Development Optimisation Leads to Reduced Overbreak and Cycle Efficiencies

Project Summary

Dyno Nobel and Glencore Xstrata's George Fisher Mine successfully completed a series of development optimisation trials where the various elements of drill and blast were evaluated in order to establish standards to optimise the development cycle.

The elements optimised included perimeter charging, drill and charge designs utilising bulk emulsion and the use of precision timing in both perimeter only and full face development headings.

The trials were conducted in a controlled environment with each introduced element measured and validated against captured benchmark practices. Benefits of the optimisation trial included:

- A 12% saving in direct development costs;
- A 13% reduction in the development cycle time;
- Increased productivity to the development schedule;
- Improved standard in drilling practices.

Background

The George Fisher Mine is situated approximately 25km north of Mt Isa, it is an underground silver, lead and zinc operation wholly owned by Glencore Xstrata PLC producing in excess of 3Mtpa.

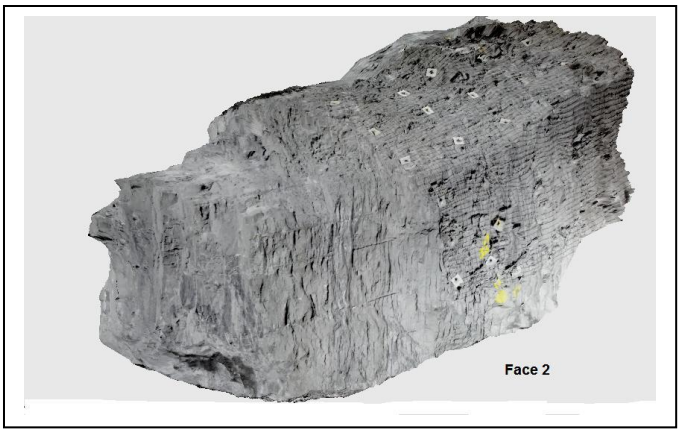
The mine is divided into two separate mining areas, being George Fisher North and George Fisher South. Both mining areas have dedicated development schedules with a North: South split of 66:34 for the scheduled development metres for 2013/14.

During the last decade, mine sustainability has been impacted by lower ore grades, increased costs in overheads and consumables, and capital requirements in an environment of global financial unrest and volatile metal prices.

To ensure competitiveness and sustainability in today's challenging environment, miners must look to decrease their development costs per meter through improved mining practices that will deliver benefits whilst ensuring zero harm to personnel.

Dyno Nobel understood market expectations and recognised that tangible benefits could be achieved through optimisation of the development cycle. As a result, a proposal was put forward for a development optimisation project.

Project Goals



The objectives of the project were to:

- Measure and establish a benchmark for current practice;
- Improve the profile integrity and smoothness of backs and walls (half barrel markings) through optimised charging and the use of precision initiation;
- Develop a standardised drill design with reduced drill holes;
- Improve blast fragmentation and muckpile positioning through the flexibility and consistency of precision timing;
- Reduce the costs and cycle times associated with the elements of development mining;
- Establish a standard of best practice.

The plan involved introducing changes to the key elements in a controlled manner (one change at a time) to evaluate performance and quantify the benefit of each change against the benchmark.

Validation of the changes to various elements in order to optimise development practices was achieved by direct measurement, comparisons against the baseline, digital & photogrammetry imaging, cost analysis and operator feedback.

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Groundbreaking Performance

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Technology Applied

Optimal charge designs were achieved in practice using the DynoMiner™ Profile to deliver TITAN® 7000i bulk emulsion utilising string loading capabilities (decoupled charge) for improved perimeter control as well as adjustable density to suit ground conditions. The use of bulk emulsion also eliminated traditional manual handling issues associated with the use of specialised perimeter products.

The application of Dyno Nobel's electronic detonators was a major enabler of the development optimisation process. The precision timing of the detonators has mitigated "delay scatter", while the combination of timing flexibility and accuracy has resulted in consistent and repeatable blasting outcomes.

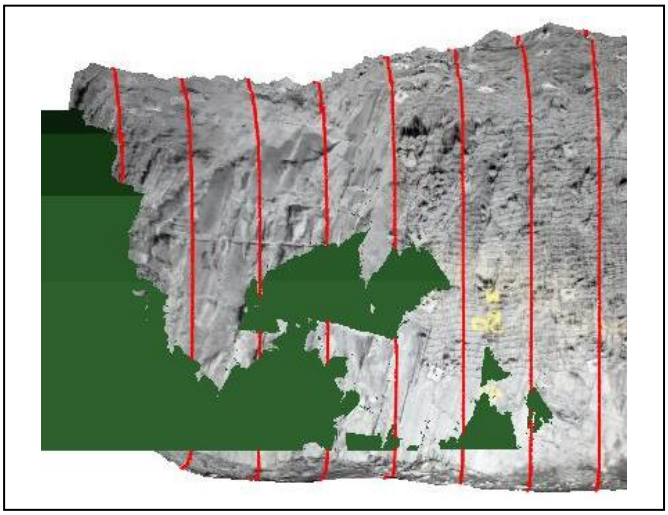
Remote initiation of development headings from the surface was achieved with a Blast Control Unit (BCU) which eliminates any potential risk to personnel during firing times and greatly improves firing reliability.

Photogrammetry analysis was used to capture 3D images from which volumes of post fired faces can be calculated to determine under/overbreak and confirm the benefits of the introduced optimised elements.

Value Added

Value added benefits realised from the optimisation project include:

- Safety improvements in the charging process through the use of bulk emulsion, eliminating manual handling issues associated with cartridged products;
- Improved quality and integrity of the perimeter profile as evidenced by the half barrels post blasting;
- Overbreak reduced from 25% to 5% due in part to firing all perimeter holes at the precisely the same time which creates a smooth profile and reduces radial crack damage outside the perimeter;
- A standardised drill design used by all jumbo operators across all profiles incorporating at least a 9% reduction in face holes. The timing flexibility of electronic detonators provided the ability to optimise blast hole interaction which allowed for the removal of drill design redundancy;
- Reduced explosive usage per face by 30%;
- Butts reduced from 400mm average to 50mm average;
- Qualitative feedback indicates reduced scaling and ground support cycle, together with improved fragmentation (average 150mm) with a reduction in the mucking cycle;
- A 12% saving in direct development costs;
- Decrease in cycle times of 13% resulting in an increase in development productivity.



The ability to remain sustainable in the face of adversity and reap the benefits of improved margins in favourable markets is dependent on reducing the cost per metre of development. To that end, establishing standards from optimising the various elements of drill and blast in development mining will assist to ensure best practice and optimal cost position.

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