

Appropriate Mine Design for Room-and-Pillar Underground Coal Mine in Morupule Coal Mine, Botswana

Maipelo Gaopatwe
 Laboratory of Rock Engineering and Mining Machinery
 Department of Cooperative Program for Resources Engineering

1. Introduction

Roof falls are potential hazards in ground control. Aside from being hazards, they affect the safety and economy of underground coal mines and remain a leading cause of coal mining injuries. The Morupule Coal Mine in Palapye is selected as a case study mine. In the study area in the study area roof falls often occur due to roof separation between the coal seam and weak mudstone layer; excessive roof spans and scaling on pillars. The research objectives are to investigate the stability of the roof in an underground room-and-pillar coal mine and recommend support design to improve the stability.

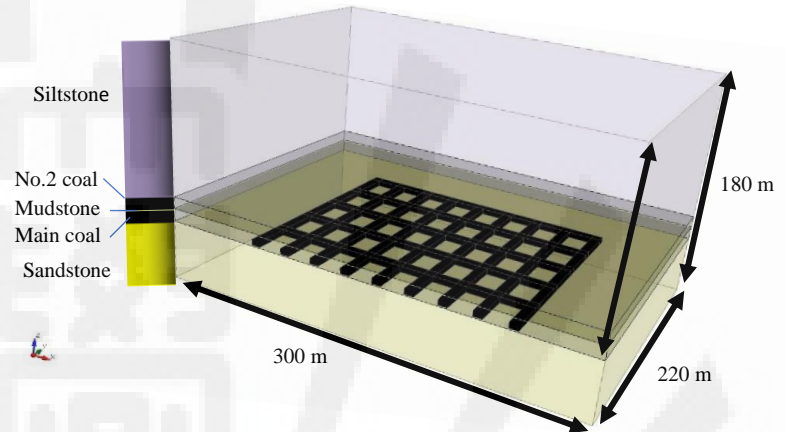


Fig. 1 Numerical model.

2. Numerical analysis

Figure 1 shows the numerical model used in this research. A series of numerical parametric studies were conducted in order to investigate the effect of different parameters such as orientations and magnitudes of the horizontal in-situ stresses; distance of weak mudstone from the roofline; mining depth; and the size of pillars on stability of the excavations. The distribution of vertical displacements, strength factor and major principal stress are monitored at the roofline in this case study. Figure 2 shows the current support design.

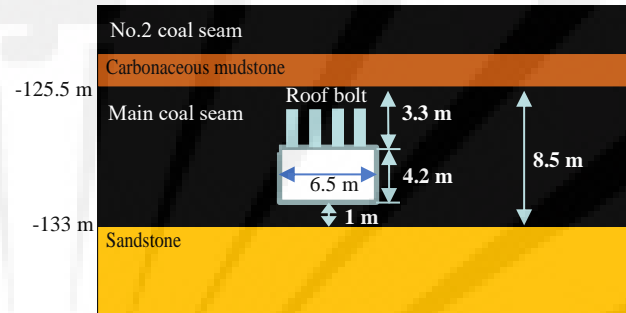


Fig. 2 Current support design.

3. Results and discussions

To maintain stable roof condition the following conclusions were made:

- Orienting the entries to a direction 0° (parallel to entries) from the maximum horizontal stress direction.
- Increasing the pillar size with depth, significantly improves the roof stability.
- 1.5m beam of coal is necessary to maintain roof stability.
- The support layout currently employed is Four 1.8m long resin-grouted rock bolts, which are 1.4m horizontally apart and spaced 1.5m vertically. From numerical analysis and field observation it can be seen that for areas where the mudstone and poor rock mass are present, the current support system is not adequate. A proposed change for a 3m long roof bolt for an average thickness of 1.5m of coal maintained in the roof. This provides enough anchorage into the rock unit above the mudstone and future application to mine the bottom coal as shown in Figure 3.

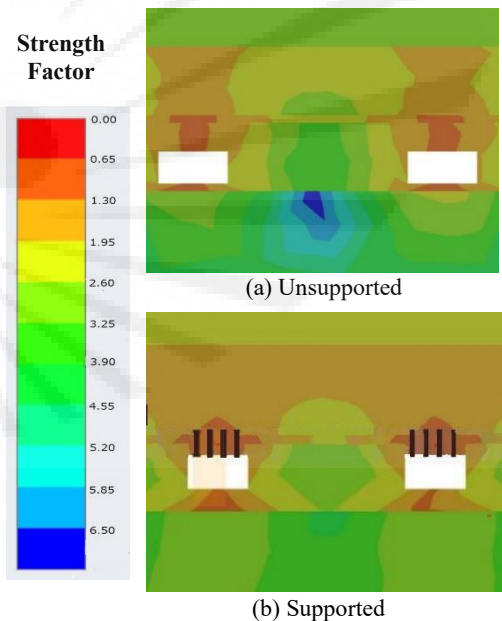


Fig. 3 Proposed support design.