CASE STUDY

BLASTING NEAR CRUSHER FREES 3M TONS OF ORE

3 MILLION TONS OF ORE FREED

VALUE OF $72 MILLION

SUMMARY

DYNOCONSULT LEADS TO $72M IN FREED ORE

Dyno Nobel's DynoConsult team worked with a metal mine to safely and effectively blast near existing structures to free 3 million tons of ore with a value of $72 million.

BACKGROUND

CLOSE-IN BLASTING

A mine operator wanted to open up ore reserves by blasting two benches near several mine structures including two crushers, the conveyor belt drive, and the thickener. The immediate area around the blast location had been mined out many years ago prior to the installation of the structures. Now, in order to open up additional ore for extraction (over 3 million long tons), it was necessary to blast out two benches near the mine structures. Mine management was concerned that flyrock and/or vibrations from the blasting could damage the nearby structures.

The crushers were approximately 250 ft from the nearest blast hole while the belt drive and thickener were 800 ft and 1300 ft, respectively, from the nearest blast hole. The crushers were identified as critical structures as they were the production lifeblood of the mine. If the crushers were shut down due to any damage from the blasting, the revenue of the mine would be adversely affected.

DynoConsult® was contacted by the local distributor to provide recommendations on how to drill and load the blastholes so there would be no flyrock and minimal blast vibrations.

PROJECT GOALS

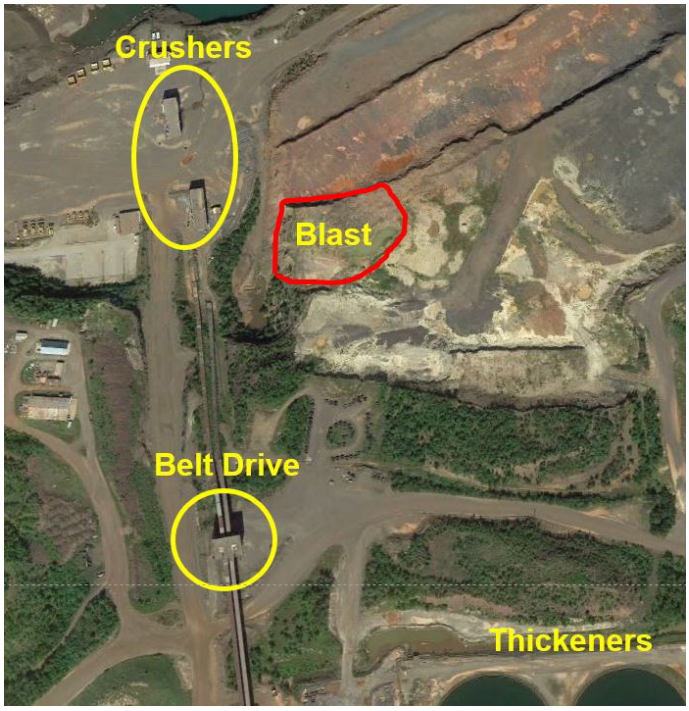
ELECTRONIC DETONATORS AND 3D MODELING

Several goals for the blast design were established by the mine management.

A crucial goal was that rock movement from the blast should be limited so none of the mine structures would be damaged by flyrock. This was considered the most important goal for the blast design.

The second goal was to minimize the blast vibrations at the structures, particularly the crushers. Excessive vibrations could damage the structures, leading to extended downtime and costly repairs.

The last goal was to produce a muckpile that could be dug easily by the shovels. However, the mine management was willing to accept coarse fragmentation if the flyrock and vibration goals were achieved.



The blast site with nearby existing structures

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CASE STUDY

TECHNOLOGY APPLIED

MINIMIZING VIBRATIONS AND FLYROCK

There were two issues that provided an extra challenge to the blast design. The first was that the blast holes had to be 16 inches in diameter as that was the only hole diameter available. The second issue was that the bench height was short, varying from 34 to 40 ft.

From the beginning of the project, it was recognized that electronic detonators would be required to achieve the necessary control of the blast. Dyno Nobel's DigiShot® detonators were used as the initiation system. UAV flyovers of the blast area were conducted to provide a 3D representation of the free faces and bench surface. The 3D point cloud produced from this was used to measure the shape of the free faces. Once the shape of the free faces was quantified, it was possible to establish proper placement of the crest holes and develop a custom explosive load for each blast hole.

Dyno Nobel's proprietary blast design methodology was used to determine the burdens, spacings, and explosives loads for each blast hole. The specific equations used were those designed to minimize rock movement while providing adequate rock fragmentation. This was particularly important given the large diameter blast holes (16 inches) coupled with the relatively short hole depths down to 32 ft. This combination of large diameter blast holes with a short bench provided an unfavorable geometry for the goals established by the mine management.

Finally, Dyno Nobel's proprietary program Dyno42 was used to determine the optimum delay times in order to minimize the blast vibrations at the nearby mine structures. Dyno42 is a signature hole analysis software employing linear superposition of vibration waveforms.

3D representation of the free faces

VALUE ADDED

$72M IN FREED ORE

The results of the blast were what the customer requested. Upon seeing the blast results, the Process Manager for Drill & Blast at the operation stated, "You all are awesome and did an awesome job on the design, loading, and timing on that shot! We really enjoyed talking and learning with you all. Great job, give your team a pat on the back as they were a large reason why the blast crew was accepting and interested in the DigiShot electronic system and a pleasure to work with. We look forward to working more with you all."

The peak vibration level at the crushers was 0.91 in/s at a frequency of 15 Hz. There were no flyrock or blast vibration issues at any of the nearby mine structures. In fact, the rock movement was well contained. As a result, the mine was able to maintain its production with no downtime. The muckpile was well fragmented with reports from the shovel that it dug well. Three million long tons of ore, with a value of $72M, were made available by the blast.

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