New Blast Planning Solutions Reduce Risk

Hardware and software solutions offer accurate predictions, improved production, and reduce costs

BY JESSE MORTON, TECHNICAL WRITER

The latest solutions in the blasting space help reduce risk. Customers report using the solutions to successfully complete complex special projects and to achieve critical goals. Suppliers say those goals can be improved fragmentation, production and safety, and reduced costs. Which is why they say they expect rapid market acceptance and growing demand for the following solutions in the near future.

TITAN Delivers Win

A white paper by Dyno Nobel said partnering with a mine on a special blasting project in the Powder River Basin delivered optimal results and showcased a long list of benefits offered by TITAN products.

"The use of a solid Blast Optimization Team (BOT) to ensure a solid supplier and customer working team looking at daily production KPI's as well as continuous improvement projects proved to be critical," said Baron Fidler, general manager, corporate accounts, coal. Fidler represented the supplier on the BOT, which, over the course of three months, made a series of decisions that led to the safe execution of the special project blast.

The list of benefits offered by the TITAN products that were realized was topped by reduced or no post-blast NOx fumes, according to the paper. "Added benefits of increased water resistance, increased actual energy yield verses theoretical value, increased product sensitivity results in high-order detonation, and the ability to control density, redistribute energy, increase detonation pressure, and maintain cost per loaded foot (ft)," gave "good fragmentation and good displacement very similar to regular standing coal blasts."

The blast, however, was far from regular.

The customer was a Wyoming miner producing 8,100- to 8,200-Btu/lb coal for electrical power generation. It is supported by Buckley Powder Co., a joint-venture business partner of Dyno Nobel with corporate offices in Englewood, Colorado," Fidler said.

For dewatering, the mine "uses a crack line system ahead of the working panel to allow dewater pumps to be inserted," the paper said. "The dewatering structure consisted of 11-in.-diameter holes drilled more than 100 ft in depth along a 5,000 ft-panel-length of pit."

The BOT launched the special project after "a large coal crack … opened up along the coal seam dewatering structure," the paper said. The crack ranged in width from 2 to 7 ft.

The BOT brainstormed solutions after it was determined that "trying to fill the crack in order to tram a blast-hole drill across was not safe," the paper said. "One solution was to talk with a contract driller who has a smaller track drill that could reach over the crack to drill holes from the surface," it said. "This would allow the drill to remain on stable ground and the drill could drill at different angles with hole lengths to best match the burdens."

The proposed process "consisted of maintaining demarcation of unstable ground, tie-off when working on outside of the crack, crossing the crack with portable plank-type bridges, continuing crack monitoring, and doubling the blast event clearance distance," the paper said.

An Epiroc SmartROC T45 was used to drill the holes. "At first a spherical button bit was used but was slow," the paper said. Eventually a ballistic bit was used.

The driller was ordered to stay away from the crack.

Using 43 drill stations, the proposed blast pattern had 107 5-in.-diameter holes in three rows along 505 linear ft. "Drill hole angles ranged from 58° to 7° off vertical in a fan shape," the paper said. "Hole depths ranged from 25 to 48 ft with hand stemming of 12 to 35 ft."

The TITAN Differential Energy calculator was used to arrive at the blast-

A 2-ft crack opened and widened along the coal seam dewatering structure at a mine in Wyoming. It prompted a special blasting project managed by a Blast Optimization Team, which used TITAN products to accomplish their goals. (Image: Dyno Nobel)

hole loading options. "The calculator is a mobile phone app allowing the user to quickly determine the pounds per loaded ft and pounds per hole on the blast bench in order to make adjustments for conditions the blaster encounters," Fidler said. TITAN XL1000 only uses a single-density emulsion segment per hole, but the calculator easily calculates various column load comparisons, Dyno Nobel reported.

"The mine surveyed the area, providing a coal block model with hole angles and locations to allow for much of the hole loading calculations to be completed prior to start," he said. "Utilizing pre-blast modelling allowed for much of the hole loading to be completed with minimal on-the-bench adjustments."

The BOT planned for the pattern to be loaded during a single day shift. It prioritized "the safety of the surveyor, drill crew and blast crew to ensure good coal recovery percentage," Fidler said.

Three crew members were involved in the hole loading process.

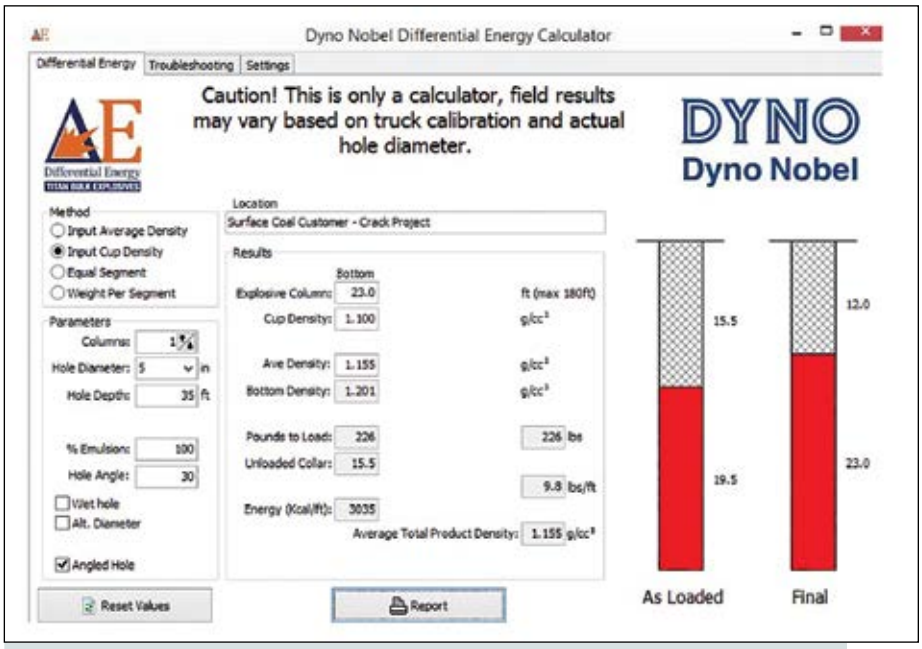
"NONEL MS (millisecond) down-the-hole delays and Trojan cast boosters were used as primers," the paper said. At a rate of 125 lb/min, "TITAN XL1000 was loaded into the holes with a 1.10 g/cm^3 (68.7 lb/ft^3) density using a 1-in. flexible hose," it said.

Using TITAN products meant the crew could "make adjustments as they loaded along the length of the blast using an easily manageable flexible loading hose," Fidler said.

Sometimes "the hose was pushed into the holes and the water was displaced as the emulsion was loaded," the paper said.

At 100% waterproof, TITAN XL1000 is chemically sensitized to "minimize lost emulsion into cracks and fissures," Fidler said.

"The emulsion density can be adjusted to match the hole conditions, meaning if the coal was solid with good burdens then the density could be increased to allow for increased pounds per loaded blasthole," he said. Conversely, if the coal was "cracked with poor burdens the density could be reduced to allow for reduced pounds per loaded blasthole."



For a complex special blasting project, the TITAN DIFFERENITAL ENERGY calculator was used to determine the blasthole loading options. (Image: Dyno Nobel)

"Stemming collars ranged from 10 ft to 15 ft," the paper said. Holes had to be hand stemmed. Sometimes a push pole was used.

The blast delivered the expected results and showcased the benefits of using multiple TITAN products in concert. "General comments are the material was dug without complaints from wheel loader operators and there was no change in production," the paper said.

The customer was satisfied with the results and continues its partnership with Dyno Nobel and Buckley Powder Co., Fidler said. "The mine still uses TITAN XL1000 today."

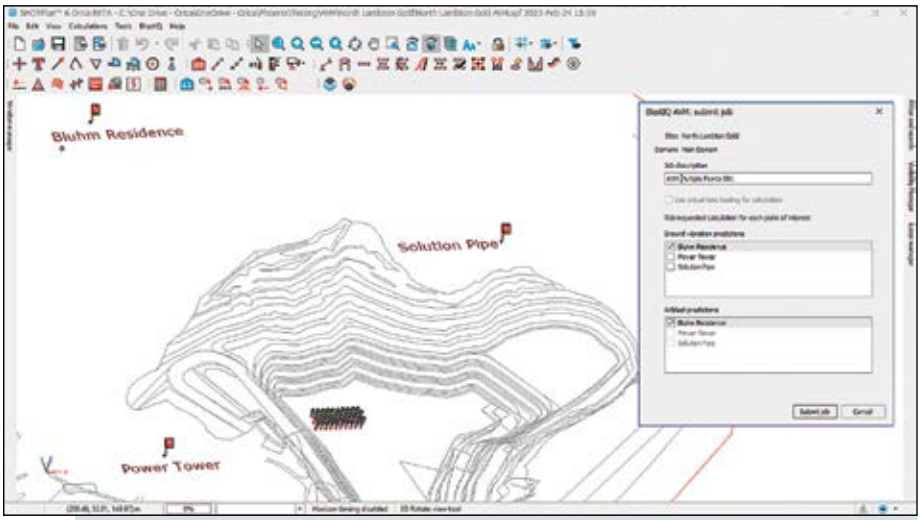
AVM Increases Production

Orica Ltd reported Advanced Vibration Management (AVM) can help a mine predict blast vibrations, meet regulations, cut risk and improve productivity.

"Blasting is a risky event that, if not conducted safely and accurately, can impact sensitive infrastructure," said Raj Mathiravedu, vice president, digital solutions. "A key part of a mine's license to operate is to limit its impact to the community and environment, including key mining infrastructure," he said. "AVM provides that additional level of control, allowing the blasting engineer to predict what will happen before it happens."

AVM is an extension of the company's SHOTPlus blast design and modelling software. It gives users the option to leverage the BlastIQ platform and suite of enhanced blast optimization tools for "increased control of the blast design," Mathiravedu said. "SHOTPlus is used to design the blast, AVM is used to model the blast outcomes, and BlastIQ is used to implement the optimum design, store documentation and measure performance."

AVM offers tools that allow the user to generate and run vibration and airblast models that consider multiple points of interest. "When used in conjunction with the BlastIQ suite, AVM allows customers to seamlessly link blast designs, drilled actuals, and vibration measurements," Mathiravedu said. The solution uti-



Advanced Vibration Management, an extension of SHOTPlus blast design and modelling software, can be used to model blast outcomes for risk mitigation purposes. Above, a blast design in SHOTPlus Premier with points of interest marked. (Image: Orica)

lizes cloud computing architecture to "deliver reliable and timely data across multiple measurement points throughout the operation."

It was designed to be "user friendly," he said. AVM "connects automatically to SHOTPlus, removing unnecessary importing and exporting of files," and has an "easy-to-navigate and insightful interface to capture and view both the predicted and actual results of vibration monitoring."

The solution features tools for producing charts, graphs and images that support detailed analysis for each monitoring point, and that give the predicted airblast vibration results for all monitors. Offered benefits include increased production, reduced costs, ensured compliance, and improved safety.

AVM provides tools and insights that allow the customer to most effectively blast areas that, without those tools and insights, might be off limits.

"When structures sensitive to vibration and airblast are closely located to an operation, uncontrolled blasting operations can cause significant damage," Mathiravedu said. "With an advanced prediction algorithm, customers can now access areas of their operations that may have previously been inaccessible or deemed too high risk to blast in," he said. "This can allow operations to potentially extend the overall life of an operation and enhance its license to operate."