Combining Paired Blastholes with Electronic Initiation Systems

Project Summary

THE ACCURACY OF ELECTRONIC DETONATORS HELPS REDUCE BLASTHOLE INTERRUPTION

To test the ability of the DigiShot® electronic initiation system to deliver accurate initiation times between blastholes drilled in close proximity along the front row. The blast was designed with two 5¾ inch diameter holes drilled two foot apart. A second pairing of similar holes was drilled eight feet from the first paired holes on the front row.

The holes drilled two foot apart were initiated on the same delay time with 16ms between the two holes located eight feet away. This timing was determined by using Signature Hole Analysis (SHA) seismic modeling to insure minimal off-site impact on neighboring properties.

Background

USING PAIRED HOLES AS A COMMON PRACTICE WITHIN THE AGGREGATE INDUSTRY

Paired holes have been used in the industry for many years to help where excessive burdens are encountered and angle holes are not an option. This practice allows for a small load in the bottom of one of the holes to increase the powder factor in the bottom of the shot face to help with the additional burden.

While this process has been used with success, many blasters worried that with the cap scatter found in even the most accurate pyrotechnic detonator, hole interruption between the closely paired holes inhibited the full release of energy in both explosive columns, limiting the effectiveness of this type of blast design. Concerns were even raised with regard to the possibility of dead pressing emulsion products, resulting in little or

no fragmentation and the possibility of higher ground vibration.

The blast event in this study consisted of paired holes 8 ft apart along the spacing, to handle 37 ft of burden on a 40 ft face.

Project Goals

CAN PAIRED HOLES PERFORM AS WELL AS REDUCING THE SPACING IN THE FRONT ROW?

The concept of paired holes in the front row is to provide a larger charge weight in the bottom of the shot when excessive front row burden cannot be compensated for by traditional blast design modifications.

By pairing the holes, the combined charge weight allowed for more spacing between front row “pairs” which gave a wider range of options for the waveform analysis. The paired holes (timed on the same delay) were considered as one, when performing the analysis.

With precision initiation timing using electronic detonators, the chance for hole interruption is greatly reduced. If both holes in the pair fire nominally, better overall fragmentation should be observed along with better floor and toe control as well as a reduction in oversize.

With a more efficient blast, and the ability of using specific hole sequencing through the use of Signature

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Hole Analysis, off site vibration results should also show improvement in reduced peak particle velocity values and/or better frequency spectra for the vibration event.

Technology Applied

SIGNATURE HOLE ANALYSIS, DIGISHOT ELECTRONIC DETONATORS PROVIDE THE TOOLS TO GET THE JOB DONE RIGHT

By pairing holes on the front row, the ratio of front row holes to the number of holes in the remaining rows of the shot becomes smaller. This makes it easier to develop standard inter hole and inter row timing based on SHA analysis of the specific blast design. By utilizing SHA timing, delay sequences are designed to provide for destructive interference and a reduced off-site vibration footprint.

The precision and accuracy of the programmable DigiShot electronic detonator allows the blaster to make use of timing solutions designed specifically for the blast.

Value Added

VIBRATION CONTROL, BETTER MUCKPILE SHOWS THE RESULTS OF PAIRING HOLES

Blast patterns designed with paired front row holes to combat excessive burden have proven effective in maintaining strict vibration limitations in close quarters. Better energy distribution in the blast and the reduced potential of energy loss due to hole interruption provides for better digging, enhanced cycle times and better floor conditions.

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