THE AUSTIN ADVANTAGE

USING 3-D BLAST MODELING FOR BLASTING NEAR PIT PUMP

GENERAL INFORMATION

Location: Southwest Virginia

Industry: High-quality limestone

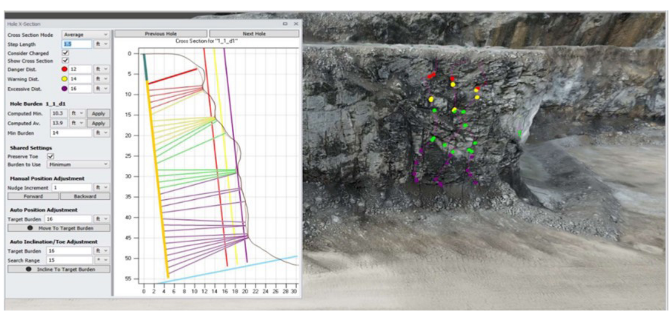
Products Used: Paradigm, E*STAR

Project Lead: Steven Bell

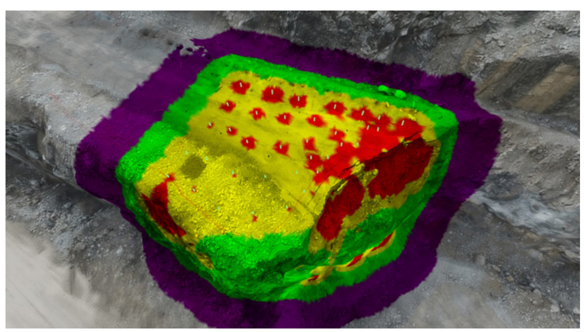
Author: Steven Bell

THE HISTORY

Blasting operations in mining have evolved significantly over the years, with advanced technologies improving precision, safety, and efficiency. In Southwest Virginia, a high-quality limestone mine required a carefully planned blast to remove a bench near critical infrastructure. With a sump pond and a high-voltage power junction box nearby, traditional blasting methods posed risks to operations. The challenge was to ensure controlled fragmentation while minimizing any impact on surrounding structures. To meet these demands, 3-D blast modeling was utilized to engineer a solution that would achieve the necessary production targets while mitigating risks.



3D profile shown on the model to show how it finds the minimum burden



Heat map of burden to help determine individual hole loads

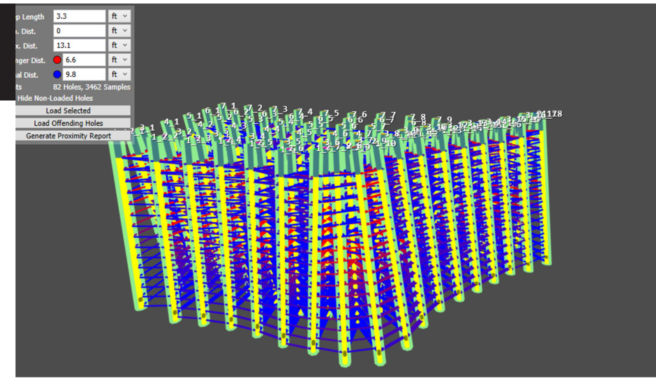
THE GOALS

1. Successfully remove the remaining bench within 70 feet (21.3 meters) of existing mine infrastructure.
2. Ensure no rock fell into the sump pond, preventing waves that could impact the pump.
3. Achieve adequate fragmentation to feed directly into the plant without requiring a crusher.
4. Maintain structural integrity of the sump pond and power junction box.
5. Utilize advanced UAV and blast modeling technology to optimize blast design and execution.

CUSTOMER **CHALLENGE**

The mine faced several challenges in executing this blast safely and efficiently:

- Poor geological conditions, making it difficult to keep blast holes open.
- Up to 50% of drill holes in some shots were unloadable.
- No real crusher on-site, requiring an 85% target of 36-inch passing material.
- Ensure minimal muckpile displacement to prevent debris from reaching the pond.
- High-precision drilling and blast design to accommodate variable geology.



Proximity viewer used to see how close holes are at all points of the borehole

THE **AUSTIN** SOLUTION

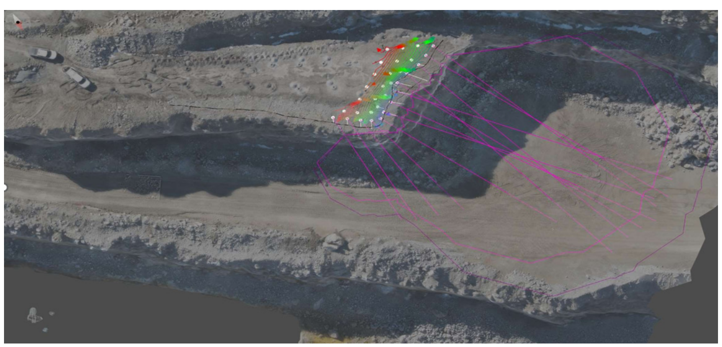
Austin Powder implemented an innovative approach leveraging 3-D blast modeling and UAV technology:

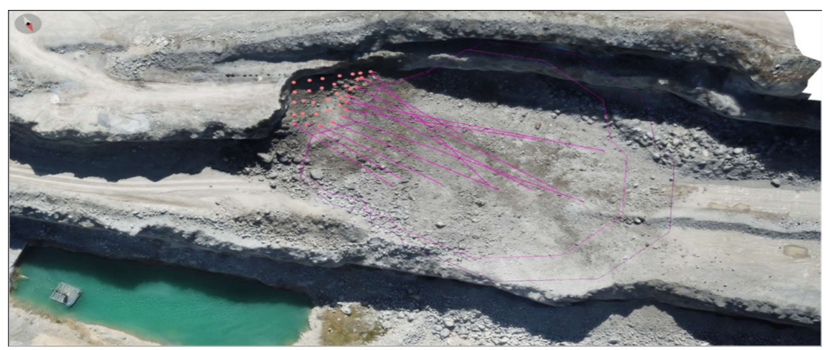
1. Mapping and Modeling

- UAV flights were conducted over the blast area to create an orthomosaic image.
- The high-resolution image was input into proprietary blast design software.
- 3-D modeling was used to predict the muckpile profile and ensure minimal impact on the sump pond.

2. Blast Design and Drilling

- Blast holes were strategically positioned to minimize throw from the face.
- Boretrak technology verified hole locations and azimuths.
- Smart Drill technology received digital hole data via XML files for precise drilling.
- Geologic anomalies such as soft seams and voids were accounted for in the final blast plan.


Top down view showing the timing contours of the shot and muckpile profile


Post photo of Shot 2 showing how well the muckpile projection worked for this shot

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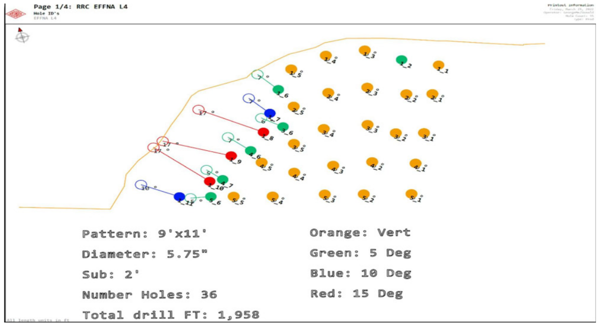
3. Hole Loading and Firing

- Bulk gassed emulsion was used for controlled energy release.
- Each hole was dual primed with boosters placed at specific depths.
- Electronic detonation sequencing ensured optimized inter-hole and inter-row delays.



4. Performance Evaluation and Adjustments

- The first shot delivered good fragmentation and stable resultant faces for the next blast.
- Some small rocks impacted the pond but did not affect pump operation.
- A second shot was planned closer to the pond with additional safeguards, including increased burden on face holes and a berm to prevent rolling debris.
- The second shot further optimized fragmentation and completely eliminated any risk to the pump and power box.

THE **OUTCOME**

The project demonstrated that critical blasting operations could be executed safely and efficiently with proper engineering and technology integration. Key outcomes included:

- Controlled fragmentation that met production targets without requiring a crusher.
- No significant impact on the sump pond or pump operation.
- Customer approval for additional shots closer to critical infrastructure based on demonstrated success.
- A refined predictive model calibrated from actual muckpile profiles for future use.
- Reinforcement of the importance of detailed planning, UAV imaging, and blast modeling in mitigating risks.

Post Blast photo of the first shot

Ultimately, this case study illustrates that when blasting is properly engineered and executed with advanced tools, even complex and high-risk operations can be completed with confidence and precision. Customer collaboration, careful planning, and technology-driven solutions were instrumental in achieving a successful outcome.

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