

Recalibrating bit drilling culture

A case study in eastern Canada

Project challenge

An iron ore mining customer in eastern Canada was starting to see production decreases because it could not meet its targets for meters drilled in extremely hard rock areas of the pit. To optimize the drill program, this customer was looking for drill production gains of at least 15%. The customer asked for help reviewing operational practices for the 320XPC and 120A drills they were using at this site. They also wanted to evaluate bit consumption with the goal of lowering costs without sacrificing drill penetration performance. Even a small percentage cost reduction on consumables while maintaining production levels would be a huge benefit to this mine.

“We have had dramatic results in the past month, drilling-wise. We can say that Komatsu’s presentation and training served as a hard reset of the drilling culture here. Our positive approach worked wonders and the operators really got with the program. The bit supplier cannot believe the sudden turnaround. The operators immediately implemented the new techniques and now understand what’s really going on with the bit.”

Solution design

The customer asked Komatsu to partner on solutions aimed at improving drill productivity and production, specifically:

- Identify improvements in overall mine site operational practices
- Identify best practices for drill fleet operations, including the P&H blasthole drills, through an evaluation of current practices
- Improve training and coaching for drilling operations

A study was conducted at the mine site over the course of two weeks, with follow-up visits to report on findings and conduct trainings. Mine site staff partnered with Komatsu staff in daily observations of the drill program and a site audit for the P&H blast hole drills. The team identified existing best practices to reinforce as well as areas that could be improved. Other steps taken during the study:

- Bit testing to establish standards (we ensured that variables were consistent during testing and evaluated failure modes)
- Evaluating bit break-in procedures, pulldown and rpm control, and hole finishing practices
- Evaluating shift change processes

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The solution

Komatsu staff helped define areas of operational improvements and adjustments to machine operations. Supporting data demonstrated the potential for significant production gains with an emphasis on improving drill parameters, using best practices when operating machines and improving the care and management of drill consumables. Recommendations were as follows, each with the potential to improve productivity, increase efficiency, or both.

Optimized machine settings

- Optimize the use of rpm and pulldown force controls to help reduce bouncing and shaking, thereby minimizing damage and increasing available time for the machine
- Fine reduction adjustments for rpm could also help reduce shaking and keep the bit rotating
- Drilling technique in hard ground should have higher pulldown with lower rpms to avoid regrinding while utilizing the proper bit

Drill consumables management

- Improve bit evaluation and breaking-in techniques to maximize bit life, and work with bit provider to adjust settings that can maximize production
- Drive the message through training that drillers must drill to the conditions of the ground they are in, based on geological changes
- Leverage the site's outstanding capabilities for tracking specific drill information and use the analytics of this data to evaluate drill fleet status and other areas for improvement

Best practices and training

- Improve leveling techniques and standards, with the potential to improve blasthole quality and reduce machine damages
- Promote efficient collaring techniques with the goal of reducing machine damage
- Refine hole finishing techniques, using proper air shutoff and reduction of drill rates to avoid knocking material into the hole
- Improve delays and shift change procedures to reduce overall downtime related to mine operational delays and in return achieve a higher operational time
- Standardize training to create a more uniform level of drilling knowledge and expertise among different crews and promote best drilling practices
- For improved availability of machines, reinforce through training the important balance between machine availability and sustaining high productivity with proper drilling practices
- Institute documentation of formal standard operating practices, training programs and operator evaluations, all aimed at developing world-class drill operators

The results

The customer goal was to achieve a minimum 15% increase in blasthole drill performance (meters drilled per hour). Komatsu staff showed potential productivity increases of 23% to 41% above the customer's existing penetration rates by implementing its recommendations from the field audit. **The customer has implemented the majority of those recommendations and has seen as much as 126% penetration rate gains in some areas** — almost 2.5 times faster than before Komatsu's study.

Pulldown and rpm practices

The customer started by having operators implement reduced rpm controls at specific pulldown capabilities and rock drilling conditions, and found that they reduced average rpms by 17.2%, which reduced the observed over-spinning of the bit in hard rock drilling conditions. As Komatsu's drill instructor observed, "Drillers have noticed how much the drilling has stabilized. They're also trying to stabilize drilling by slowly reducing rpms when they hit rough patches."

Reducing rpms in the collaring and drilling phase increased the effective cutting force of the rotary bit to increase performance and reduce detrimental vibration on the drill. This also reduces bit damage and failure, prevents premature wear, and prevents drill string damage, among other benefits.

Continuous measurement and improvement

The customer is continuing to monitor and establish the optimal drill setting in the hardest drilling conditions while optimizing bit life. These observations are also driving the customer to evaluate the selected bit classifications and bit OEM providers to reduce bit costs and sustain production levels.

Training and evaluation practices

The customer has scheduled Komatsu to conduct in-depth driller evaluations and trainings to ensure proper drilling practices and sustain the higher production levels they achieved. Komatsu can offer drill training for all drill types on site, allowing for a single source to evaluate overall effectiveness of operators while assisting to establish best practices for continuous drill training. The best practice recommendations will be incorporated into the customer's training program.

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