DigiShot® Precision Combined with Signature Hole Analysis Minimizes Off Site Blast Effects

Project Summary

DIGISHOT® PRECISION COMBINED WITH SHA OPTIMIZATION REDUCED COSTS WHILE MINIMIZING OFF-SITE EFFECTS

Operating quarries in areas with high population density can result in an increased risk exposure for the operator. Solutions often come with added production costs or restrictions in the overall productivity cycle that frequently have a negative impact on profitability. The transition to DigiShot electronic detonators at this Midwest customer aided in productivity by providing better use of energy during the blasting process. By using site-specific seismic modeling that determined optimum firing sequences on a shot by shot basis, not only were off-site vibration effects minimized but additional gains in overall blast efficiency led to: better fragmentation, faster truck cycle times, reduced oversize, increased pattern geometry, elimination of decking and the ability to increase shot size. Reduced risk exposure by minimizing off-site effects and increased shot size combined with better productivity and lower production costs provided this operator with a winning combination.

Background

RISK EXPOSURE FORCES CHANGES IN BLAST PROGRAM

Because companies face an ever increasing risk of litigation, the threat of blasting claims is a contributing factor in the design of many blasting programs. Since the cost of handling blast complaints is considerable, many operators are willing to accept solutions that may add to the overall production costs of the operation. The use of decking and reduced shot size is often employed as a way of moderating the blasting footprint for a mine or quarry, but this solution often comes with added costs and loss of efficiency.

Hole	Row	Deck	Charges	Peak	RHZ	RHZGraph	VHz	VHZGraph	THZ	THZGraph
17	75	0	3	0.168	2.00		2.00		2.00	
18	77	0	2	0.177	2.00		53.25		2.00	
13	76	0	2	0.187	2.00		2.25		2.00	
17	96	0	3	0.191	2.00		2.00		2.00	
18	78	0	3	0.194	2.00		53.25		2.00	
15	125	0	2	0.194	8.25		64.00		24.25	
13	75	0	3	0.194	2.00		2.25		2.00	
17	97	0	3	0.195	2.00		60.00		2.00	
13	77	0	2	0.195	2.00		2.25		2.00	
17	76	0	2	0.195	2.00		2.00		2.00	
18	94	0	2	0.198	2.00		53.50		2.00	

Project Goals

PRECISE SHOT-SPECIFIC TIMING CAN PROVIDE A SOLUTION WITH THE ADDITIONAL OF BENEFIT OF REDUCED COSTS

Enhanced vibration control not only can aid in reducing risk but has also been shown to provide better overall blast efficiency. By utilizing the Signature Hole Analysis (SHA) seismic modeling tool, changes were recommended to the basic blast design in this operator's location with the expectation of capturing gains in several productivity and cost areas. These gains would more than offset the cost of transitioning to an electronic detonator system.

DYNO
Dyno Nobel

Groundbreaking Performance

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Technology Applied

DIGISHOT PRECISION AND FLEXIBILITY ALLOWS FOR USE OF ALTERNATIVE TIMING

The basic firing time for the blast was determined by using SHA seismic modeling to insure minimal off-site impact on neighboring properties. Timing sequences were developed based not only on the location of the blast but also on the specific shot geometry.

The DigiShot electronic detonator system allowed the blaster to take recommended timing sequences from the SHA analysis tool and to execute for all of the production blasts.

The implementation of the SHA analysis was employed as a continuous improvement tool to adjust firing times to match shot geometry on a shot by shot basis. Vibration and productivity measurements were constantly evaluated to allow for changes in basic shot metrics to aid in cost control and provide additional productivity enhancements.

Value Added

DIGISHOT PRECISION COMBINED WITH SHA OPTIMIZATION REDUCED COSTS WHILE MINIMIZING OFF-SITE EFFECTS

This Midwest customer needed help to optimize their blasting program while reducing the risk exposure from blast complaints. Dyno Nobel proposed a transition to DigiShot electronic detonators. First, a SHA program was introduced to aid in determining firing times for reducing peak particle velocity and enhancing the high frequency spectra element to minimize structure response.

This allowed Dyno Nobel to maximize the value of the precision and flexibility of the DigiShot electronic detonator. As a result of using DigiShot detonators with modified timing sequences, vibration was reduced and dominant frequencies were increased.

Hole	Row	Deck	Charges	Peak	R	V	T	RHz	VHz	THz
15	83	0	3	0.299	0.263	0.177	0.299	36.50	2.00	2.00
13	86	0	2	0.299	0.299	0.101	0.290	2.00	2.00	2.00
10	91	0	2	0.299	0.291	0.110	0.299	2.00	2.00	2.00
12	113	0	3	0.299	0.220	0.218	0.299	9.75	17.00	17.75
20	107	0	3	0.299	0.250	0.168	0.299	36.50	48.50	48.00
19	107	0	3	0.300	0.240	0.200	0.300	37.50	37.50	2.00
11	122	0	2	0.300	0.195	0.155	0.300	33.00	17.00	2.00
20	86	0	2	0.301	0.231	0.170	0.301	35.75	48.50	35.50
21	115	0	2	0.302	0.195	0.162	0.302	34.25	44.75	45.00
11	104	0	3	0.302	0.289	0.114	0.302	10.25	2.00	19.00
17	121	0	2	0.302	0.196	0.290	0.302	32.75	58.00	17.00
20	122	0	2	0.302	0.179	0.269	0.302	48.50	49.75	49.25
12	110	0	2	0.302	0.302	0.207	0.287	37.50	17.25	17.75
18	88	0	3	0.303	0.285	0.285	0.303	34.50	56.75	2.00
18	117	0	1	0.303	0.198	0.176	0.303	34.50	16.50	34.25
19	121	0	2	0.303	0.186	0.176	0.303	33.00	50.50	33.00
19	99	0	2	0.303	0.218	0.293	0.303	2.00	51.25	2.00
14	92	0	2	0.304	0.226	0.102	0.304	2.00	2.00	2.00
10	90	0	2	0.304	0.304	0.103	0.285	2.00	2.00	2.00
15	103	0	2	0.304	0.289	0.155	0.304	2.00	2.00	19.25
20	117	0	2	0.304	0.182	0.304	0.267	35.00	51.25	43.50
13	88	0	2	0.304	0.285	0.101	0.304	2.00	2.00	2.00
20	97	0	3	0.304	0.304	0.304	0.251	51.00	51.25	2.00
22	104	0	2	0.305	0.305	0.162	0.300	38.75	47.00	46.25
12	114	0	3	0.306	0.208	0.228	0.306	9.75	17.00	17.75
17	104	0	2	0.306	0.226	0.306	0.200	37.50	58.00	2.00
15	104	0	2	0.306	0.306	0.167	0.284	37.50	65.50	19.25
19	122	0	1	0.306	0.186	0.168	0.306	32.75	50.00	32.75
20	120	0	2	0.306	0.171	0.306	0.294	49.50	50.00	49.25
16	80	0	3	0.307	0.189	0.242	0.307	2.00	63.25	2.00
13	87	0	2	0.307	0.286	0.100	0.307	2.00	2.00	2.00

Improved energy utilization during the blast resulted in the elimination of decking, pattern expansion and a dramatic increase in blast size.

The customer value is to reduce drilling and blasting costs while helping to reduce the number of blast events nearby residences may feel.