Technology News

No. 467 NIOSH November 1997

Wood Crib Performance Model

Objective

To provide an engineering solution to wood crib design and deployment strategies that will ensure safety for underground coal mine workers. This is accomplished by preserving necessary ground control requirements while minimizing support costs or by developing new support strategies to enhance ground support in difficult conditions. A secondary objective is to be able to quantify wood crib support performance to define support requirements for alternative support systems. These objectives have been achieved through a simple-to-use computer program called the wood crib performance model (wcpm).

Background

Wood cribs are the most widely used support in underground coal mines and provide critical roof support in many applications. Optimal use of these timber supports has been overlooked in the past due in part to the low cost of wood, which allowed highly conservative support strategies. With the increasing cost of wood and greater dependency on wood cribs for support in applications such as longwall tailgate and bleeder entries (figure 1), more efficient use of wood crib supports is required.

Approach

The WCPM is unique in that it was developed through full-scale testing of wood crib supports in the unique mine roof simulator load frame at the National Institute for Occupational Safety and Health's Pittsburgh Research Laboratory. Several hundred full-scale tests were conducted to evaluate the design parameters associated with various wood crib constructions. The performance of wood cribs is determined by not only the type of wood used in the crib construction, but also how the crib is built. Therefore, full-scale testing is required to develop a realistic model that accurately predicts wood crib performance.

Using the WCPM

The interactive computer program is currently written in MicroSoft QuickBASIC and is very easy to use. Simply install the computer disk into the drive and type "woodcrib" to execute the program. A general description of the program is described, followed by a main menu that allows to user to select from five subprograms:

- ***WCPM:*** **This program computes crib load as a function of displacement of the support structure induced by roof and floor convergence. The program will provide the user with recommendations to improve the current crib construction.**
- ***MINLOAD:*** **This program helps the user to define support requirements based on designated mine conditions.**
- ***CRIBOPT:*** **This program optimizes wood crib design by determining whether to use a 4- or 9-point crib and how big the timbers should be to provide the required support capacity and crib stability.**
- ***PLACOPT:*** **This program determines the optimum crib spacing for a specified crib design and required support capacity per foot of mine entry.**
- ***SYSOPT:*** **This program evaluates the material handling requirements and cost of the current support design in conjunction with the support capacity and allows comparison of up to three alternative support systems.**

U.S. Department of Health and Human Services

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For More Information

To obtain the WCPM computer program or to receive a copy of a report detailing full-scale test results and mathematical derivation of the WCPM, contact Thomas M. Barczak, NIOSH Pittsburgh Research Laboratory, Cochrans Mill Rd., P.O. Box 18070, Pittsburgh, PA 15236-0070, phone: (412) 892-6557, fax: (412) 892-6891, e-mail: **thb0@cdc.gov**

Mention of any company name or product does not constitute endorsement by the National Institute for Occupational Safety and Health.

To receive additional information about mining issues or other occupational safety and health problems, call **1-800-35-NIOSH (1-800-356-4674)**, or visit the NIOSH Home Page on the World Wide Web at http://www.cdc.gov/niosh/homepage.html

As of October 1996, the safety and health research functions of the former U.S. Bureau of Mines are located in the National Institute for Occupational Safety and Health (NIOSH).

Figure 1.—Installation of cribs in a longwall tailgate entry. (Photo by Frank E. Chase, NIOSH Pittsburgh Research Laboratory.)