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# DynoConsult Optimizes Blasting Strategy

By Jesse Morton, Technical Writer

Dyno Nobel reported DynoConsult recently helped a coal mine optimize their blasting strategy and reduce overall overburden removal costs. The strategy used could be applied at other mines, a consultant for the supplier said.

The coal miner hired Dyno Nobel's DynoConsult team to help debunk an underperforming blasting strategy and then find a better one that would reduce overburden removal costs. "The customer and DynoConsult found a cast performance problem and identified it as blast stacking," said Charles Dammann, field consultant, Dyno Nobel Americas.

"This problem is caused by face material not moving far enough or fast enough, thus impeding the movement of the remainder of the blast material and creating a smaller power trough," he said. "With customer collaboration, DynoConsult theorized that the reduction of the front row burdens would allow for sufficient movement to prevent it from impacting the back row movement."

Per the theory, "an extra row was added, and the pattern implemented a variable burden design," Dammann said. "The burden was lowered on the front three rows and widened on the back three rows to maintain a consistent average powder factor between that of the front and back rows."

The variable burden design should increase casting performance "because it allows material in the front of the blast to move further into the effective cast zone," the paper said. "This accompanies an increase in powder factor between the two overburden cuts."

The supplier had previous success with the strategy, but it was new to the mine site.

The DynoConsult team launched an experiment to compare the results of the new strategy to those of the existing blast design.

"A 140-ft control cut and a 140-ft experimental cut were used to compare cost records and overburden cast blast data collected by the customer and by DynoConsult," Dyno Nobel said in a white paper. "The primary change between the two overburden cuts was the layout of the drill pattern."

To compare the results, the DynoConsult team assessed cost and performance data for both the control and experimental cuts.

“The unit costs and material volumes were provided by the customer,” the paper said. Using a drone, DynoConsult collected the performance data.

“The cast data collection process took a few months, but that was limited by the production rates at the site,” Dammann said. “The data collection process involved setting up a drone flight path over the blast, and taking top-down photos of the area before and after the overburden cast is initiated.”

The drone, a DJI Mavic 2 Pro, offers “many advantages in a cast-analysis situation,” he said. It is capable of a 30-minute flight on one battery. “The drone is compatible with many free flight apps, allowing for quick flight path setup and flying.”

The drone was equipped with a high-resolution camera for optimal accuracy in the resulting three-dimensional (3D) mosaics. “The pictures taken by the drone have drone-GPS location data stored in the pictures’ metadata,” Dammann said.

“The photo location measured by the GPS allows a computer program to spatially relate the pictures to each other, then stitch them together in a process called photogrammetry,” he said. “The result is a 3D mosaic of the bench before the blast and the muck pile following the blast.”

For the performance analysis, “the pre-blast and post-blast mosaics are overlayed as contour maps in Carlson AutoCAD,” Dammann said. “The features of this program make volume comparisons quick and easy to set up,” he said. Comparison results were available within 30 minutes.

“The use of a CAD program allows for accurate volume measurements, as opposed to the traditional method of muck profiling,” Dammann said. From the blast geometry, a virgin block and final spoil slope are rendered.

“By comparing the volumes between the virgin block, the muck pile, and the final spoil slope, blast performance is measured,” he said. The results include rock swell, expressed as a percentage.

“The total material cast is the muck material that is cast beyond the toe of the virgin block,” Dammann said. Total cast is expressed in cubic yards and as a percentage of total swelled volume.

“Effective cast is the muck material that was cast to its final location on the spoil slope,” he said. Effective cast is expressed in cubic yards and as a percentage of the total swelled volume.

“The casting volumes and swell are determined for every cast on the bench in question, and that data is sent to the customer and saved in a database by DynoConsult,” Dammann said. “When the customer requested an analysis of cast performance following a planned change in pattern design, the saved data was used to compare the performance of the two cuts.”

The analysis spanned two weeks, “with much of that time spent compiling cost and explosive usage data from the customer’s database,” Dammann said.

The cast performance data showed “improved casting results,” the paper said.

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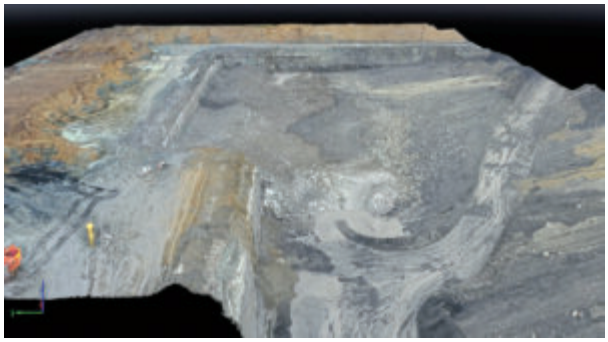

Above, a screenshot of the post-shot 3D mosaic, which was one of the models used in the cast performance analysis. (Image: DynoConsult)

“The total cast increased from 36.7% to 43.7%, and effective cast values increased from 17.4% to 24.9% between the cuts,” the paper said. “The resulting overburden cast increase reduced the amount of work for the bulldozers.”

Extrapolating that out showed the new strategy could “reduce rehandle material by 3,430,000 bank cubic yards,” the paper said.

“This increase in casting volume accounts for much of the 19% decrease in bulldozer hours between the cuts,” it said. “The change in pattern design is projected to save the mine $500,000 annually on direct material movement costs.”

The new strategy would also reduce bulldozer hours, the paper said. “Having bulldozers available for additional work further reduces costs and improves overall efficiency of the mine.”

While the strategy was designed for a specific coal mine, “the changes to the pattern design are not specific to the geology and layout of the mine in question,” Dammann said.

The blast strategy was “shown to improve cast blasting performance at this specific site, but the pattern design itself is not necessarily site-specific,” he said. “The different pattern design could be used at other sites that use cast blasting.”

*The original Coal Age article can be found here.*

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