CASE STUDY

COST SAVINGS THROUGH IMPROVED CAST BLASTS

$500,500 IN COST SAVINGS

7.54% EFFECTIVE CAST INCREASE

19% DECREASE BULLDOZER HOURS

SUMMARY

IMPROVED BLASTS TO SAVE COAL MINE $500K ANNUALLY

DynoConsult gathered and analyzed data at a coal mine to determine if changes to drill and blast practices reduced overall costs.

BACKGROUND

DRILLING AND BLASTING OPTIMIZATION

An area coal mine planned to run experimental changes to their drill and blast program to reduce costs through efficient blasting. They enlisted the help of Dyno Nobel's DynoConsult team to analyze the effectiveness of changes to the drill and blast practices and determine if they would reduce overall overburden removal costs. A 140-foot control cut and a 140-foot experimental cut were used to compare cost records and casting data collected by the customer and by DynoConsult.

Unit Costs	
Drill (USD/ft)	*$0.65*
Dozer Cost (USD/hr)	*$250.00*
Dozer Production Rate (lcy/hr)	*305*
Avg. % Swell (Cut 14)	*24.42%*
Avg. % Swell (Cut 15)	*27.47%*

Table 1. Input variables used in cost comparisons.

PROJECT GOALS

DETERMINING ECONOMIC IMPACT

The primary goal of this project was to reduce costs through effective blasting. To determine if increased drill and blast costs were offset by a consequential reduction in secondary material movement costs, DynoConsult analyzed the data collected. After a cast analysis showed a higher effective cast in the experimental cut compared to the control cut, the customer wanted verification that the reduced rehandle material would lead to lower bulldozer pushing costs.

TECHNOLOGY APPLIED

DATA COLLECTION AND SOURCING

The data for the comparison between the control cut and the experimental cut came from multiple sources. The unit costs and material volumes were provided by the customer. This data is collected and compiled monthly, and the customer evaluates and verifies the accuracy of their drill and blast data.

All cast performance data was collected by DynoConsult as part of DynoConsult's work with the customer. This data is collected with a drone and analyzed using CAD tools. The material volume and location before and after each blast forms the basis for short-term mine planning and cost tracking. The combination of cost data and cast performance data for the control and experimental cuts allows the appropriate comparisons to be made.

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CASE STUDY

VALUE ADDED

DATA ANALYSIS AND RESULTS

The five key components of this comparison are pattern data, explosives data, drill data, cast data, and dozer data. The primary change between the two cuts was the layout of the drill pattern. In the experimental cut, the number of rows was increased, and the burden and spacing were reduced. Part of that change was the introduction of a variable burden, where the burdens on the face were increased and burdens at the back of the shot were decreased.

The variable burden design is responsible for much of the increase in casting performance because it allows material in the front of the blast to move further into the effective cast zone. This accompanies an increase in powder factor between the two cuts. Cast performance data collected by DynoConsult demonstrates the improved casting results. The resulting cast increase reduced the amount of work for the bulldozers.

There is a difference in bank volume between the two cuts. The change in bank volume between the cuts necessitates all comparisons be normalized to bank cubic yards, resulting in the summary results being relayed with the units per bank cubic yard. The results summary can be seen in Table 2. Looking at the total and effective cast values between the cuts, there is a noticeable change. The increase in powder factor resulted in an effective cast increase from 17.43% to 24.97%. Over a year of production at this site, the effective casting increase will reduce rehandle material by 3,430,000 bank cubic yards (BCY). This increase in casting volume accounts for much the 19% decrease in bulldozer hours between the cuts.

The change in pattern design is projected to save the mine $500,500.00 annually on direct material movement costs, assuming all material not in the effective cast is moved by bulldozers. If any material is moved by truck and shovel, then the cost savings will increase. The other major benefit is the reduction in bulldozer hours. Having bulldozers available for additional work further reduces costs and improves overall efficiency of the mine.

Because of the overall cost savings, the customer implemented the experimental changes as part of their new standard drill and blast practices once the comparison was completed.

Key Comparisons		
	Cut 14	*Cut 15*
Rows (Avg.)	*5.45*	*6.32*
Burden (Avg. ft)	*24.01*	*21.33*
Spacing (Avg. ft)	*22.11*	*21.70*
Volume (Total BCY)	*939,361*	*816,898*
Total Bulk Explosive (Lbs)	*1,038,284*	*1,060,664*
Powder Factor (Lbs/BCY)	*1.1053*	*1.2984*
Total Cast %	*36.76%*	*43.37%*
Effective Cast %	*17.43%*	*24.97%*
Dozer Push Volume (LCY)	*965,069*	*781,296*
Total Dozer Hrs	*3.164.2*	*2,561.6*
Drill Costs (USD/BCY)	*$0.0345*	*$0.0387*
Blast Costs (USD/BCY)	*$0.2692*	*$0.3122*
Dozer Costs (USD/BCY)	*$0.8421*	*$0.7839*
Total Costs (USD/BCY)	*$1.1459*	*$1.1349*

Table 2. Comparison of data between the control and experimental cuts.

Results Summary	
Effective Cast Change	*+7.54%*
Dozer Hour Change	*-19.04%*
Cost Savings Per Unit (USD/BCY)	*$0.011*
Annual Direct Cost Reduction	*$500,500.00*

Table 3. Summary of end results.