The Situation

A project was initiated with Orica Mining Services to improve blasting practices and quantify the impact on the process plant. While significant improvements to blast fragmentation had previously been made, the actual benefit of those improvements to downstream processing had not been quantified and it was believed that there was scope for further improvement.

The primary goal of the trials was to further optimise the ore blast designs by implementing the results of fragmentation modelling work and to measure the impact of blast fragmentation on the total cost of mining and processing.

Mining Issues

The key mining issues Argyle Diamond Mines (ADM) faced were to:

- Fast-track the optimisation of blast designs, due to the then anticipated remaining mine life of only four years, and the continuously increasing pressure on mining costs.
- Identify the major drivers on blast fragmentation. The major driver was identified as pattern size. Reducing pattern size increased fragmentation and drill and blast costs by virtue of increased powder factors.

Technical Solutions

Orica Mining Services combined a number of its blast modelling and assessment tools with its technical expertise to further improve blasting practices in conjunction with Argyle Diamond Mines to quantify the impact on the process plant.

Modelling was used to predict fragmentation results as an efficient method of short listing a number of improvements for field blasting trials. In particular, Modelling was used to examine in detail the relationship of fragmentation to stemming length, subdrill and spacing to burden ratio. These parameters actually affect fragmentation without significantly affecting drill and blast cost.

Orica Mining Services Powersieve® photographic technique was then used to measure the fragmentation results from the modified blasting techniques.

The Result

The overall results and cost benefits of the trails were evaluated jointly with the Argyle team. The conclusions drawn were:

1. Modelling predictions and blast trials confirmed that finer fragmentation was achieved primarily by reducing pattern size and also by increasing spacing to burden ratios and reducing stemming length.
2. There was a strong correlation between finer run of mine fragmentation and improved process plant performance Benefits arose from:
   - increasing the amount of material bypassing the secondary and tertiary crusher (this was a significant saving, worth more than double the drill and blast cost per tonne);
   - reducing the liner wear and power draw at all points in the process such as crushers, screens and feeders;
   - boosting the availability and utilisation of the high pressure rolls crusher by providing feed that was both finer and more uniform. This was the highest single operating cost item in the Argyle process plant, hence its utilisation had to be maximised;
   - reducing operating costs of the load and haul cycle in the mine through improved productivity and lower wear rates on ground engaging tools.
3. No measurable increase in diamond breakage by reducing drill pattern sizes.

The main objective of measuring the effect of increased fragmentation from blasting on the rest of the downstream. The major benefit achieved is a
boost in plant throughput, which delivered not only a decrease in overall mining and processing cost but additional diamond sales revenue.

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