The laser scanning survey revealed a 10 ft wide by 7 ft high haulageway extending approximately 230 ft in the horizontal perspective. Created 2D and 3D perspective views from the data, and determined void sizes and volumes. The video camera provided records of the void conditions (such as open/collapsed areas, nature and characteristics of pillar/roof/floor), and monitored the placement of the foamed-sand backfilling of the mapped haulageway.

Ground Stabilization: DRMS, through its contractor Hayward Baker, used foam reagents (Geofoam™ supplied by Cellular Concrete), mixed with sand, and low mobility grouting to fill and stabilize the discovered haulageway and collapsed areas. The foamed-sand mix filled the void with 267 yd³ of sand, to the approximate quantity estimated by the laser scans.



**Laser Scanning: 3D Perspective Views
of Haulageway and Cross-cuts**

Video Image during Foamed-Sand Backfilling