

Modular drills into explosive costs

Significant explosive consumption cost savings are being achieved at mines using modern stratification or 'rock recognition' systems with current machine guidance technology, to better design drill holes based on bench geology patterns, according to Modular Mining Systems.

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Two mines in Brazil cut explosives use by more than 20% a year through integrated drill guidance

The developer of advanced mine production management technologies says two large mines in Brazil reduced their explosives consumption by more than 20% per year after integrating its drill guidance system and stratification analysis product.

Charles Orr, Modular's Product Manager, Machine Guidance, told *Mining Magazine* successful fragmentation depended on several factors, including explosive type, detonation timing, drill-hole spacing, and rock hardness.

"Fragmentation has evolved into an increasingly integral component of mine production and efficiency," he said.

As equipment downtime, operator error, and material output weigh heavily on a mine's bottom line, it became even more imperative that solid ground be optimally-fragmented. For excavators, improper fragmentation meant broken teeth and difficult digging as a result of shovelling rocks that were too large.

"Likewise, crushers are often taken offline due to damage caused by these same large rocks," Orr said.

He said Modular's ProVision machine guidance system with its Stratification Module took fragmentation to another level, providing data and energy calculations that could be used to better refine drilling and blasting processes.

"These refinements can result in better productivity, longer equipment life, and increased cost savings and safety for mining operations everywhere.

"When using such a system a mine's geologist assigns typical ranges of drilling energy to a set of materials or hardness based on configurations determined by geophysically-measured drill holes at certain regions or elevations in the pit," Orr said.

"A mobile system constantly monitors drill data, sending information to an office server, where it is stored in shift databases. Specific drilling energy for each hole is calculated after drill completion.

“The system then stratifies the drill holes based on this energy and material or hardness category. Stratification results can be viewed in graphical reports or conveniently exported in CSV to mine planning or blast management software packages.”

When fragmentation for one bench was finished, stratification results were analysed to determine a new blast pattern for subsequent benches. Thus stratification allowed for blast patterns that were tailored to specific bench elevation, rock hardness and explosive type, resulting in more consistent rock sizes.

Orr said stratification also allowed for better-optimised material fragmentation and blast-loading design, and improved dig-ability.

“Data gathered by geological patterns and blast results provides valuable insight for neighbouring blast designs,” he said. “And since the ProVision system automatically sends up-to-date blast designs to equipment operators, geological models can be continually fine-tuned.”

Stratification is said to provide even more significant advantages where mining engineers are faced with voids produced by underground water or old mining tunnels.

“As the field computer system continuously polls bit depths, it measures such parameters as RPM [rotations per minute], torque, penetration rate, and pull-down pressure, which provide valuable clues about the locations of voids,” Orr said.

“These identifiers can result in significant monetary savings, allowing the operator to make better-informed decisions about which explosives to use. For example, when the stratification module identifies underground water, blast planners will know that they need to use a waterproof explosive to allow for proper detonation. But the clues gathered by the field computer can also improve safety and equipment health by alerting operators of heavier equipment to stay away from unstable ground, which they can fall into.”

Orr said drill time, explosives, and drill bits and other consumables contributed to fragmentation costs that could grow exponentially when equipment downtime resulted from improper fragmentation.

“Modular’s ProVision machine guidance system and Stratification Module create a full production cycle, allowing mine sites to attain maximum material output by refining drill patterns for each bench based on the results of the previous bench’s drill holes and geological patterns,” he said.

“And the Stratification Module helps minimise equipment downtime that can often result from fragmentation.”