



Technology News

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Resin-Grouted Cables for Enhanced Coal Mine Roof Support

Objective

Develop an easy-to-use, reliable, resin-grouted cable support system capable of being installed as primary and secondary roof support in coal mines.

Background

Primary and supplementary support of coal mine gate roads has become an area of great interest as coal production from advanced longwall technology has increased in the United States. Variations in geology, stress conditions, and mining geometries all affect support selection decisions. With the goal of improving mining safety, the U.S. Bureau of Mines (USBM) is investigating the use of cables as a support option for longwall gate roads.

Previously, the most common type of supplementary support was wooden cribs. Cribs can provide significant reinforcement capacity over a large deflection range. However, crib support systems restrict the flow of air necessary for the ventilation of the workplace, generate unacceptable floor heave, and permit large roof deformations that can lead to failure. Additionally, the placement of wooden cribs or posts accounted for 905 injuries in 1993, approximately 5% of all underground accidents that year. The lack of an adequate supply of timber has also elevated the pricing structure and created some shortages.

How They Work

Cable supports are composed of multistrand wires that are anchored into the mine roof with slightly modified

resin formulations. Because they are flexible, the cables can be easily installed into holes much deeper than the height of the opening. Cables also have a high load-carrying capacity, 258 kilonewtons (58,000 pounds force), and the reinforcement mechanism is similar to that of resin-grouted roof bolts. Rock is strong in compression but weak in tension, and most roof failures are caused by tensile failures of the rock. Cable bolts act to decrease the tensile forces, which reduces the potential for roof failure.

As a supplementary support system, cable bolts have several advantages over wooden cribs. They reduce the resistance to ventilation by approximately 25%, which permits higher volumes of air at lower velocities and helps to minimize suspended rock and coal dust. The use of cable supports can also reduce the material-handling injuries related to the placement of wooden cribs, since cables are much lighter and are easy to install.

Test Results

Four massive test areas have been established in coal mine gate roads using high-strength seven-strand cable bolts as supplementary support, and the results have been extremely favorable. The immediate roof of the tailgate entry was maintained as the retreating longwall passed the test area. Cable supports were also used to stabilize bleeder entries, longwall setup rooms, longwall recovery shoots, and difficult intersections. A typical geologic cross section is used to select the cable support and resin-grout lengths, as shown in figure 1. A coal mine tailgate supported with resin-grouted cable supports and subjected to the stresses and subsequent loads associated with first and second panel mining is shown in figure 2.

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Cable supports may not be the support of choice in every supplementary support situation. More research will be conducted to study the rock-support interaction mechanism to develop safe cable bolt reinforcement parameters and designs.

For More Information

Addition information can be found in "Cable Bolts for Longwall Gate Entry Support," by S. C. Tadolini and J. L. Gallagher, a paper in "Technology for Longwall Ground Control," USBM Special Publication 01-94.

Currently, two manufacturers provide system components for resin-grouted support systems used in the USBM underground investigations. For product information and material availability, contact

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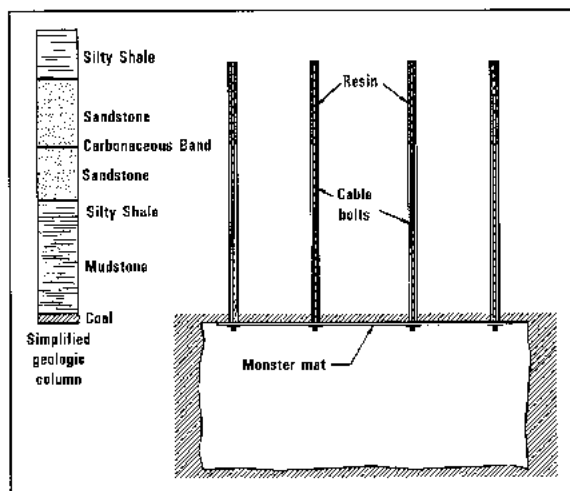


Figure 1.—Typical coal mine intersection column used for designing cable bolt length and resin-grout length.



Figure 2.—Gate road supported by resin-grouted cable has already been subjected to first panel loading. Panel 2 is approximately 60 meters (200 feet) in by this location.

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