Mining World

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Trusonic – a case study

Customer	Kennecott copper mine
Product	Trusonic
Rig	SR-121
Location	Bingham Canyon, Utah
Application	Sonic drilling

Overview

Waste rock dumps are often placed adjacent to mine pit areas, and as mining expands more room is needed for the waste rock. Certain physical and chemical characteristics of the waste rock dumps are often needed to better understand the geotechnical and geochemical behavior of the large dumps and to evaluate potential mineral value. Sonic drilling enables the collection of highly representative samples and excellent sample recovery. This method of drilling has been used for the re-exploration of dumps, tailings and heap leach pads.

Waste rock dumps consist of mainly unconsolidated material, and it's often difficult to know how deep they are or what types of material they contain, which can lead to challenges in drilling. However, Trusonic technology provides a solution by being able to produce 100% accurate in-situ core samples through varied ground conditions.

The challenge

Boart Longyear drilling service took on the challenge of drilling core samples from the unconsolidated waste rock dump at Kennecott Utah copper's Bingham Canyon mine. The intent of the drilling was to define the contents of the waste rock dump. The waste rock dump consisted of rock blast material ranging in size from 254 to 304.8 mm (10 to 12 in) in diameter and was made up mainly of porphyry deposits (granite-like rocks).

With a targeted depth of 213.36m (700 ft), the main goal was to provide a detailed continuous sample of the waste rock dump material and confirm bedrock depth. Boart Longyear also needed to install piezometers (water level monitors) and lysimeters (moisture content monitors). Geotechnical samples would also need to be taken every 6.096m (20 ft) to confirm stability and moisture content for the first 60.96m (200 ft).

The solution

Sonic drilling is the perfect method for drilling in unconsolidated material, such as the waste rock dump at the Bingham Canyon mine, because of its sample recovery rate, straight cased borehole and the flexibility to offer geotechnical sampling via the split spoon sampler. Boart Longyear chose its Trusonic system consisting of the SR-121 sonic rig.

As drilling commenced, Boart Longyear took on the task one step at a time by tackling the depths in stages. For the first 106.68m (350 ft), the company drilled a 228.6 mm (9 in) borehole while tripping the drill string every 6.096m (20 ft) to pull a split spoon geotechnical sample for the first 60.96m (200 ft).

For the second stage, the team drilled to 152.4m (500 ft) using a 203.2 mm (8 in) bit with casing. Moving deeper to 228.6m (750 ft), the drillers used a 177.8 mm (7 in) bit with casing for the third stage. Surpassing their targeted drill depth of 213.36m (700 ft), the drillers still had not reached the bedrock formation.

Needing to find the true depth of the waste rock dump, Boart Longyear felt that the Trusonic rig still had the capability and pullback to go deeper. Easing forward the team drilled to 264.261m (867 ft) using a 152.4 mm (6 in) bit with casing. The last stage couldn't be drilled with casing as it was necessary to move to a 101.6 mm (4 in) borehole. Leaving only the bit for the final push to 274.32m (900 ft) – and setting a new Boart Longyear record for sonic drilling – a 28% greater depth than initially targeted was reached.

It took 16 shifts of 12 hours (192 hours) to accomplish the new record depth for sonic drilling. Boart Longyear lost two of those shifts (24 hours) to rain. Another key accomplishment was the entire depth was reached through dry drilling and achieved 100% in-situ core samples at less than 1% hole deviation.

Safety was the number one concern every day. Lead driller Gabe Caredenas determined whether it was safe or not before drilling to a greater depth. He had the authority to stop anytime he felt hole conditions unsafe.

"With the perfect conditions, sonic technology and a well-trained crew, we were able to prove the strengths of sonic technology," said Ronald Cain, project manager for Boart Longyear. "We always knew we had the potential to go deeper with sonic drilling, and with constantly improving technology we'll continue to set new standards."

Kennecott copper mine

The Utah Copper Co was formed in 1903 and mass production started in 1906. The site eventually became the Kennecott copper mine, also known as the Bingham Canyon mine. Located southwest of Salt Lake City, Utah, it is one of the world's largest open-pit copper mines and is owned and operated by Rio Tinto. Noted as an engineering marvel of the world, the Bingham Canyon mine is more than 1.2 km (3/4 mile) deep and more than 4.42 km (2.75 miles) wide at the top. During the 100-plus years of operation, the Bingham Canyon mine has yielded more than 19M tons of copper metal, plus significant by-products gold, silver and molybdenum.

Boart Longyear

Boart Longyear is the world's largest mineral exploration drilling company. With over 120 years of expertise, the company provides both drilling services and

related drilling products for the global mineral exploration industry. It also has a substantial drilling and products presence in mine de-watering, environmental sampling, energy and oil sands exploration.

Boart Longyear is a global company headquartered in Salt Lake City, Utah, USA, and is listed on the Australian Securities Exchange in Sydney, Australia. Sales in 2011 were over $2.0 billion, and the company employs over 10,000 employees worldwide. Contract drilling services are conducted in over 40 countries, and exploration products are manufactured in seven global factories and sold to customers in over 100 countries.

Boart Longyear was a private company for over 85 years. In 1975, it was purchased by Anglo American which was headquartered in Johannesburg, South Africa. Then in 2005, Private equity purchased Boart Longyear from Anglo American and subsequently listed the company on the ASX in April of 2007.

Some people say… culture's link to optimisation and profit

by Kay Sever, CMC, CQIA, Sustainable Improvement Consultant and Coach

It's easy to write about equipment performance. Throughput, delays and productivity are linked directly to profits, and their links to cost becomes easy to make when we talk about reducing variable costs associated with production. The reader's expectations for these topics are clear and quantifiable: investment, time, throughput, capacity . . . how much, how long, etc. What if the topic involves culture? When hearts and mindsets are involved, it's a different story. Expectations of the reader are often fuzzy but the needs are great. Miners have many skills when it comes to increasing productivity, but culture is our greatest challenge. Linking culture to production, cost and profits can be a challenge. When we can't easily make that link, we may assume that the link has a minimal impact on performance.

I believe that we fail to recognise the financial contribution that culture makes to profit because the connecting point involves the hidden potential to improve (ie, what's left to get). By this I mean the excess costs that can be reduced but haven't been reduced, as well as existing capacity that could be used to produce more tons but remain hidden.

Hidden potential is a funny thing . . . hidden equipment capacity is not recorded anywhere on the general ledger. In fact, to quantify hidden capacity, we must go out of our way to calculate it. Excess costs are recorded on the ledger but are not categorised in a way that makes them easy to spot. As a result, these two categories of hidden potential are not an area of focus and are easily glossed over, even in process improvement work.

Some people say that all opportunities to reduce costs, increase production and optimise performance can be addressed via process changes at the mine/plant level using six sigma, lean, TQM, etc. There is no doubt that millions of dollars of improvements CAN be captured with process changes, but if process changes are all that's required, why isn't every mining operation that has implemented an improvement initiative already optimised? Because the barriers that prevent optimisation and the capture of improvement potential are still in place! Improvement potential can be hidden by what people believe about change, especially by management's beliefs about change – their role in change, what they accept as "normal", and their role in removing the barriers that hold them back. These beliefs are overlooked by traditional improvement initiatives.

Kay Sever

Management beliefs directly affect management behaviours (words and actions) within the team and with the workforce. These behaviours either build trust or tear it down. This dynamic is a key factor in success or failure with change because trust determines culture and culture connects to improvement potential! With trust, a "proactive" culture forms that is focused on potential (ie, what is possible to achieve). When a team is focused on potential, its members can talk about anything that stands in their way, including issues considered politically incorrect or "sacred cows."

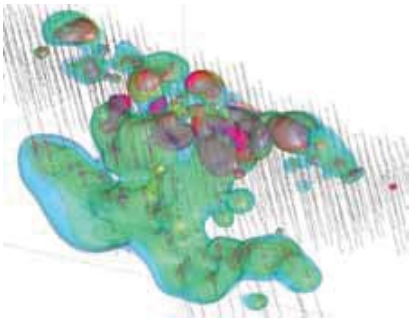
Without trust, a "reactive" culture forms that waits to be told what to do, does not believe that things could be different and does not think that management's beliefs or behaviours could be responsible for making change difficult, including communications, follow-through and taking responsibility. If your company is experiencing the problem described above, if your management team seems disjointed, if you have trouble reaching consensus, if managers say they want culture change but behave as if they don't, you would benefit from calling Kay Sever. She has 31 years of mining experience and a hands-on track record of removing the barriers to change. She will "connect your people to performance and profits" and help you "manage change like you manage operations". Kay works with every organisational level and department to find the highest dollar opportunities and remove barriers that prevent sustainable change. She helps management teams lead improvement and better execute the budget, capital approvals, incentive plans, communications, etc. Kay created The change revelation, a leading-edge management training "experience" that prepares management for success with change.

Implicit modelling

Coming soon from Mintec Inc, the software developer and service provider for the mining industry, is MineSight Implicit Modelling (MSIM) which could revolutionise the generation of geological surfaces and solids in a general mine planning system, the company claims.

Constructing grade and lithological wireframe models routinely consumes geologists' time and attention. Generating accurate grade and geological boundary models is essential, but the process often prevents the creation of multiple models, or slows down the update process as new data is added. Instead of manually wire framing drill hole data, MSIM uses mathematical algorithms to build complex shapes directly from drill holes, rapidly and accurately.

MSIM's ability to add user-defined control strings, points and structural measurements will enable the geologist to manage the model creation, and build more realistic interpretations of the geology. It will feature a simple user-interface, and future features will include a batch processing utility; direct-to-model output; and input data will include point clouds, existing surfaces and models.



Expanded Boart Longyear DTH range

Boart Longyear, provider of drilling services and complementary drilling products for the global mineral exploration industry, is expanding its down the hole (DTH) bit options by releasing 18 new product configurations that are compatible with over 26 third-party DTH hammers.

The DTH bit body incorporates premium hardened steel alloy for improved shank wear resistance and managed bit body wash. Multiple tungsten carbide button insert designs provide durability by allowing for multiple re-sharpening while delivering optimised penetration rates.

The new DTH bit shaft configurations offer a combination of different spline counts, diameters and lengths. Optional foot valves can be added when required. Multiple face designs, including flat, recessed and dome, can be changed to match the various ground conditions for improved productivity.

Powerscreen launches Warrior 1400X

Powerscreen, part of the Terex group, has launched the new Warrior 1400X screen, building on the foundation of its predecessor, the Warrior 1400 scalper.

The 1400X offers a reduction in fuel consumption of up to 15% in comparison to its predecessor. Other improvements include the screening angle range widening to 13°-19°. Standard stockpiling capacity on all conveyors has increased by up to 25%. With the chassis riser option and the telescopic side conveyor option, the fines and mid-grade stockpiling capacity is increased to more than double that of a standard Warrior 1400. Time required for set-up and shutdown is faster than the previous model.

The Warrior 1400X now has a two speed tracking system as standard. It can be fitted with either a tier 3/stage 3A Caterpillar C4.4 ATAAC 4 cylinder diesel engine developing 90 kW (120 hp) at 1800 rpm, or a tier 4i/stage 3B Caterpillar C4.4 4 cylinder diesel engine developing 82 kW (110 hp) at 1800 rpm.

Warrior 1400x

The CDC system for DTH drilling

Designed to enable fast, strong, accurate, simple, effective and time-saving drilling, the Sandvik CDC is a concentric tool system for drilling and casing holes simultaneously. The CDC system can be used to install casings in many different types of overburdens, and in all types of natural formations as the system drills straight holes and penetrates boulders easily. CDC may also be used to drill and case comparatively deep holes depending on the application, hole inclination and ground conditions.

The system consists of a pilot bit and a concentric ring, with these two components, together with a DTH hammer, the drill pipes and the casings, comprising the complete system. The CDC pilot bits are currently available with Sandvik M, DHD, QL and TD shank designs, but as many of these are now generic, the system can be used with numerous different makes of hammer. Likewise, as the CDC system does not rotate the casing during drilling, and is designed to install the casings permanently in the hole, there are no significant extra demands on a standard DTH rig's capacity with regards to pull-down, rotational torque, holdback or pullback. This means that a CDC tool system of a given ring bit diameter can be used on most drill rigs that are equipped to drill the same diameter of hole using a normal DTH drill string.

The CDC system may also be used with light weight drill rigs that are more suitable for use in more difficult terrain thanks to advanced bit design, precise concentricity and the use of the percussive drilling method. This enables penetration of even hard rock easily, and in comparison with other drilling methods CDC needs little feed force and low rotational torque. Additionally as all percussion takes place down the hole, the CDC minimises environmental impact, and due to little risk of harmful vibrations being transmitted into nearby structures, the CDC may be used in sensitive areas that contain underground structures which must not be disturbed.