BLAST ROUND DESIGN FOR A SMALL CHARGE AUTOMATED DRILL AND BLAST SYSTEM

by

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ABSTRACT

The small charge blasting technique was tested at Colorado School of Mines, Edgar Mine, Idaho Springs, Colorado. The geologic structure in the study area is moderately jointed and highly fractured. The purpose of this investigation was to determine the effects of geologic structure in relation to round parameters and to measure the ground vibration caused by blasting of this type. Rounds of 24 and 30 in. depths were tested in order to evaluate the factors in round design to give optimum breakage efficiency which will be required for an automated drill, blast, and muck system.

The rock breakage from four rounds of 24 and 30 in. depth was successful. A modified hole pattern provided good breakage, fracture control, smooth walls, and minimal fracture into the walls.

The small charge blasting concept uses simultaneously fired explosive charges detonated in a line of holes 2 - 6 holes/shot, 50 - 200 gm/hole and makes effective use of stress wave reinforcement. Typically, when the size of charges is reduced to an optimum value, air blast overpressure, ground vibration, noise, and fly rock velocity are appreciably reduced as compared to conventional blasting. The V-cut pattern utilizing small diameter holes (1-1/4 in.) also resulted in good breakage, and effective fragment distribution. The velocity of the ejected rock fragments from the face was not sufficient to cause significant damage to the shield.

The available information from manufacturers of slurry explosive together with the current round design parameters show that Iremite alum-
inized slurry with a critical diameter of 1 inch is effective in breaking the rock in 1-1/4 in. diameter boreholes. This type of explosive is desirable because of its strength and safety characteristics for use in the automated loading/ blasting system.

Finally, the whole V-cut round consists of 48 to 52 boreholes. The utilization of simultaneously fired small charges of high explosive in a line is a key factor for the success of the automated drill and blast system. The small charge method appreciably reduces the lost time due to the cyclic nature of DBM and eliminates or controls other undesirable features of the conventional blasting operations.