

CASE STUDY

Optimising the Drill and Blast cycle with FRAGTrack™

Kevitsa, Boliden Group (Finland)

Site Profile

The Kevitsa deposit is one of the largest ever mineral discoveries in Finland. Owned and operated by Boliden Kevitsa Mining Oy, the mine employs 520 people and 300 contractors. Kevitsa mine's production is approximately 40 Mt per annum, including 8 Mt of ore containing nickel, copper, gold, platinum and palladium.

Kevitsa is committed to maximising operational efficiency and regularly run projects targeted at improving blast performance.



Figure 1 – Kevitsa site overview

The Situation

Boliden acquired the Kevitsa operation in year 2016 and identified fragmentation as the key performance indicator to assess several productivity improvement projects, including:

- SAG mill throughput improvements by optimising primary crusher settings
- increased explosive energy trials with Fortis™ Extra
- increasing powder factors
- pattern expansion trials in waste
- Electronic Blasting Systems (EBS) trials with i-kon™

Unlike dig rates or crusher throughput which may be influenced by external factors, fragmentation, particularly at the point of excavation, can only be influenced by blast design and geology.

To ensure conclusions drawn from the data were accurate, a large unbiased sample size was required. This eliminated the possibility of using manual sampling methods as they are time consuming and cause significant disruption to ongoing operations. Instead, an automated system that could withstand the harsh conditions associated with a mine situated 150km north of the arctic circle was required.

Technical Solutions

In response to Kevitsa's requirements, Orica proposed to implement FRAGTrack™.

FRAGTrack™ uses a combination of 2D and 3D image analysis with a unique algorithm to provide industry leading accuracy over traditional standalone systems, particularly in poor lighting conditions. Stereo vision cameras and 3D photogrammetric analysis improves definition of finer size fragments and its automated analysis does not require costly yearly calibrations.



Figure 2 – FRAGTrack™ F60 camera and F50 processor

Two shovel units (1x PC8000 and 1 x PC5500) and one conveyor mounted system were initially installed in 2016. The shovel systems measured post blast Particle Size Distribution (PSD) allowing engineers to assess the direct impact of blast design changes whilst the conveyor unit provided PSD's of material leaving the primary crusher and entering the SAG mill.

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In December 2019, the original Research and Development units were upgraded to the Next Generation FRAGTrack™ system with an additional unit also being mounted onto the Caterpillar CAT® 6060 shovel. Kevitsa chose not to replace the conveyor unit as they had already gained enough data points between 2016-2017 to optimise the mill throughput.

Smart trigger settings ensure only true samples are recorded and every image is processed and uploaded to the FRAGTrack™ website where they can be viewed and accessed, anywhere at anytime.

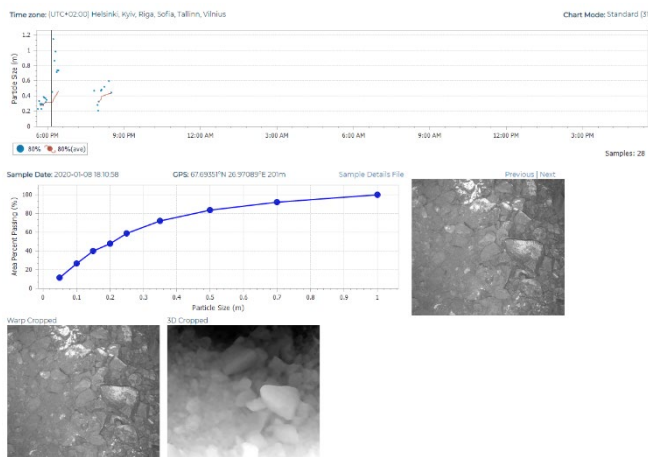


Figure 3 – Actual fragmentation results on the FRAGTrack™ website

The Result

FRAGTrack™ has been operational in Kevitsa for over 4 years and providing unbiased and extensive PSD data. Within the first 12 months of operation, the 2 shovel units have already collected over 30,000 images across 256 blasts.

Every image has a Global Positioning System (GPS) location assigned to it, which means samples can be associated to a specific geological domain. This allowed Kevitsa to quantify the effect that geology was having on blast performance. The data showed that areas of high amphibole content gave a 20% coarser fragmentation (P80) when compared to equivalent blasts with a lower content. As engineers made targeted

design modifications in these areas, FRAGTrack™ was able to measure how effective each change had been. For example:

changing to Fortis™ Extra gave a 12% finer P50. an increased powder factor from 1.16 to 2.0 kg/m³ improved the P80 by 10% and increased the proportion passing 200mm from 50.3% to 55.9%.

Kevitsa also looked to increase productivity by expanding drill patterns in waste material. FRAGTrack™ measurements were used to demonstrate that, by using Fortis™ Extra, an 11.5% pattern expansion was possible whilst maintaining the same PSD as before. The predicted net result is a 1.45M€ benefit over 4 years.

The FRAGTrack™ conveyor unit ran for over a year without interruption, collecting over 60,000 data points. This enabled closed sized setting adjustments to the primary crusher to ensure optimal PSD input to the SAG mill which maximised throughput.

During EBS trials, FRAGTrack™ provided an unbiased assessment of the effectiveness of i-kon™ detonators, identifying a 11.2% P80 and 13.4% P50 improvement in ore blasts but little difference when waste shots were analysed. This allowed Boliden to focus i-kon™ usage in the areas where it was shown to be most effective.

In 2019, FRAGTrack™ was launched globally with its re-engineered generation 3 hardware. Upgraded cameras with built-in gamma correction provide reduced variations of brightness and capture better image quality than before. The manufacturing process has also been updated to increase reliability and durability and added technical resources ensure support is always available should the need arise.

Kevitsa remains committed to continual improvement and FRAGTrack™ continues to be an essential tool in achieving this. Automated and unbiased fragmentation analysis allows optimisation of the drill and blast cycle by providing the data necessary to make informed design decisions based on measured results rather than opinion.

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Figure 4 – F60 camera unit mounted on a PC8000

Testimonial

Installation of fragmentation cameras and a good testing plan allowed us to compare different bulk emulsion explosives and to optimise our blast pattern sizes in a way to suit the fragmentation that was required in ore and waste.

Based on those results, we were able to start using purely Fortis™ Extra as our primary bulk explosive and we have been able to increase our pattern sizes in low-amphibole ore without having any negative effect to fragmentation. In the mid and high amphibole ore, instead of increasing pattern sizes, we have managed to use the increased energy of Fortis™ Extra to optimise rock fragmentation.

In an open-cut pit, the majority of rock mined is waste, so expanding the blast pattern in this region has decreased the cost of drilling in waste. Furthermore, optimised fragmentation sizes speed up the shovel loading cycle and decreases maintenance costs. This has a positive effect on the economy of the operation.

FRAGTrack™ cameras give us very valuable information when evaluating our own success. Overall, we are very satisfied in all possibilities that Orica has delivered for us to optimise our bulk explosives use and to measure post blast results.

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