DELAYED BLASTING TESTS TO REDUCE ROCKFALL HAZARDS

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ABSTRACT

The Bureau of Mines conducted delayed blasting experiments at a contour coal mine, which were designed to reduce overbreak without special mrilling or significant additional costs. In the standard layout of the blast pattern at this mine, the ends of the rows formed the highwall. Overbreak was reduced by increasing the delays on the last row of holes at the highwall, which changed the effective delay pattern geometry and the direction of burden movement. These experiments resulted in smoother highwalls, which were also inherently safer because of the reduced likelihood of rockfall.

Three delay combinations were tested: 50 ms longer than the nominal mesign, 100 ms longer than nominal, and 50 and 100 ms longer in the two rows of holes nearest to the highwall. The mine's nominal blast mesign was a flat V-pattern with 17-ms surface delays between holes, 42-ms surface delays between rows, and 200-ms in-the-hole delays in each hole. All three test mesigns produced highwall improvements, compared with results using the nominal mesign, with occasional exceptions because of geologic variations. Observations and terrestrial photogrammetry showed that the delay changes produced generally smoother vertical profiles with less loose material.

INTRODUCTION

One of the major hazards found in surface mining is rockfall from highwalls. This hazard occurs in all forms of excavation in rock, especially where explosives are used. The explosive energy not only fractures the rock to be excavated but also damages the rock that borders the excavation. This reduces the stability of the highwall and increases the potential of rockfall. The rockfall hazard is normally attributed to blasting practices, geologic conditions, and adverse weather in 65 pct of accidents resulting from fall of rock (1). Of these three factors, only blasting is controllable, and therefore, blasting was the subject of this investigation.

In earlier research sponsored by the Bureau of Mines, Engineers International Inc. evaluated blasting practices at nine contour mines (2). Almost all the mines visited had highwall instability problems that were aggravated by poor blasting practices. Engineers International conducted eight test blasts that demonstrated that good blasting practices did improve highwall stability. However, after the tests were complete and the contractor was off the site, the mine personnel reverted to their old blasting practices.

To avoid a similar result, the tests in this report emphasize simple, easily understood