Electronic Detonators Allow Quarry to Increase Production While Keeping the Neighbors Happy

Project Summary

DIGISHOT®, SHA RESULTS IN LARGER BLAST HOLE AND MORE PRODUCTION

Opening a new quarry in a high-density population center in the Mid-Atlantic region of the United States is very difficult. Often, concessions to appease the community result in blasting limitations that create obstacles to peak production.
At this quarry, the duration of blast events was limited for each month making it difficult to increase the size of the blast event as a solution to an increase in demand.

By using Signature Hole Analysis (SHA) modeling to develop alternative timing sequences, Dyno Nobel was able to increase the blast hole diameter allowing for pattern expansion and an increase in blast rock per hole. Pattern expansion resulted in lower drilling costs, and timing sequences kept vibration levels low, while enabling the quarry to increase production per blast event while ensuring minimal off-site ground vibration to satisfy the local market demand for stone.

Background

COMPROMISES IN PERMITTING PUTS PRESSURE ON BLAST DESIGN

In order to secure the required permitting to open a new quarry outside a major eastern U.S. city, the owner made several concessions to local property owners. One of these allowances was to place a limit on blast event duration permitted each month.

While this restriction posed no problem during initial pit development, it was soon evident that changes would be required to meet the projected product demand for this quarry. Since blast event duration was limited, simply increasing the number of holes per blast was not an option. Drilling capacity, or the number of holes that could be drilled in a day, was also a limiting factor.

Project Goals

MAXIMIZING PRODUCTIVITY PER HOLE WITHOUT INCREASING VIBRATION WOULD SOLVE PRESSURE OF INCREASED DEMAND

Dyno Nobel proposed the use of signature waveform analysis to develop site-specific timing sequences that would allow for an increase in hole diameter without raising vibration levels beyond acceptable values. DigiShot electronic detonators would be used to insure that timing sequences in the blast matched the design sequence created by the SHA model.

DYNO
Dyno Nobel

Groundbreaking Performance

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Technology Applied

DIGISHOT FLEXIBILITY ALLOWS EASY CHANGES TO MEET SHA TIMING RESULTS

To determine optimum firing times for vibration control, a series of test holes were designed by DynoConsult and the quarry staff. For each test location, an array of seismic recording units was deployed to record data from each trial.

Using state of the art waveform analysis software, DynoConsult derived site-specific blast design sequences calculated to minimize resultant ppv values and to enhance the high frequency spectra of the event to reduce structure response. Computer-generated timing sequences were reviewed by the Dyno Nobel and quarry blast team. Delays were then selected based on data to provide optimum fragmentation and dig-ability, as well as control vibration. Once desired timing designs had been determined, a program was put in place to evaluate the results in the field before moving to larger blast holes on expanded patterns.

The Dyno Nobel blast team applied the alternative designs using the DigiShot system to insure precise firing times. Accurate timing sequences allowed for a methodical evaluation of each blast. This process enabled the blast team to meet its production targets and to limit off-site effects. Additionally, the DigiShot system permitted the blaster to make modifications to timing as bench conditions continually changed.

Value Added

LARGER DIAMETER BLAST HOLES, INCREASED PRODUCTION PER HOLE, MAINTAINED LOW VIBRATION AND REDUCED COMPLAINS, ADDS UP TO BIG SAVINGS

The use of signature hole analysis is not a new concept for vibration control. However, it was not until the application of electronic detonators that the full ability to actively reduce peak particle velocity was realized.

By introducing new timing sequences with the precision and flexibility of the DigiShot system, vibration levels were reduced to readings that allowed for the increase in borehole diameter

from 5.5 inches to 6.5 inches.

This enabled a significant expansion of blast-pattern geometry while maximizing drill efficiency.

The client was able to easily meet production demands while staying well within the limitations agreed to with regard to the community. New timing sequences allowed an increase in charge weight per delay from 300 lbs to 1300 lbs without impacting off-site effects. such as ground vibration or air over pressure.

Expanded patterns meant a savings in drilling costs that more than compensated for the investment made in transitioning to the DigiShot system.

As regional technical manager Joe Nawrocki states, “A reduction in total blasting costs of over 5 cents per ton has been accomplished at this operation. Our client is a firm believer in the capabilities of DigiShot and the SHA process to insure their continued operations In this key growth market.”