Analysis of Retreat Mining Pillar Stability (ARMPS): Version 4.0 for Windows

Objective

To help prevent squeezes, collapses, and other pillar failures through better pillar design, thereby enhancing safety for underground mine workers.

Background

Proper pillar design is essential for safe pillar recovery operations. Between 1989 and 1996, 25% of all roof and rib fatalities in the United States occurred on pillar recovery sections. The Analysis of Retreat Mining Pillar Stability (ARMPS) computer program was developed in 1995 and has been widely accepted by the mining community. A Windows version of ARMPS is now available. It features simplified data input, graphics, and an expanded online "HELP" facility.

How It Works

The ARMPS program estimates the loads applied to, and the load-bearing capacities of, coal pillars used in retreat mining. It then calculates a stability factor (SF). ARMPS can model the significant features of most retreat mining layouts, including angled crosscuts, varied spacings between entries, barrier pillars between the active section and old (side) gobs, and slab cuts in the barriers on retreat (figure 1). It also features a pillar strength formula that considers the greater strength of rectangular pillars. The program may be used to evaluate bleeder designs as well as active workings.

A database of 140 pillar retreat case histories was collected across the United States to verify the program. It was found that satisfactory conditions were very rare when the ARMPS SF was less than 0.75. Conversely, very few unsatisfactory designs were found where the ARMPS SF was greater than 1.5 (figure 2). Preliminary analyses also indicate that pillar failures may be more likely under sandstone roof and that the ARMPS SF may be less meaningful when the depth of cover exceeds 230 m (750 ft).

ARMPS is well suited for initial feasibility studies where no previous experience is available. Operators may begin with an SF near 1.5 and then adjust as they observe pillar performance. In an operating mine, ARMPS can be calibrated using site-specific experience. ARMPS may also help in optimizing panel designs by identifying pillars that might be needlessly oversized. The "HELP" text included with version 4.0 of the program contains many tips on selecting the proper input parameters when using ARMPS.

For More Information

To obtain a single copy of the ARMPS computer program, version 4.0 for Windows, send three double-sided, high-density diskettes to: Christopher Mark, Ph.D., NIOSH Pittsburgh Research Center, Cochrans Mill Rd., P.O. Box 18070, Pittsburgh, PA 15236-0070.

Information Circular (IC) 9446, "Proceedings: New Technology for Ground Control in Retreat Mining," contains papers presented at technology transfer seminars sponsored by NIOSH dur-ing 1997. The papers describe several new, highly practical technologies developed by the NIOSH Pittsburgh and Spokane Research Centers to improve safety during pillar retreat operations, including ARMPS. Two central issues are addressed: pillar design and mobile roof supports (figure 3). To obtain a free copy of IC 9446, contact Diane Felice, NIOSH Pittsburgh Research Cen-ter, Cochrans Mill Rd., P.O. Box 18070, Pittsburgh, PA 15236-0070, phone: (412) 892-4411, fax: (412) 892-6877, e-mail: **def9@cdc.gov**
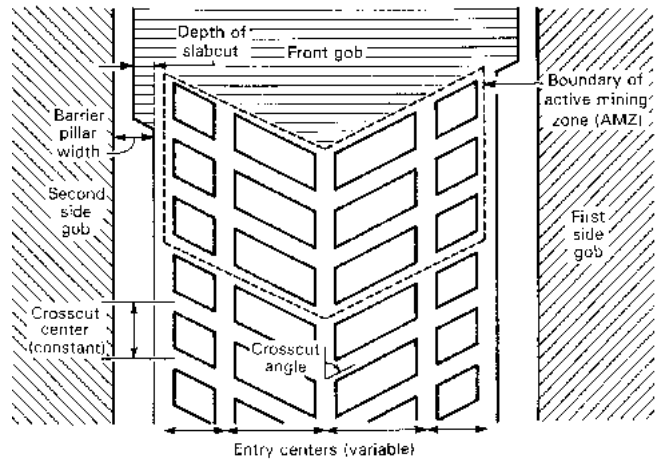
Figure 1.—Section layout parameters used in ARMPS.
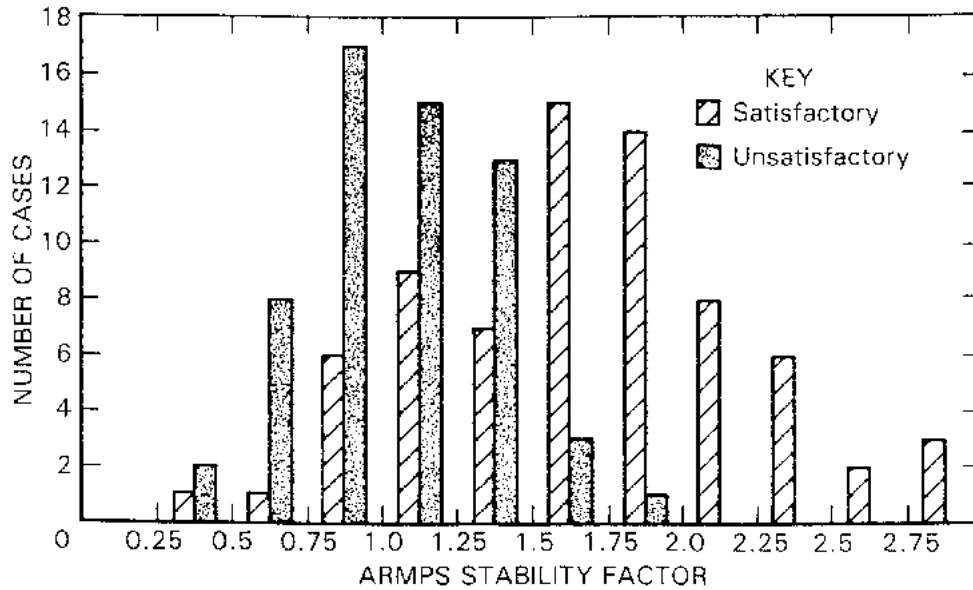

Figure 2.—ARMPS database.

Figure 3.—Full pillar extraction using mobile roof supports.