

and mining. In Figure 5, mining height is 2.4 m (8 ft). Entries and crosscuts are 6.1 m (20 ft) wide; pillars are 21x21 m (70x70 ft). Barrier pillars are 137 m (450 ft) wide. A 15.2 m (50 ft) strip separates barrier development from the main entries; a 33.5 m (110 ft) wide strip separates previously mined longwall panels from barrier pillar development.

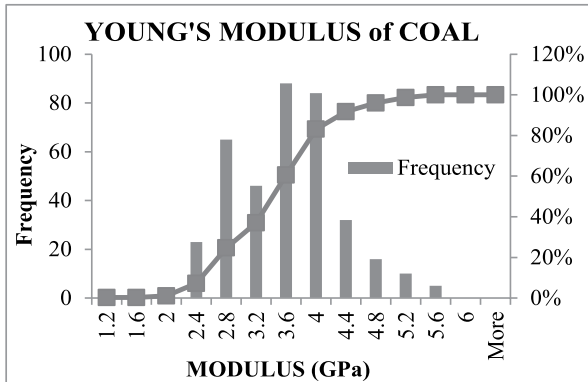


Figure 1. Young's modulus of coal in histogram form with cumulative plot.

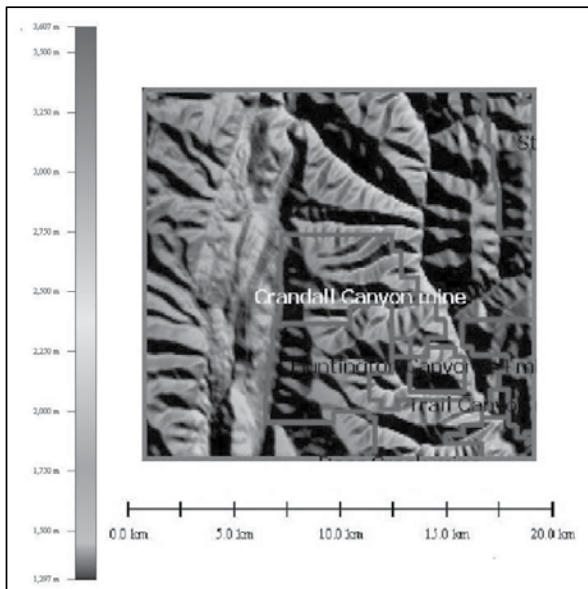


Figure 2. Digital terrain model of the Crandall Canyon Mine area..

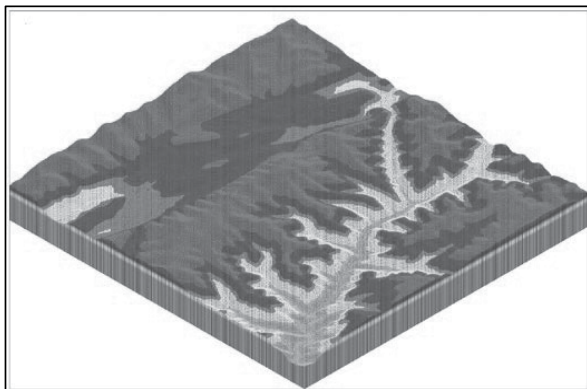


Figure 3. Three dimensional mesh after excavation to current topography. Colors indicate different strata. This mesh contains over 13 million elements. Edge length is about 16.8 km (55,000 ft).

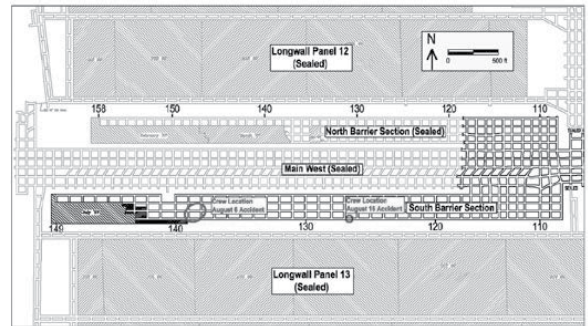


Figure 4. Drawing showing the layout of barrier pillar mining at CCM (MSHA, 2008). Note: 500 ft = 152 m. North is at the top of the figure; West is left.

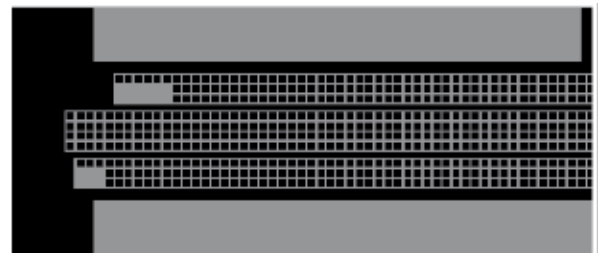


Figure 5. Seam level mesh illustrating past mining, main entries (5), barrier development (4 entries) and some barrier pillar mining (grey is mined, black is coal).

Figure 6 is a three-dimensional view of the "small" dual mesh, the "small" mesh that encloses the barrier pillar mining region.

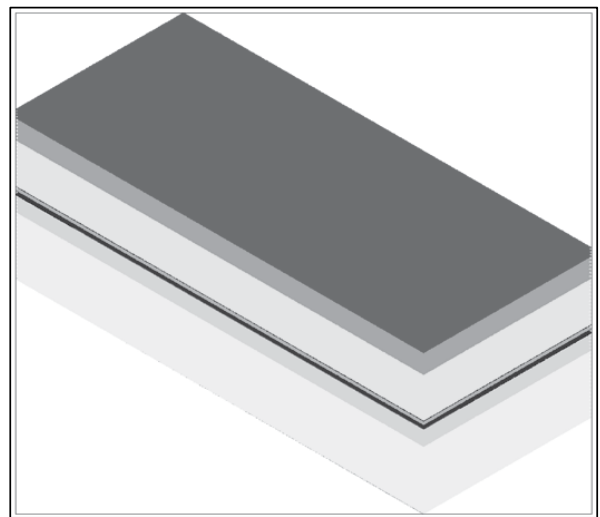


Figure 6. The dual mesh that encloses the region about barrier pillar mining. This mesh is 1,689 m long, 695 m wide, and 610 m high (5,540 ft x 2,280 ft x 2,000 ft high) and contains over 3.6 million elements. There are three coal seams in the mesh as given in Table 1. The Hiawatha seam is between the purple and dark blue colored strata but is too thin to be seen in this view.

RESULTS

The most important results of analysis of CCM barrier pillar mining are; (1) comparison of reported with calculated mine subsidence, (2) evolution of model yield zones in the vicinity of main entries and barrier pillars as mining progresses and (3) correlation of mine-induced seismicity with model yield zone growth.