Mining & Construction

A magazine from Epiroc

miningandconstruction.com

The Safety Issue
01–2019

INSIDE

[Sustainability]

It's electric

Battery loader creates a better work environment for operators at Atacocha mine in Peru – and improves productivity. Pages 46–47

“Productivity and safety hand in hand”

DEAR CUSTOMERS, we work in a demanding industry – sometimes in dangerous conditions. It is natural that all of us have safety as a key priority.

Epiroc will always prioritize safety. One example is our automation solutions, such as remote-controlled drill rigs. They enable people to work away from dangerous areas – a win-win for customers as it boosts both safety and productivity.

WE RECENTLY LAUNCHED our second generation battery-electric underground vehicles, consisting of heavier trucks, loaders and rock reinforcement rigs. Customers are showing strong interest, and no wonder since switching from diesel to battery power means less noise, heat and exhaust fumes – a much healthier work environment. In addition, the operational costs for underground work drop when going electric since less money is spent on ventilation while still improving productivity.

In April, we completed the acquisition of New Concept Mining, a manufacturer of underground rock reinforcement products. This also relates to safety. Every year, the average mine is getting deeper as commodities are extracted, increasing the need for secure bolting methods. New Concept Mining brings expertise in rock bolting methods, especially for deep-level operations in areas with higher risk of seismic activity.

MORE CUSTOMERS ARE discovering the endless advantages of new technology. For instance, they are increasingly using Mobilaris’ (of which we are part owner) solutions for real-time positioning of machines and personnel. The technology boosts safety and makes operations more efficient.

IN THIS ISSUE you can read in-depth about safety in our industry, and much more.

Happy reading and stay safe!

On my radar

Productivity partner
We work closely with customers to jointly develop the best solutions for specific needs.

Agility in product development
We are shortening our time from concept to ready product.

Workforce of the future
Our industry will need top talents in such areas as automation and artificial intelligence to meet the challenges. How do we, as an industry, ensure that we attract the workforce of the future?

Enjoy!

Helena Hedblom
Senior Executive Vice President,
Mining and Infrastructure

Epiroc Group – get to know us better

With a heritage that dates back to 1873, Epiroc was formed out of Atlas Copco’s mining and construction business, and builds on proven expertise, quality and performance.

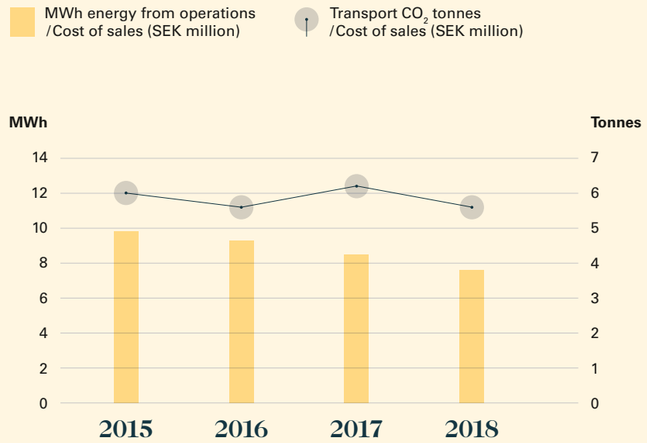
Our innovations

Our solutions aim to solve our customers’ key issues – including requirements to reduce operating costs, increase productivity, increase utilization of equipment, reduce environmental impact, and enhance health and safety conditions.

Industries we serve

- **Mining and quarrying**
  Underground mining, surface mining, exploration, quarrying, well drilling, oil and gas.
- **Infrastructure**
  Underground civil engineering, surface civil engineering and urban development, deconstruction and recycling.

Energy and CO_2 2015–2018



Epiroc

About Epiroc

Epiroc is a leading productivity partner for the mining and infrastructure industries. With cutting-edge technology, Epiroc develops and produces innovative drill rigs, rock excavation and construction equipment, and provides world-class service and consumables. The company was founded in Stockholm, Sweden, and has passionate people supporting and collaborating with customers in more than 150 countries.

The Group in numbers

14 000

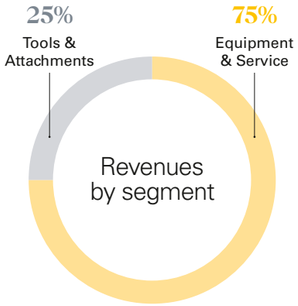
- **More than 14 000 employees**
- **Customers in more than 150 countries**
- **145 years of experience**
- **Revenues 2018: SEK 38 billion**

Divisions and reporting segments
Equipment & Service / Tools & Attachments

Rock Drilling Tools
Dedicated to rock drilling tools worldwide

Hydraulic Attachment Tools
Dedicated to hydraulic attachment tools for carriers

Rocktec
Dedicated to technology solutions, and drives the automation and interoperability expansions for Epiroc’s divisions



Drilling Solutions
Dedicated to a wide range of rotary drilling equipment

Mining and Rock Excavation Service
Dedicated to parts and services aimed at maximizing customers’ productivity

Surface and Exploration Drilling
Dedicated to rock and exploration drilling equipment

Underground Rock Excavation
Dedicated to a wide range of tunneling and mining equipment

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[FEATURE]

Safety

Safety at work has grown in importance over the years and a holistic approach is a must if you want to reach the desired level. Safety culture and systematic work are touted as being vital ingredients in order to avoid weak links.

26–41

SHUTTERSTOCK

ON THE COVER
Smoke from diesel engines sometimes prevents Yordan Rojas and his fellow operators at the Atacocha mine in Peru from working. With Nexa Resources introducing Epiroc's Scooptram ST7 Battery loader, that might soon be a thing of the past.

The 34th edition of **Perumin**, the second biggest mining convention in the Americas, will take place on September 16–20 in **Arequipa**, **Peru**. Besides being a trade show, it is also a conference with lots of satellite networking events. Perumin is organized every other year, and more than 65 000 attendees are expected.

perumin.com/perumin34

JUAN CARLOS RECABAL

KUNAL RATHOD

BRADLEY KANARIS

GANZORIG MIIMAA

Selected highlights

Mining & Construction is published by Epiroc. The magazine focuses on the company's know-how, products and methods used for mining and construction worldwide.

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Safety first

Epiroc is committed to complying with or exceeding all global and local rules and regulations on personal safety. However, some photographs in this magazine may show circumstances that are beyond our control. All users of Epiroc equipment are urged to think of safety first and always use proper ear, eye, head and other protection as required to minimize the risk of personal injury.

Product news and innovation stories
(choose country and click Media): **epiroc.com**

Epiroc corporate press releases
(click Media): **epirocgroup.com**

Welcome to Epiroc, Fordia!

Epiroc had a fantastic start to 2019 with the acquisition of Fordia, a well-known Canadian manufacturer of exploration drilling tools. This serves to strengthen Epiroc's offering and position in the exploration segment. **Arunkumar Govindarajan**, President Rock Drilling Tools at Epiroc, looks forward to continue providing customers with high-quality drilling tools.

"This acquisition is a perfect fit for our strategy going forward with the exploration consumables product lines. Fordia's brand equity and great reputation on the market leverages our innovation power and existing product range, providing the customer with an optimal solution adapted to suit their needs and challenges," says Arunkumar Govindarajan.

MYRIAM FRENETTE

FORDIA HAS ACHIEVED fantastic success in the diamond drilling industry since the company was founded in Montreal, Canada in 1977. Founder **Clement Paquet** and his assistant first ran the entire company by themselves, establishing the manufacturing and quality control processes that have become the hallmark for the brand. Today, Fordia has around 240 employees, sales in more than 70 countries, and factories in Canada and China. The company's sophisticated technology with production precision of a controlled-atmosphere furnace has been crucial to this success. Epiroc intends to continue building the Fordia brand, but instead of competing, the companies will join forces to provide customers with the best possible products and services in the exploration market.

"Both Fordia and Epiroc customers gain a new dimension of business as our two companies come together, getting the full offering from both sides. Fordia's agility and customer focus are now backed up by some serious muscle power, and the future is bright as sparkling diamonds," says Arunkumar Govindarajan.

Fordia also considers the acquisition a great success. **Denis Landry**, General Manager at Fordia and VP of Exploration, Rock Drilling Tools at Epiroc, elaborates: "Fordia and Epiroc coming together puts us in a position to become global leaders in the industry, and we will see more innovation within diamond drilling in the future."

Fordia in numbers

- Year founded: 1977
- Number of employees: 240
- Global presence: Sales in more than 70 countries
- Annual turnover: CAD 82 million

Epiroc and Ericsson cooperate on mining wireless technology

EPIROC AND LEADING communications technology provider Ericsson have entered into a cooperation agreement to provide mining customers with high-performing LTE (Long-Term Evolution) and 5G technology solutions. High-performance wireless connectivity has become vital for mining companies seeking to digitalize and automate their operations to increase productivity, enhance operator safety and lower cost. This includes, for example, remotely operating machines from a control room.

Epiroc supports Kimberley Ekapa Mining on its digitalization journey

KIMBERLEY EKAPA MINING will use Mobilaris Mining Intelligence (MMI) from Epiroc when modernizing its diamond mine in South Africa, embracing mine digitalization to enhance safety and increase productivity. With the use of MMI, Kimberley Ekapa Mining will, among other things, be able to track assets in realtime, and integrate and visualize machine data, machine location and the shift plan.

More bit.do/mmifacts

Boomer key element in quartzite quarry

VALS QUARTZITE OF the highest quality is the trademark product of Truffer AG. The natural stone is extracted in the company's own quarry and then processed in a factory in Vals, Switzerland. Since 2017, Truffer AG employs a **Boomer E1-DH** in the quarry. It's exotic in the quarry business, and the machine – equipped with the high performance **BUT45 boom** – is able to drill holes up to five meters in length.

FIGURE

5 600 meters

PowerROC T25 DC vital at high altitude

THE WORLD'S HIGHEST observatory is being constructed on the summit of Mount Chajnantor in Chile, more than 5 600 meters above sea level. To eliminate the huge boulders that sometimes block the path, earthmoving specialist Movitec is using a PowerROC T25 DC drill rig when building the road to the observatory.

Read more in next issue of Mining & Construction.

PROJECT NEWS

Diamec Smart 6 premiers in Turkey

Epiroc's Diamec Smart 6 drill rig is now being used for the first time in Turkey at the Tüprag Efemçukuru Gold Mine. Exploring specialist Tüprag Metal Madencilik has used Diamec PHC 6 rigs before, but this is a first for Smart technology. "The rig's features help us achieve safer, more efficient and low-cost production," says Geology Department Manager Mustafa Özkayhan.

RIG CONTROL SYSTEM

The Diamec Smart 6 is equipped with an advanced Rig Control System that enables automatic drilling from a safe distance. Drilling parameters are easily set and monitored.

More www.epiroc.com/diamecsmart6

Fordia, a manufacturer of exploration drilling consumables based in Montreal, is now a part of Epiroc.

How will customers benefit?

Mariepier Pelletier
Mechanical Design Engineer, Fordia
Montreal, Canada

"The customers will get the best of both worlds. On one hand you have Fordia's great drill bit development team, and on the other Epiroc's large product portfolio and infrastructure. For Fordia's sales team, the acquisition means that they can reach new customers and offer them a wider product selection."

Dave Lewis
Regional Manager, Fordia
Sudbury, Canada

"I'm really excited about the fusion. Fordia customers will have access to a wider product line and our market presence will increase significantly. For Epiroc, the strength will be our experienced and dedicated technical and customer service team focused 100 percent on exploration consumables."

Charles Boisvert
Marketing Project Manager, Fordia
Montreal, Canada

"Fordia and Epiroc are two very strong brands in the industry, and both take pride in their identity and the quality of our products. This means a renewed focus on the culture of innovation, quality control, and customer service that we are already known for, and that's where the client wins."

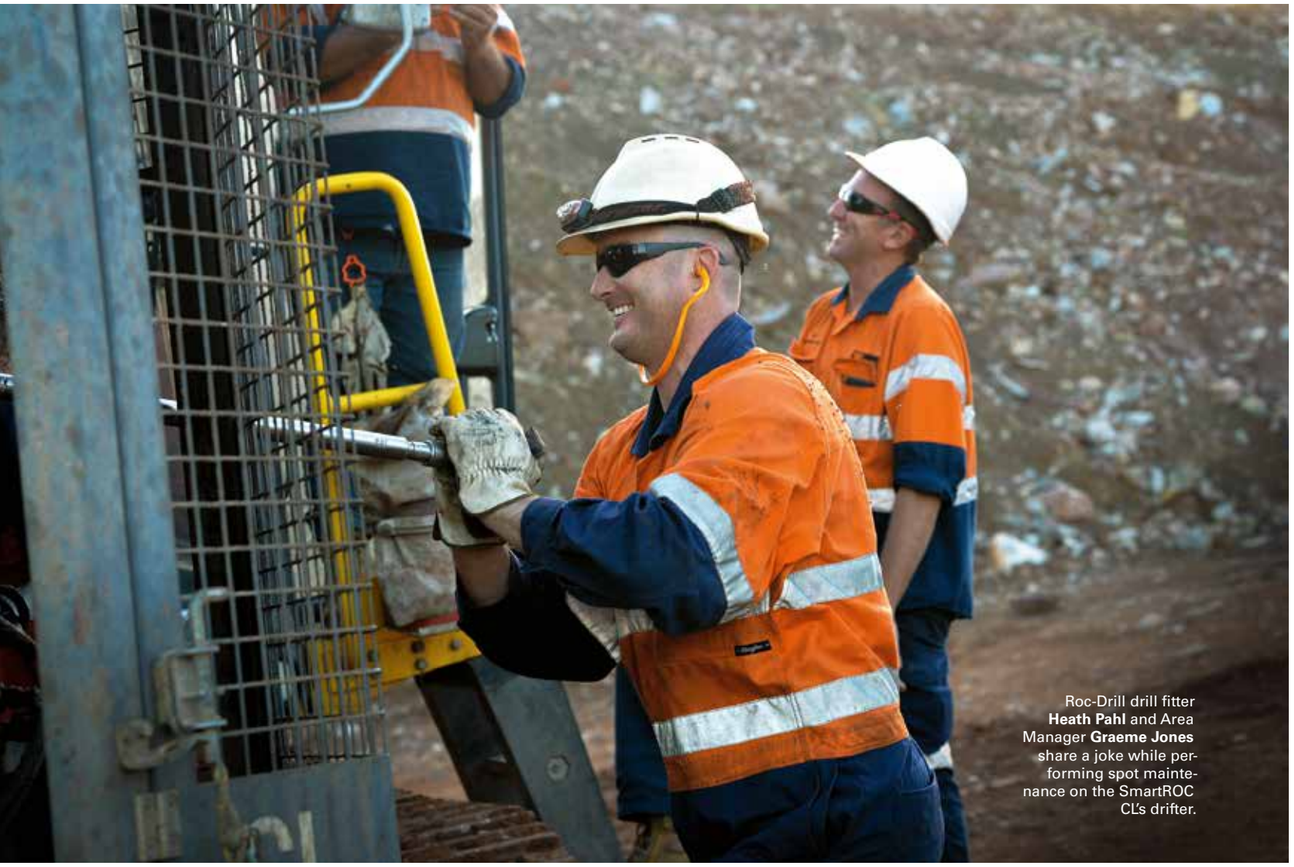
Matt Shea Bradley Kanaris

Turning up the heat

ROC-DRILL JOINS THE QUEST FOR COPPER WITH THE HELP OF COPROD TECHNOLOGY

[On Location]
Australia

At a mine in the north of Australia, Roc-Drill is joining the quest for copper with a pair of Epiroc SmartROC CL rigs. But here, hours from the nearest town and in a place where temperatures can inch towards 50 degrees Celsius, man and machine are pushed to their absolute limits.



Roc-Drill drill fitter **Heath Pahl** and Area Manager **Graeme Jones** share a joke while performing spot maintenance on the SmartROC CL's drifter.

"THE FIRST THING you notice is the dust. It's red – bright red – and it gets into everything.

"It's a nightmare," says Roc-Drill Area Manager **Graeme Jones**. "And then it rains and it's the mud."

This is Crusader, an open pit copper mine in Northwest Queensland. We're a two-hour drive from Cloncurry, the nearest town; 20 hours from Brisbane, the state capital. It's the Australian desert, jagged Martian peaks dotted with knee-high ant hills and desiccated trees – yet it still rains.

A FEW WEEKS AGO a years-long drought broke here, creating a vast inland sea. Crusader and its base camp at Mount Cuthbert, 25 kilometers (over 15 miles) away, were cut off for days, workers eventually needing to be helicoptered out.

"When you hear Julius Dam has spilled you have eight hours to leave," Jones says, idling his Landcruiser on the Leichhardt River as a bask of freshwater crocodiles crosses a weir in front of him. "Otherwise, you're stuck."

This is the wet season in Australia's north and storms can appear out of nowhere. We experience it firsthand when a dark bank of clouds causes an early end of shift, Jones whisking us away from the pit in a line of LVs, orange lights flashing. A black curtain of rain and wind and dust rushes in the other direction, stabs of lightning and electrical activity enforcing an exclusion zone around a loaded shot.

Graeme Jones
Area Manager, Roc-Drill

Nigel Deveth
Managing Director, Roc-Drill

Jones grins. This is mining in the extremes.

"If you want to test something, bring it to Australia," says **Nigel Deveth**, Managing Director of Roc-Drill, a Brisbane-based drilling contractor.

Roc-Drill was established in 2012 as an offshoot of Deveth's existing company, Deveth Drilling Qld. Deveth's own history with drilling dates back 32 years via companies such as Geothermal Industries, Deveth Drilling and the formerly family-owned Straitline Australia. For much of that time he has specialized in running Epiroc equipment.

Drilling into soft earth can be slow going. But once they hit hard rock, the SmartROC CL drill rigs will come into their own.

ROC-DRILL CURRENTLY boasts one of the largest fleets of Epiroc crawler drills in Australia. It's no surprise, then, that Deveth was the first in the country to take on a pair of new SmartROC CL drill rigs. Roc-Drill wanted to put the COPROD-equipped rigs to work in some of the more difficult ground jobs it tackles across Australia and Papua New Guinea. With the COPROD system, developed by Epiroc, the high penetration rate and low fuel consumption of tophammer equipment is married with the hole straightness and hole quality of a down-the-hole drill.

"They have the potential to change how we drill into difficult rock," says Deveth. "It gives you increased penetration rate because you don't lose percussive energy through the drill string because there are no joints. There's better hole accuracy on a low pressure air system, and you've got no excessive wear through the increased velocity that you run a down-the-hole drill with. And there's a much lower fuel burn."

Not that Roc-Drill didn't have to work to get the rigs operating effectively in Australian conditions. Deveth's team spent months going back and forth with Epiroc to break in the SmartROC CLs at a mine near Cloncurry, adjusting hammer, feed and rotation pressures to better handle the mix of soft and hard terrain typical of Australian mines.

CRUSADER IS THROWING UP similar challenges for Roc-Drill.

This mine has existed in one form or another for over a century. Ancient rail infrastructure lies abandoned, blackened by the sun. Back then it was gouging and underground operations. In 2019, mine owner Malaco Leichhardt is involved in something much more complex, extracting copper sulfide ore from an area rich in dolomite, quartzite, talc and magnetite.

Working on a cutback in the mining pit, Roc-Drill's two SmartROC CL rigs sit above the flooded pit void, drilling into one of Crusader's old waste dumps. The earth is soft and progress slow, with sodden clay regularly clogging up the drill bits.

Operator **Glen Hoyle** takes care to collar his holes, expertly mixing the gray earth like a cake batter. It's time consuming and chews through water, but it's worth it.

"It will be a couple of days before the bomb crew get here," Hoyle says as he locks the CL into auto and lets it go to work. "The last thing you want is all that earth falling back down your hole. They'll mark it up as a redrill."

In some ways, Hoyle is simply biding his time. One of Roc-Drill's 12-strong fleet of trusty SmartROC D65s would be just as capable on this soft terrain. But peer into the pit and you see what the SmartROC CLs are here for – the harder bedrock with its rich deposits of copper.

Glen Hoyle
Operator, Roc-Drill

Roc-Drill

Established in 2012 as a blast hole drilling contractor, drawing on Nigel Deveth's 32 years in the mining industry, Roc-Drill has expanded to work across mining, quarrying and civil operations.

Roc-Drill now operates in mines in South Australia, Queensland and Papua New Guinea.

Notable customers: Hillgrove Resources, BIM Gold, Chinova Resources, Minjar Gold, OkTedi Mining Ltd and Malaco Leichhardt.

“Once we get to that harder rock, we’re going to get consistent pen rates. They’re really good machines”

Mark Killip
Mining Engineer, Malaco Leichhardt

“IN GOOD HARD ROCK, this and a D65 together? It would flog it to pieces,” Hoyle says. “Hard rock is where these go really well.”

Mark Killip
Mining Engineer,
Malaco Leichhardt

Still, the penetration rates for this kind of earth are already high, and the SmartROC CLs are paying off in other ways. With a wider rod, the rigs can carry a smaller compressor to clear their holes, meaning a smaller engine and some eye-popping savings on fuel – “maybe half of what the 65s use,” Graeme Jones says. At Crusader, where temperatures can climb towards a whopping 50 degrees Celsius (122 degrees Fahrenheit) deep in the pit, it has other benefits. “With a smaller compressor, your engine isn’t working as hard,” Hoyle adds. “That’s keeping pressure off the engine. Here, you need all the help you can get. It’s as hot as hell.”

OTHERWISE, THE SmartROC CL rigs drill straight and true, something not lost on **Mark Killip**, Mining Engineer for Malaco Leichhardt. Killip was already impressed by Roc-Drill’s ability to mobilize to site so quickly, and speaks effusively about the new rigs.

“Those COPROD drills are fantastic,” he says. “For being able to get really good, consistent drilling on a range of grounds, they’re great. They have GPS, which takes away the hazard of putting people in the field. If there’s a slight change in ground conditions and it moves a couple of hundred millimeters, the GPS automatically accounts for that. Once we get to that harder rock, we’re going to get really consistent pen rates. They’re really good machines.”

Then again, with Roc-Drill breaking them in you’d perhaps expect nothing less. “We don’t mind being pioneers,” Deveth says. “These machines might not reach their full potential if introduced by another company. We don’t allow that to happen.”

“We’ve got a great reputation,” he continues. “There’s not one job where we haven’t been under budget for the client. We strive to continually cut costs for our business and these can be passed on to our clients. That’s what sets us apart. That’s why we have CL drills.”

Epiroc and Roc-Drill

Roc-Drill’s relationship with Epiroc spans 25 years. Roc-Drill has one of the largest fleets of Epiroc crawler drills, including the two SmartROC CL rigs, along with various other tophammer, DTH and rotary drills. The large fleet allows parts to be readily shared between rigs and jobs, ensuring high equipment availability.

A smaller compressor takes pressure off the SmartROC CL’s engine, allowing it to better cope with temperatures that can inch towards 50 degrees Celsius at the bottom of Crusader mine’s pit.

Crusader Mine

- In the early 1900s, Crusader was an open cut and underground mine with a rail line to Mt Cuthbert, 25 kilometers (over 15 miles) away
- Crusader was most recently mined for oxide deposits over 20 years ago
- Malaco Leichhardt reopened the mine in early 2019, focusing on copper sulfide ore mining

FIVE KEYS TO SUCCESS

1 Technical support	2 Interchangeable parts	3 Operator focus	4 Innovative solutions	5 Consumables supply
A member of Epiroc’s Northwest Queensland team spent two weeks on site at Crusader Mine, helping the Roc-Drill crews fine-tune their rigs to work in softer earth and even uploading a specially developed “clay” setting into the SmartROC CL rigs control software.	*The use of numerous standard parts across multiple models makes it more attractive for companies like Roc-Drill to run Epiroc fleets. Components such as Rig Control System cables and modules are easily swappable from one rig to the next.*	*The air conditioned cab of a SmartROC CL is an easy place to work. Controls are familiar from other rigs, making training a cinch. Plenty of automation enables operators to multitask more efficiently while cutting down on the need to step outside.*	*Newly improved COPROD drilling technology combines the high penetration rate of tophammer equipment with the hole straightness of down-the-hole drills. Lower air pressure requirements mean less stress on engines and big savings on fuel and oil.*	*The COPROD drilling technology requires specialized consumables. It is vital for Epiroc’s service teams to keep plenty of stock on hand and deliver to Roc-Drill on time, every time, in order to keep the SmartROC CL drills running smoothly.*

[On Location]
London

Fitting building project infrastructure – in this case, ventilation fans – into the middle of one of the world's busiest city districts is no simple task.

Serpent Ventilation

The ventilation solution for the Bank station project used a series of Epiroc's four 2-stage AVH100 fans with an inner diameter of 1000 mm, each with two 55 kW motors. Four separate duct lines with a diameter of 800 mm were attached.

Christian Tarras Ericsson Nick Guttridge

Banking on fresh air

With the help of Epiroc, construction company Dragados could implement a tunneling ventilation system for the Bank station reconstruction within the confines of the bustling City of London.

Central London is one of the busiest metropolitan areas in the world, and the Bank & Monument station complex one of its most hectic hubs. The Bank and Monument stations are located 360 meters apart in the City of London district, surrounded by narrow, heavily trafficked streets and an abundance of weekday-occupied offices. During rush hour, more than half a million commuters pass through the stations, with a large number of them making use of the tunnel system connecting the two.

Construction company Dragados was awarded the contract for building new tunnels as part of a large reconstruction project, enabling the station complex to handle 40 percent more passengers. All this combined to pose a considerable challenge for Dragados and Construction Manager **John Comins**.

What have been the major challenges?

"First of all, working inside the city. Getting materials in through congested traffic and removing water and electricity services in the streets meant that it took us a year to get down to where we could actually start work on the new tunnel. We also had to find a solution for ventilating the tunnel – we couldn't do much down there without it."

In what way did ventilation pose a problem?

"We needed an exhaust system to extract dust and heat away from our people, but there were no sufficiently large areas on the surface for the fan and ducting in a traditional single-fan system. We were also limited by the space within the tunnel as there are some bottlenecks to contend with. A single-fan system wouldn't suffice in the long run."

John Comins
Construction Manager, Dragados

How did you solve it?

"Epiroc suggested a multistage four-fan system that we could activate step by step as we got further in to progressively improve the ventilation as needed. The smaller fans are relatively compact, so we could fit them into the only area available: a steel gantry we built over King William Street."

Has that solution been satisfactory?

"The efficiency of the fans is brilliant. They've been running continuously since the beginning of 2017, but have needed no spare parts and no maintenance beyond the basics. In short, ventilation has been the least of our problems. But our environmental team has been very conscious about the sound levels – I suppose we're not helping the city noise much. And the cost of running all four fans at full capacity has been quite high. But we've throttled them back to 70 percent efficiency and that has helped greatly with both issues."

Hello!

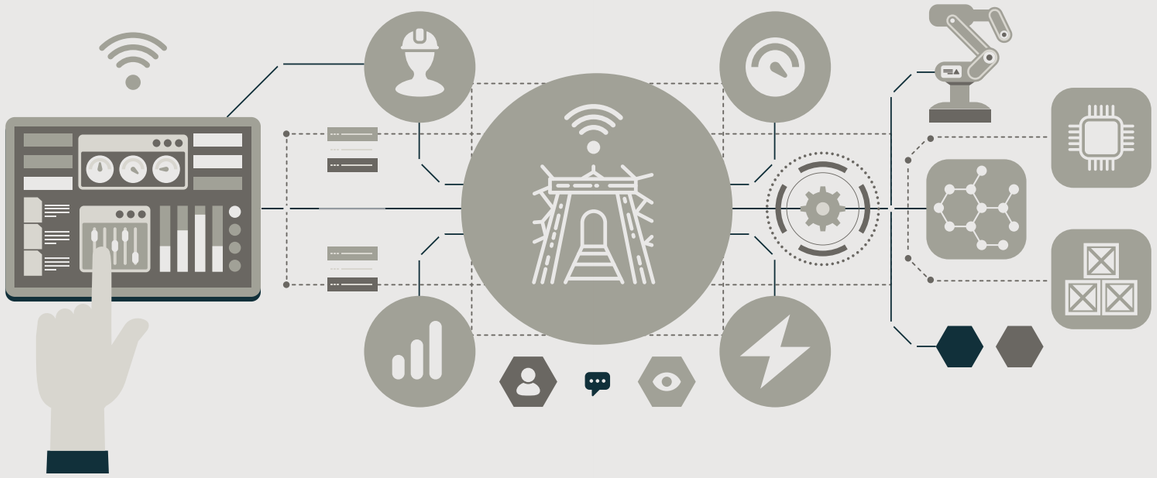
Tomas Otterberg
Global Product Line Manager, Infrastructure, Epiroc

"Due to the compact design and four parallel multistage fans, sound levels will be higher in comparison with a single big fan. To minimize the sound, we added extra intake silencer plates, which greatly reduced the sound going straight out from the fans and also helped reduce rebound effects from surrounding buildings. This system does have a higher cost at full fan speed, but is equipped with variable-frequency drives to adjust the speed – which is exactly what was used in the Bank station project. This can be improved further by using our solution for ventilation on demand, Serpent Automatic."

More www.epiroc.com/ventilationfacts

Tom Azzopardi Juan Carlos Recabal Shutterstock

HERNAN RODRÍGUEZ
Mine Manager of Anglo American's El Soldado mine in central Chile.



Drilling in safety

REMOTE-CONTROLLED DRILL RIGS GET WORKERS OUT OF THE DANGER ZONE

When Anglo American was looking how to carry out drilling at its El Soldado mine in Chile without exposing workers to rockfalls and other risks, it found the solution in Epiroc's BenchREMOTE, a remote operator station for surface drilling operations.

[On Location]
Chile

Anglo American had for some time been looking at how to introduce remote-controlled equipment to its El Soldado mine in order to reduce the exposure of personnel to risks such as rockfalls and challenging weather conditions.

Epiroc's BenchREMOTE system for operating surface drill rigs remotely proved an ideal fit for the vital job of presplit drilling which must be carried out in the riskiest parts of the mine.

Mining & Construction sat down with Anglo American's **Hernán Rodríguez** and Epiroc's **Francisco Campos** to find out how Epiroc was able to implement a solution to the mining company's challenges.

What was the challenge facing Anglo American at El Soldado?

HERNÁN RODRÍGUEZ: "El Soldado is an open pit mine located on a steep mountain slope, which means we are always looking for technologies and innovation to help us address the particular geomechanical conditions of the mine."

Have you worked around these conditions?

HR: "We have a radar system to detect potential rockfalls, but normally we know that it could take hours, days, and even weeks for them to occur, depending on the speed at which the rock is moving. So there is a period of time in which we could deploy our equipment in the area. However, we don't want to expose our employees to any level of risk. So two years ago, we looked at the problem afresh and realized that during this period we could continue working in these

FRANCISCO CAMPOS
Business Line Manager of the Surface and Exploration Drilling division at Epiroc Chile. Based in Santiago, Chile.

"Automation increases productivity, takes better care of the motor and reduces fuel consumption, but the most important advantage is the ability to remove the operator from the line of fire"

Francisco Campos, Business Line Manager of the Surface and Exploration Drilling division at Epiroc Chile

areas using remotely-controlled equipment. Now we have a remote-controlled hydraulic shovel and are looking to implement a bulldozer."

Why has Epiroc developed the BenchREMOTE technology?

FRANCISCO CAMPOS: "For precisely the kind of problem Hernán mentioned. Epiroc's BenchREMOTE system allows an individual to operate up to three drill rigs from up to 100 meters away using controls and displays identical to those installed in the cabin and a live feed giving multiple views. Automation increases productivity, takes better care of the motor and reduces fuel consumption, but the most important advantage is the ability to remove the operator from the line of fire."

What led to you to contact Epiroc?

HR: "One of the key tasks in El Soldado is presplitting to ensure a clean cut when we are blasting. But, it involves working very close to the pit wall, where the operator could be exposed to rockfalls. We had some experience of remote-controlled drilling at Anglo American's Los Bronces mine and that led us to Epiroc."

What has been the experience of implementing BenchREMOTE in Chile?

FC: "By the time we got to El Soldado, we had implemented BenchREMOTE in several mines in Chile. The first time we did it, it was quite tricky. It took us a month to get the rig operating, but we now have an experienced team with the right skill set.

In Focus: Anglo American

Anglo American is a leading global mining company with a portfolio of mining operations and undeveloped resources. Its primary products are diamonds (through De Beers), copper, platinum group metals, iron ore, coal and nickel.

El Soldado is an open pit copper mine located in central Chile 132 kilometers north of Santiago.

It produced around 52 700 metric tons of copper in the form of concentrates and cathode in 2018.

- **64 000 employees**
- **Founded in South Africa in 1917**
- **EBITDA in 2018: USD 9.2 billion**

More angloamerican.com

It's not always sunny at the El Soldado mine. On some days, visibility is restricted by sea mist. But, with remote-controlled equipment, operations can continue as normal.

At El Soldado, we provided one of our best technicians, who is based near the mine, to support the implementation."

HR: "This has been a big help as we have been able to call on the support team help at any time. Even once at midnight, when our system had failed, we called them, and they were able to fix it. We have now extended the contract so all our personnel can be trained on BenchREMOTE."

Hernán Rodrígues
Anglo American, Chile

How have operators adapted to the new system?

HR: "At first, we began with just a few workers. They all wanted to try it as it was something new. There were some problems with the structure where the system was installed. Now it is on a truck. The speed of acceptance was very quick, especially among younger workers who have grown up playing videogames. For them, it was natural."

FC: "Yes, but some workers are resistant to change with new technologies. Another issue is the working conditions. When on the rig, the operator is exposed to the dust, the noise, the vibrations – none of which you feel operating remotely. Everyone appreciates this."

Francisco Campos
Epiroc, Chile

How are the drills operating now? What impact have they had?

HR: "We are using the rigs in the areas of the mine where we don't want our workers to be exposed to risks. It has allowed us to continue operating with challenging geomechanical and weather conditions. For instance, we have on average 34 days a year of sea mists rolling in off the Pacific. But, our remote-controlled equipment can continue as normal."

FC: "Another advantage is productivity, which is more consistent over time. When an operator starts their shift, they are full of enthusiasm, but as the hours pass, it's normal for their performance to decline. But if the processes are automated, the drilling rate is constant throughout the shift."

What are you looking to do now with BenchREMOTE?

HR: "We would like to let people operate the rigs from an office rather than from a vehicle. We are having a meeting to discuss the next steps."

What has been your experience of working with Epiroc during this process?

HR: "The collaboration has been a key point in the relationship so far, and we certainly expect to keep exploring the possibilities this system provides to improve safety in our operation." ×

4

KEYS TO A SUCCESSFUL PARTNERSHIP

In order to tackle a problem that a client is facing, you need to have more than the right solution. You also need to provide the necessary support to ensure it is properly implemented, and build trust to ensure an effective working relationship.

The right solution

✓ Epiroc's BenchREMOTE system for operating surface SmartROC drill rigs remotely was specifically designed for safety challenges like the one faced by Anglo American at its El Soldado mine.

High quality technology

✓ Anglo American trusted in Epiroc's reputation for developing high-quality mining technology, which meant that it could rely on its equipment to operate in the most testing conditions.

Experience

✓ Epiroc had already introduced the BenchREMOTE system in several of the largest copper mines in Chile, so the implementation process in El Soldado was very smooth.

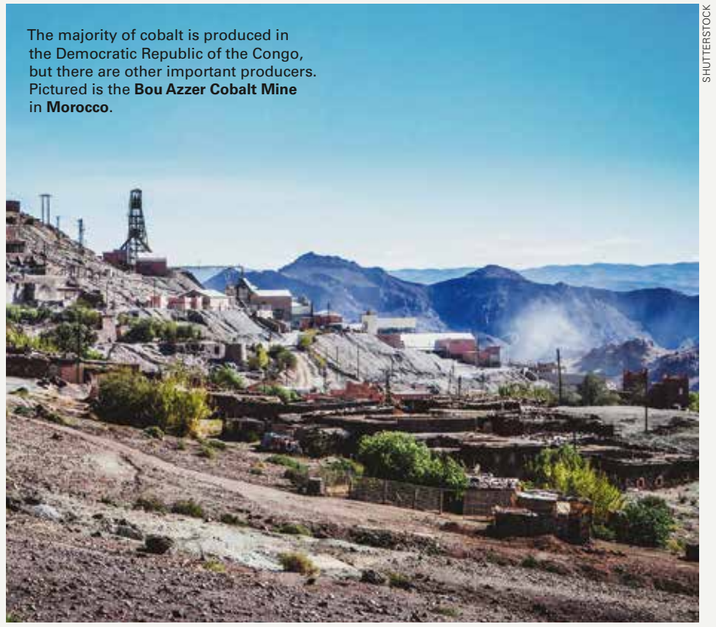
Support

✓ Having an Epiroc technician on hand round-the-clock to provide training and support enabled Anglo American's drill operators to quickly learn how to operate drill rigs remotely and resolve problems.

More www.epiroc.com/benchremotefacts

AROUND THE WORLD IN BRIEF

Want to keep track of what's happening in the mining and construction industry? Visit **miningandconstruction.com** for links to industry news and other interesting reading.



The majority of cobalt is produced in the Democratic Republic of the Congo, but there are other important producers. Pictured is the **Bou Azzer Cobalt Mine** in **Morocco**.

SHUTTERSTOCK

Demand for cobalt prompts action

THE DEMAND AND price of cobalt for use in rechargeable electric vehicle batteries will rise exponentially over the next few years, prompting manufacturers like Ford to either secure access to cobalt mines or lessen their dependency on the element. The Democratic Republic of the Congo (DRC) currently produces 63 percent of the world's cobalt, with associated problems of slave and child labor, as well as environmental damage.

At a mining industry event in South Africa, **Mining.com** reports that **Ted Miller**, Ford Motor Company's Senior Manager of Energy Storage and Materials Strategy and Research, spoke of switching out cobalt dependency for nickel, while still anticipating a possible future need to participate in cobalt mining or have direct cobalt offtake agreements.

OTHER BATTERY MANUFACTURERS have unveiled plans to recycle cobalt from used mobile phones, and develop lithium-ion batteries with minimum or no cobalt content.

Work-life balance top priority

MINING INDUSTRY EMPLOYEES and jobseekers prioritize a work-life balance according to a survey of almost 800 people conducted by Perth-based Mining People International in January 2019.

When asked "What takes priority when you're searching for your next mining job opportunity?", a work-life balance was the top choice for almost 40 percent of respondents. Second was career development with 37.6 percent, while salary was third with just 20 percent of the votes.

SHUTTERSTOCK

Kevin Murphy
Senior Analyst, Metals & Mining Research

What happened in exploration in 2018?

What were the major exploration trends during 2018?

"2018 continued most themes from 2017, with increased budgets for most commodities and regions. The only region to record a decrease was the Pacific/Southeast Asia region, where countries such as the Philippines had lower budgets again. Battery metals continued their above-average increase, up 59 percent. Although base metals saw substantial increases, the industry remains focused on gold, which captured 50 percent of global budgets. The industry continues to underinvest in grassroots allocations, which fell to an all-time low of 26 percent of the global budget. The number of active companies exploring increased for the first time since 2012."

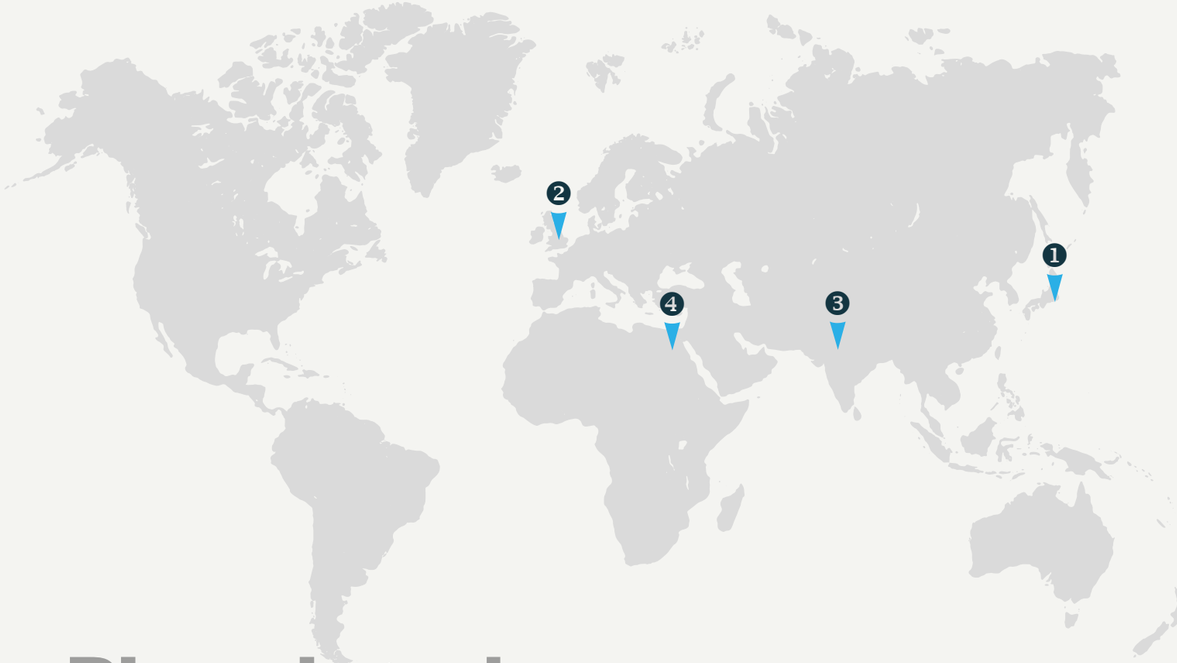
How does this affect the mining business?

"The largest potential consequence to the industry stems from the persistent lack of grassroots investment. Our analysis shows that major discoveries are on the decline, which corresponds with this underinvestment. This could have implications for the longer-term supply pipeline for commodities, especially copper and gold."

What's the preliminary forecast for 2019?

"Despite a variety of potential headwinds, we still expect a 5–10 percent increase in budgets in 2019."

More bit.do/explorationtrendsreport



Pinpointed

01 Asteroid probe prepares for mining operations
Tokyo, Japan

The Japan Aerospace Exploration Agency (JAXA) reported in February that the Hayabusa 2 spacecraft has touched down on the asteroid Ryugu, writes **Mining.com**. The probe will collect samples of the dust by firing a 5 gram tantalum bullet into the surface at more than 650 mph, and retrieve up to 10 grams of dislodged debris using a flared horn in its underbelly. The craft is expected to return to Earth with samples in 2020. JAXA scientists hope to get data on water, precious minerals and organic material, all in preparation for future asteroid mining.

02 A rocking gift for Sir David Attenborough
Mountsorrel, UK

In a recent BBC radio show, Sir David Attenborough credited his study of Mountsorrel granite with helping him earn a scholarship to Cambridge University. As reported by AggNet, he also spoke of a prized collection of granite samples he used to own.

On learning this, the Tarmac Mountsorrel Quarry carefully selected a large piece of pink granite and polished it to highlight its special geological features before sending it to Sir David. Responding by letter, Sir David thanked Tarmac, describing the sample as "magnificent" and "superb".

03 Coal loses energy shares to wind and solar in India
New Delhi, India

Coal as an energy source is losing the race to renewable alternatives in India, with tariff prices for wind and solar becoming hard to beat even for existing coal plants. New coal generators are even less competitive, given higher capital and operating costs. The existing fleet will probably contribute energy for another two decades, but coal as a major future energy source is highly unlikely. India has a plentiful reserve of coal to still be mined, but decreases in demand will likely lead to a steady production drop in coming decades.

04 Ancient quarrying technique discovered in Egypt
Hatnub, Egypt [27.5500°N 31.0000°E]

Recent discoveries reveal how the ancient Egyptians moved stone blocks from the alabaster quarries of Hatnub, located between modern-day Luxor and Cairo. The Luxor Times reports that archaeologists have found evidence of a sloped ramp with two sets of steps and numerous postholes on either side that they believe was used to help hoist alabaster blocks from the quarry via a sled. With the help of manpower and ropes, the wooden posts appear to have been used to leverage the sled uphill.

The primary construction material for the pyramids was limestone, but alabaster was used for flooring, statuary and coffins. While it remains a mystery as to how the heavy limestone blocks were transported up the sides of the pyramids, the ramp system could provide some vital clues.

SHUTTERSTOCK

Andreas Høy Knudsen
Ole Henrik Kalviknes
Fredrik Saarkoppel & Epiroc

A WILD CARD IN DOVREGUBBEN'S HALL

⟿ Mobile concrete sprayer transforms tunnel construction into a smoother game for everyone, except perhaps the Norwegian Mountain King.

As the working face of Norwegian Ljøkelsvatn water supply tunnel blasts ever deeper into the mountain, the walls are efficiently being covered in cement by the MEYCO ME5.

[On Location] **Norway**

NORWEGIAN COMPOSER Edvard Grieg first performed his piece "Dovregubben's Hall" in 1876 – and the snow-capped mountains of Norway brimmed with mystery and imagination. The Mountain King ruled the underworld while destitute farmers struggled on the surface, watching stately waterfalls yielding their colossal forces into the fjords. Fully untapped.

Today, the cascading forces are being funneled down underground to produce electricity in the darkness, thereby reviving the curious legacy of the Mountain King, who was approached by a human who had bewitched his daughter.

"This time we bring in a special wild card," says **Jan Terje Reknes**, YIT's construction manager for the Ljøkelsvatn power station in Etne, a village just south of Bergen in Western Norway. Entirely concealed within bedrock, room for the power station and its water supply is being blasted out of granite, step by step.

"The water will flow through the tunnel without tubing, meaning we must reinforce the rock surface with concrete all the way around. This is why we brought in the MEYCO rig from Epiroc," Reknes says.

The MEYCO ME5 is one of Epiroc's current top versions of mobile concrete spraying rigs, a machine assuming its place among the essential equipment for competitive tunnel construction.

"This is the very first time we are using the MEYCO ME5, and it very much operates by fits and starts. We are experiencing huge advantages with the new rig, which is much more flexible than the older equipment," says **Tomasz Kowalkowski**, manager of YIT's machinery and equipment in Norway.

Jan Terje Reknes
Construction Manager, YIT

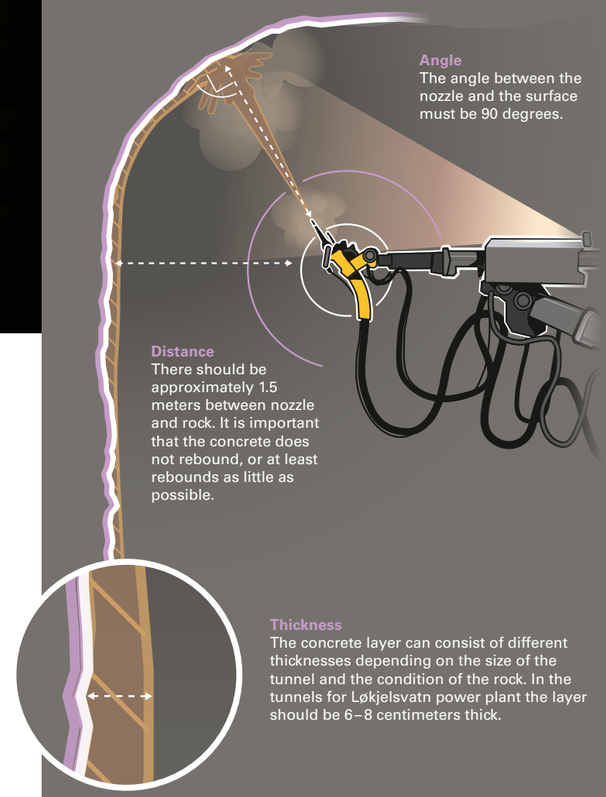
HAVING SEEN THE MEYCO ME5's ability to keep running under extreme conditions in Etne, YIT has decided to allocate the machine to their heaviest upcoming tunnel projects in Norway. When the company started working in Etne in the fall of 2018, Epiroc managed to deliver a MEYCO ME5 on short notice, replacing an older rig. Lined up among two Atlas Copco drilling rigs, three haul trucks and several smaller construction machines, the MEYCO ME5 plays a crucial role in speeding up tunnel building, which will never be fast enough for customers.

LEARN MORE // MEYCO ME5

Four steps to successful shotcreting

SHOTCRETING is a difficult art form. For optimum results, it is important to have the correct distance and angle, among other things – and to make sure that the concrete is as strong as possible.

Flow
It is important for the flow from the nozzle to be good and homogeneous in order for the concrete to become strong.



More www.epiroc.com/meycome5facts

Operators compete for the highest cement output rate, currently running at 70 percent of the MEYCO ME5´s capacity here at the tunnel face in **Ljøkelsvatn**, western Norway.

Tomasz Kowalkowski
Manager of Machinery and Equipment, YIT

Ronny Johnsen
Operator, YIT

"After a maximum of three dynamite blasts, and cleaning and pigging of the walls, all other machines and personnel pull back while the ME5 enters the bottom of the tunnel, but only for three hours, tops. Then everyone returns to prepare the next blast," Reknes says.

Thanks to a computer-guided dosing system, touchscreen adjustment of spraying mixture, and a fixed boom with flexible head for speedy auto application, the MEYCO ME5 allows for a virtual one-man show. As we meet YIT's **Ronny Johnsen** on his way to maneuver the mobile rig down the steep tunnel, we get the operator's own account:

"The rig works in a simple way, and counting from the very first day, I haven't experienced any problems using it," Johnsen states. After steering the rig for two months out of a projected two years of building the Etne power station tunnel, Johnsen has started to customize his MEYCO ME5.

"To avoid cleaning the rear pipe intake after every round of concrete, we've made our own fittings and hoses," he says. Johnsen is currently running at 70 percent of the MEYCO ME5's output capacity, while at the same time wasting less than seven percent of the concrete input.

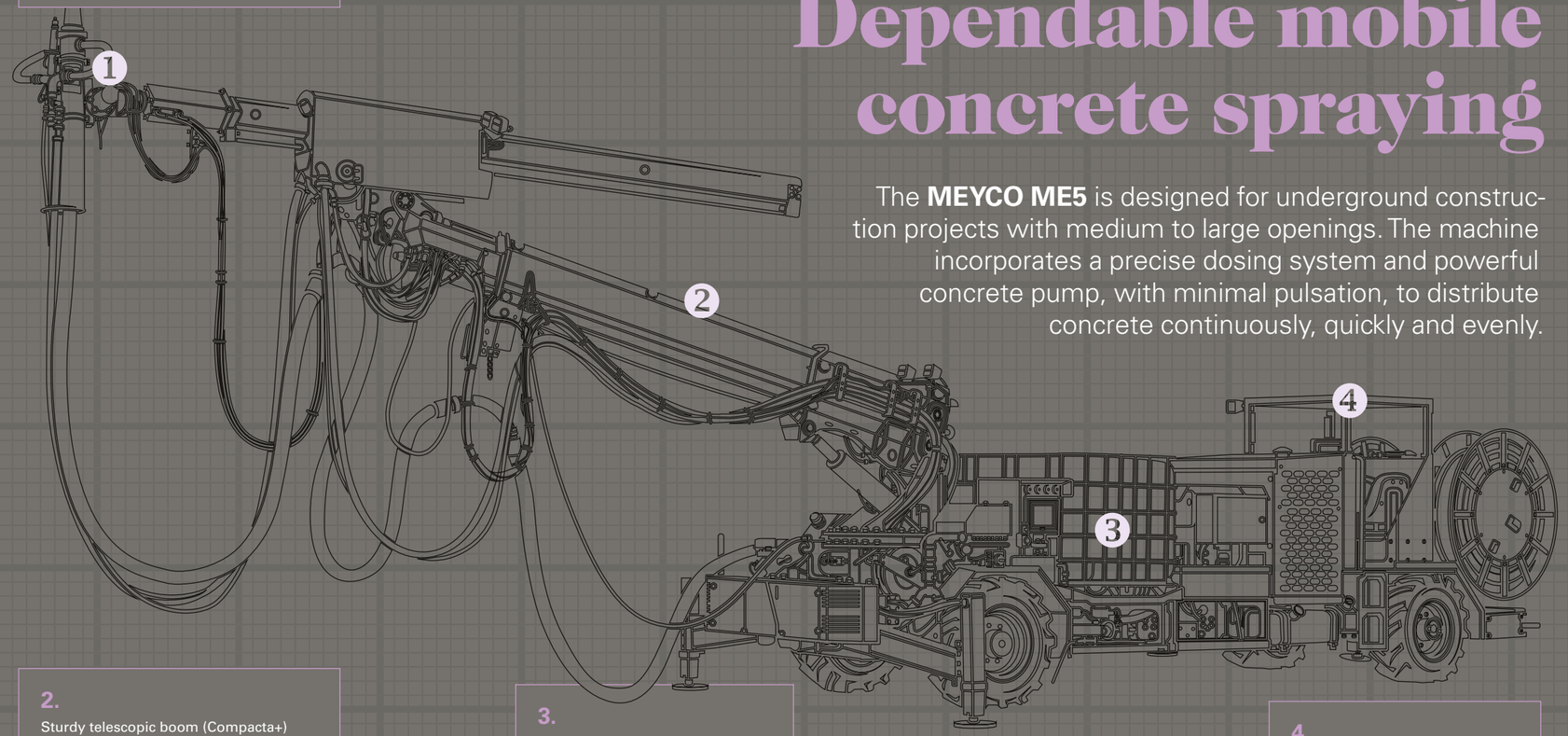
"My plan is to work even quicker while keeping waste to a minimum," he says.

While Mining & Construction's photographer immerses himself in mud to get a clear shot at the nozzle smoothly applying concrete to the tunnel ceiling, we can almost hear the rumblings of the Mountain King preparing to defend his underworld against the unrelenting arrival of the MEYCO ME5. ×

MEYCO ME5

Dependable mobile concrete spraying

The **MEYCO ME5** is designed for underground construction projects with medium to large openings. The machine incorporates a precise dosing system and powerful concrete pump, with minimal pulsation, to distribute concrete continuously, quickly and evenly.



1.
360 degree injection nozzle system delivers **high quality mix**.

2.
Sturdy telescopic boom (Compacta+) with **load-optimized design** and a patented linear play free slide system.

3.
2 x 1 000 liter container for liquid accelerator.

4.
ROPS and FOPS certified cabin.

YIT Group

YIT GROUP IS the largest Finnish and Northern European construction corporation, holding markets in Northern and Eastern Europe. YIT has over 10 000 employees and recorded combined annual revenues of 3.8 billion euros in 2017. YIT Norway holds a leading position within paving and infrastructure, specializing in tunnel construction with a focus on power plants and road projects. In 2018, YIT merged with Lemminkäinen and significantly improved its capacity in paving, tunnels and road maintenance.

More yitgroup.com

Ljøkelsvatn power station, Etne, Norway

- **In November 2018, builder SKL commissioned YIT to build a 5 kilometer, 22 m² water tunnel and a power station inside the mountain, with a capacity of 163 GWh**
- **YIT uses one MEYCO ME5 concrete spraying rig from Epiroc to cover and reinforce the entire tunnel wall and ceiling**
- **The new power station is a rebuilding of two older stations from 1920 and the 1950s, respectively**
- **Planned delivery: 2021**

The Ljøkelsvatn intra-mountain power station in numbers

100 000 M³
Amount of solid rock to be removed during construction.

500 MILLION
Construction cost in NOK (approximately 52 million euros).

163 GWh
Annual production of hydropower planned.

No one should get hurt when performing their daily duties. The essence of safety at work is quite simple – but there are challenges along the way. Social and psychological factors have to be given attention in tandem with physical measures, and globalization can be a double-edged sword.

CONTENTS

Gustaf Höök Björn Öberg Shutterstock

The safety puzzle

When the work gained momentum, it largely focused on identifying and eliminating mistakes. Nowadays, it is also important to build a healthy culture. The view of safety has changed over the years – and new challenges are waiting around the corner.

If you had to venture a guess, when would you say the term "safety culture" came into being? Can it be traced back to the industrialism of the 19th century? Did it arise when the Western world was getting back on its feet after World War II?

The correct answer is 1986.

After investigating the Chernobyl nuclear accident, the International Atomic Energy Agency, IAEA, found that a poor safety culture was a contributing factor. In other words, taking a holistic view of safety and risks in working life is a relatively new concept, even if safety work generally predates this. Research in this field gives you a quick picture of its development.

"From the 1800s to the post-World War II era, there was great focus on safe technology and physical design," says **Marianne Törner**, researcher in Occupational and Environmental Medicine at Sahlgrenska Academy, University of Gothenburg.

"The focus then began to shift to what role the individual played in the accident occurring, and in the 1970s and '80s, there was a lot of research into interaction between humans and technology."

The research eventually influenced legislation. For example, the International Labour Organization, ILO, adopted the Occupational Safety and Health Convention in 1981. Since then, the concept of safety culture has been introduced, and holistic thinking has grown in importance.

"Humans are social beings and are good at working together," says Marianne Törner. "We learn from each other, draw conclusions and create a shared view of what applies. Culture is a social infrastructure within organizations and groups, and explains why people act the way they do."

The creation of a safety culture leads to the creation of a safety climate, which has been described as a group's shared perception of policies, procedures and practices in relation to safety. It is here that managers play a key role. The rules must be perceived as relevant, and managers must communicate that safety is something that is valued.

"They should show that the organization cares about the individual's safety and well-being, and also appreciates the employees' contributions," says Marianne Törner. "Each individual should be given responsibility with reasonable conditions. This increases the likelihood of having employees who are ready, willing and able to work for safety. And it needs to be okay to sometimes fail."

A safety culture, safety climate and safety procedures are crucial for actual safety. A Danish study conducted at the National Research Center for the Work Environment found a direct correlation between how the respondents assessed the safety climate at their workplace and the number of work accidents they were involved in two years later.

Another example is the book *Ten Pathways to Death and Disaster*, written by Michael Quinlan, Emeritus Professor of Industrial Relations at the Sydney School of Management. He reviewed fatal accidents in the mining industry and other high hazard workplaces in detail and was able to identify ten pattern causes.

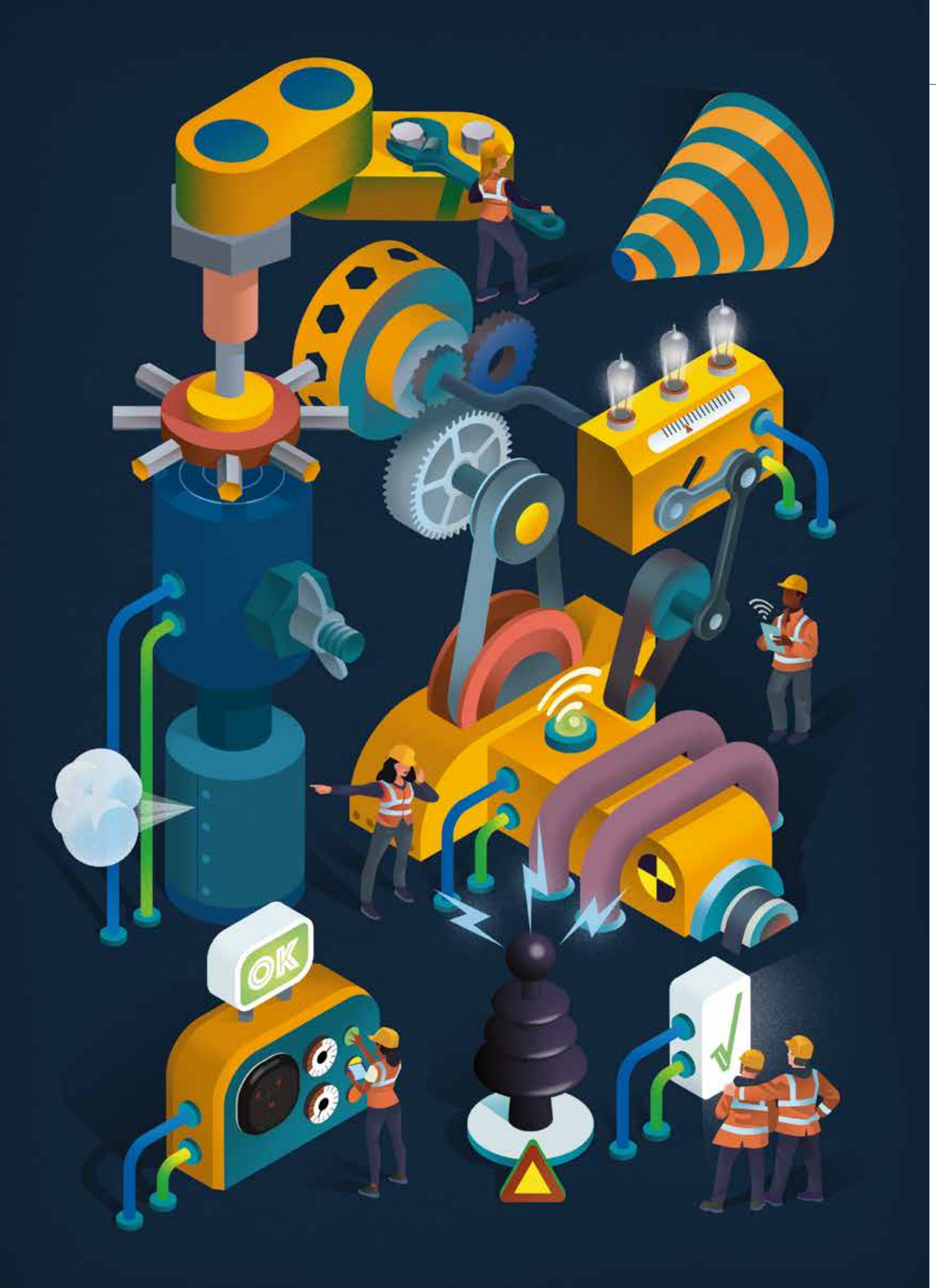
Marianne Törner
Researcher in Occupational and Environmental Medicine, Sahlgrenska Academy, University of Gothenburg

Michael Quinlan
Emeritus Professor of Industrial Relations at the Sydney School of Management

"The pattern was the same in all industries, and the more detailed the investigation, the greater the number of pattern causes that emerged," says Michael Quinlan. "A serious incident can always occur, but the greater the number of safety deficiencies, the greater the probability. Where there are a lot of latent failures or deficiencies in the system, all it takes is a trigger factor for a disaster to become reality. A lot of lives can be saved by correcting deficiencies."

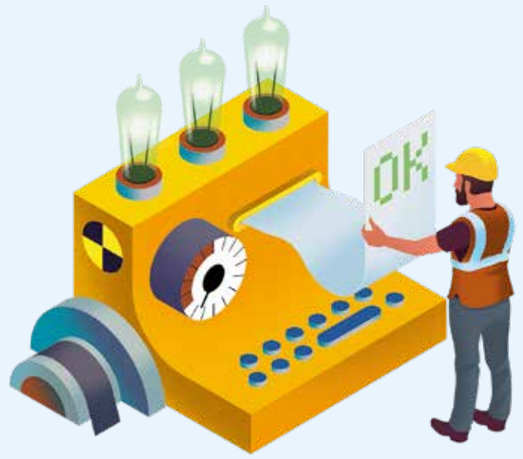
Michael Quinlan points to the importance of systematic safety work at different levels.

"It is important that the rules are actually followed," he says. "How can a company have really good safety statistics in Australia, for example, but much worse in Africa? I would venture to say that the explanation is weak trade unions, and governments that will do anything to attract jobs to their country."



"The legislation must also address new forms of employment and be adapted as jobs change or disappear"

Håkan Olsson,
Deputy Director-General,
Swedish Work Environment Authority



Safety work is at different levels in different parts of the world. In simple terms, you could say that conditions are better in stable democracies. One country that has come a long way is Sweden. **Håkan Olsson**, Deputy Director-General of the Swedish Work Environment Authority, says that the general development in the field of safety has gone from detailed regulations to an awareness that safety is a complex issue that must permeate all levels.

He continues:

"The safety work has to be well developed, and there must be feedback loops. The mining industry in Australia has a robust system, not just because the mines have their own audit systems. There are also government inspectors and union safety reps, all with great mandate. They can shut down operations if necessary."

"If you look within the EU, there are differences depending on whether the work environment authority also has labor law legislation within its sphere of responsibility," he says. "This is the case in half the EU countries, and in such case these issues are given higher priority than those related to safety and the environment."

He continues:

"In Sweden, employers, authorities and trade unions have traditionally collaborated in work with safety issues, and this has yielded results. But, one should be aware that work environment efforts take time, so it is important that countries that have not progressed as far get both support and a little push in the right direction."

Håkan Olsson
Deputy Director-General, Swedish Work Environment Authority

What future challenges do you see in the field of safety?

"Globalization makes the workforce more mobile, so it is important to keep an eye out for companies that turn a blind eye to occupational health and safety to get a leg up against the competition. The legislation must also address new forms of employment and be adapted as jobs change or disappear as artificial intelligence and automation gain ground. Development moves quickly and it is important to look at what impact this has on safety." ×

JUST IN CASE

What if something goes wrong?

THINGS DO NOT always go according to plan, so it is important to have a process that regulates how to treat an unwanted event. Within the mining industry, a **Trigger Action Response Plan** (TARP) is a fairly common tool. In particular, it is used for managing critical situations from a mine operations safety perspective. A typical TARP document sets out a certain set of conditions (or "triggers") and a set of actions that mine managers and supervisors must follow when these trigger events occur. TARPs also typically include a number of different trigger levels, each with a set of responsibilities assigned to mine personnel to take action on as necessary.

“For instance, operators must perform a brake test before every shift”

Patrik Persson
Service Engineer, Epiroc

Sustainable mining requires holistic solutions. It is not just productivity and efficiency that are vital – everything related to safety needs to be in place too. Mining & Construction visited Oyu Tolgoi mine in Mongolia to find out more about an award-winning collaboration.

In a dusty and noisy tunnel, **Patrik Persson**, Service Engineer from Epiroc Sweden, is standing with service technicians and operators next to the Scooptram ST1030 loader. “So, what should we check next?” asks Persson. A service technician points at a safety pin that locks the center hinge and boom. The group of people walk around the loader and carefully check each safety item, such as oil and brakes. Persson explains what condition each item should be in before the loader is turned on, and a safety checklist is ticked. “For instance, operators must perform a brake test before every shift,” he says.

[On Location]
Mongolia

THIS SCENE IS BEING played out 1 300 meters below ground level at the Oyu Tolgoi mine in the South Gobi region of Mongolia. It is one of the biggest copper mines in the world, but also contains gold and silver resources. Both open pit and underground mining techniques are used to extract the metals. The mine is operated by Oyu Tolgoi LLC with a number of contractors on site. Epiroc Mongolia is one of the main contractors for underground drills and other equipment, providing maintenance services for its drills and other equipment operated at Oyu Tolgoi. Patrik Persson is here to train the technicians and operators who will operate and carry out maintenance on the Scooptram ST1030 loader. An important part of the training that Epiroc provides, not just at Oyu Tolgoi but in general, is related to safety. The basic safety approach is to always make sure that the customer knows how to operate Epiroc equipment before starting to use it.

“When we supply any equipment to a customer, safety is the first thing we consider,” says **Bayar Torguud**, Business Line Manager Epiroc Mongolia. “Everyone who interacts with or uses machines or equipment must be safe. Equipment should be used correctly. After our products are supplied to the customer, we work on maintenance services in line with the customer’s needs.”

Patrik Persson
Service Engineer
Material Handling,
Epiroc Sweden

Bayar Torguud
Business Line
Manager, Epiroc
Mongolia

At Oyu Tolgoi, Epiroc Mongolia provides maintenance services for 32 pieces of equipment: mostly underground drill rigs, but also two new loaders – the Scooptram ST14 and Scooptram ST1030. The team consists of more than 100 people, including managers, supervisors and technicians.

"We started with seven machines and 30 people," says Project Manager **Alfred Lawrence**. "We have done it safely, having seen a lot of personal development not only in technical skills, but also in Oyu Tolgoi's safety awareness."

He continues:

"Safety is always the first topic to be addressed at the start of each shift. We discuss safety issues and invite team members to talk about their safety experiences. That's important to us because we don't want to see people injured. People have the right to come to work and be safe."

OYU TOLGOI LLC requires its contractors to live up to high safety standards. Lost time injury (LTI) is one of the main indicators for safety performance, and each contractor's safety initiatives matter – adding to the site's overall safety. Epiroc's approach has been successful too. When Oyu Tolgoi LLC evaluated safety performance among its contractors, Epiroc received the Safety Recognition award for the first quarter of 2018 and the Best Safety Performance Mining Contractor award for the second quarter of 2018.

"What we call a safety initiative is identifying any hazard and making sure that it doesn't become a risk to health and safety," says Alfred Lawrence. "Simple things can often have a big impact. For example, reducing a tripping hazard underground. If someone had slipped, it could have led to anything from a broken leg to a loss time injury."

AFTER THE TRAINING for safety checks in the tunnel, Patrik Persson and his service technicians move to another tunnel – a bit wider than the previous one – for brake tests. They pass through the tunnels using their helmet lights not just for lighting the way, but also for giving signals to make sure there are no incidents when confronting machinery, until they reach the designated spot where they perform brake tests. Patrik Persson stands close to the tunnel wall, the spot designated for people to stand, while other vehicles pass through. He watches the operator driving the Scooptram ST1030 loader and nods his head when the operator stops the loader.

The next stop for Patrik Persson and the service technicians is an underground workshop. Before entering, they stop in front of a red and white safety barricade ribbon, signaling to technicians inside the workshop with their helmet lights before getting the proverbial green light to go in. Today, there is a sign outside reading "CAUTION! Commissioning OR Live Testing", written in both English and Mongolian. Inside the workshop, Persson stands next to the Scooptram ST1030 loader with other technicians. They talk continually since the technicians are also eager to advance their knowledge about the loader. Thanks to Persson's training, the Scooptram ST1030 will be put into operation sooner.

Q&A

Christer Lindén
Manager Technical Service, Field Service Operations, Mining and Rock Excavation Service

As a leading productivity partner for the mining and infrastructure industries, Epiroc delivers its products from Product Companies via Customer Centers to end customers.

Q What benefits does Global Field Service bring to Epiroc customers?
A "Through Epiroc's technical support we continuously collaborate with customers, Epiroc Customer Centers and dealers to enhance competence in relation to our products and offerings. Our job is to support our customers in achieving outstanding performance."

Q What are the most common concerns from the customers' side?
A "For Epiroc equipment and services, mechanical availability is of the essence. Hence we strive to build the safest and most reliable solutions possible."

Q How much of your work is dedicated to safety issues?
A "Epiroc builds safe and reliable machines and we continuously monitor the performance of Epiroc equipment in the field. If safety-related concerns are identified, we immediately take action. The voice of the customer is of utmost importance, and customer feedback is key. Safety is an essential part of our culture."

Q How has Global Field Service developed over time?
A "As a market leader, we collaborate with our customers to increase safety and minimize the environmental impact of our equipment and services. We evolve by developing the technologies required to enhance our customers' operations and by continuously adapting the skill set of our people."

More bit.do/partsandservicesfacts

Technical Service Engineer **Patrik Persson** (middle) shares his expertise in Scooptram ST1030 with service technicians.

In Focus: Safety first

Safety always starts with you. It is up to the individual to take the necessary precautions to avoid accidents, which is why we at Epiroc incorporate safety into our culture and always put safety first.

- **Safety is a subject that is both easy and complex – it is easy to understand what it stands for yet complex in how it is applied. Safety precautions differ in different parts of the world.**
- **As part of our competence development process, we focus on the safety aspects of the product, such as hazards and the safety features incorporated in the product. One of the main goals of Epiroc's competence development is to give you the ability to work safely with our products.**
- **At Epiroc, we believe there is always a better way. We are continuously enhancing the competence development process in order to increase safety and efficiency for our customers. Safety starts with you, and that is why we believe that competence development is a vital part of achieving a safe work environment for all.**

“Overall, we receive very good evaluation results for our safety performance from our customer among all its contractors”

Bayar Torguud
Business Line Manager, Epiroc Mongolia

Oyu Tolgoi copper-gold mine, one of the largest undeveloped high-grade copper deposits, in the South Gobi region in Mongolia. The underground mine has been under development since 2016, and Epiroc’s underground drill rigs play an important role.

“Training is really important for both operators and technicians,” says Alfred Lawrence. “Operators need to feel comfortable operating the machines safely and technicians need to be fully aware of the machine’s functions.”

The caution sign is the most recent safety initiative implemented by Epiroc, explains Maintenance Superintendent **Jim Barron**.

“The purpose is to stop people from entering the workshop when there could be live testing going on,” he says. “We have signs made up and then announce it. Now, when people are about to access the area, there are proper head signs rather than just a piece of paper.”

He continues:

“We perform monthly safety walks and they have led to many improvements. These walks are an initiative taken by Epiroc Mongolia. All our employees walk around their workplaces, seeking out any safety hazard. This applies to the office in Ulaanbaatar as well as underground at the Oyu Tolgoi site.”

Looking for safety hazards and improving the work environment becomes a habit and an attitude each employee has towards their work – not just once a month, but during all working hours.

“Overall, our customer gives us a very good rating for our safety performance among all of its contractors,” says Bayar Torguud. “That’s assessment for our employees’ work attitude and their initiatives. They also apply many safety standards to their daily work, such as weekly safety talks and Job Hazard Analysis (JHA), to be conducted before each job for workshop and warehouse.”

THE SCOOPTRAM ST1030 loader with its 10-tonne capacity is the second Epiroc loader model to operate in Oyu Tolgoi’s underground mine, the first one being a Scooptram ST14. Patrik Persson thinks that his training sessions have provided useful knowledge for Oyu Tolgoi-based employees.

“The training is more about what kind of machine they operate and what kind of functions this loader has,” he says.

Alfred Lawrence
Project Manager,
Epiroc Mongolia

Jim Barron
Maintenance
Superintendent,
Epiroc Mongolia

According to Jim Barron, Epiroc has mostly provided maintenance services for its drill rigs here at Oyu Tolgoi thus far, but services are expanding with the new loader.

“As we develop, we set up more safety procedures to assist technicians and operators rather than just doing a job. We perform more formal documentation and create a hazards analysis report every time. It’s more a case of step-by-step procedures to perform a job safely,” he says.

BAYAR TORGUUD CONCLUDES by highlighting the fact that advancing technology requires even more training.

“It’s very important to train people to operate machines and equipment in the correct order,” he says. “Advanced machining technology can still lead to risks if things are not operated correctly. For all operators and technicians, it’s crucial to operate and perform machine maintenance in the correct order, to understand signs or warnings and to respond quickly.” ×

Andrew Curtis
Mine Manager Underground,
Oyu Tolgoi LLC

How is safety handled at Oyu Tolgoi?

What are Oyu Tolgoi’s main safety criteria when dealing with contractors?

“We expect all contractors to work with the same high safety standards as the rest of the Oyu Tolgoi operation. They are required to adopt and embrace the Critical Risk Management (CRM) system that Oyu Tolgoi uses to manage fatality risks. The safety of contractor personnel is as important as the safety of our own employees, so we require transparent incident reporting, investigation and injury management, and that the health and wellbeing of all personnel is always put first.”

How do Epiroc and Oyu Tolgoi cooperate on safety?

“We work in close collaboration to identify hazards through risk assessments, hazard reporting, management of change, leadership time in the field and CRM. Every person, from the operator and maintenance technician to the supervisor and leadership team in the organization, has a part to play in the CRM process. Safety is at the forefront of every meeting.”

How has Epiroc’s safety work improved your operations?

“Safety is an outcome of operational control. When the systems and processes used in daily work are well designed and implemented, and work occurs in a controlled manner, the outcome is a safe and productive workplace. Epiroc has implemented 55 initiatives, and has high standards for work area housekeeping and discipline in their working practices. All this adds up to a safe and productive workforce.” ×

More bit.do/oyutolgoifacts

PERSPECTIVE
NUCLEAR POWERPLANTS

There are always things to be learned from other organizations and other industries. This is how another player has approached the theme of this issue.

Christian Tarras Ericsson
Shutterstock

Nuclear belts and suspenders

FEW INDUSTRIES ARE as concerned with safety as nuclear energy production plants. Safety measures are studied meticulously from the very beginning of the planning phases, and take into consideration everything from rock foundation stability, earthquake frequency and grid connections to habitation proximity, insider sabotage and potential terrorist attacks.

Still, extraordinary events can make it necessary to perform a scram – a rapid shutdown of the reactor. The procedure involves three major safety steps: shutting down operating reactors, cooling them down to remove heat from the nuclear fuel, and containing radioactive materials. In most plants, over twenty redundant safety systems ensure that these three steps can be performed.

The primary means of breaking the nuclear chain reaction is the insertion of neutron-absorbing control rods into the core. All reactors have some form of backup cooling system. One example, used in boiling water reactors, is a standby system that can rapidly flood the core with a solution containing boric acid in case of problems.

THE NEXT STEP involves cooling the core, which is done by the safety-critical Essential Service Water System (ESWS). This circulates water that cools heat exchangers and other components before dissipating the heat into the environment. In case the ESWS fails, there is a host of emergency core cooling systems, all of which are dependent on electricity. If the plant is cut off from the main grid, there are backup systems in the form of diesel generators, motor generator flywheels and batteries.

THE LAST STEP is containment. The fuel core is contained in a sealed metallic or ceramic layer of cladding, which in turn is contained within the actual reactor vessel. Surrounding this is a primary – and sometimes a secondary – containment consisting of metal and concrete. Ventilation and gas treatment systems catch any airborne radioactive isotopes. And finally, in the unlikely case of a full meltdown, there is a concrete core catching system designed to stop an escaping core from melting through the plant floor.

The Dukovany Nuclear Power Station is the first of its kind in what is now the Czech Republic. All four reactors are still in operation and the power plant supplies approximately 14 TWhr of electric energy to the national power grid annually.

In Focus:
Fukushima 2011

In 2011, the Fukushima plant in Japan was hit by a magnitude 9 earthquake followed by a massive tsunami, ultimately leading to widespread dispersion of radioactive materials and the forced evacuation of 200 000 people. The accident was exacerbated by human error, but the primary cause was that the ESWS system failed due to tsunami-flooded backup diesel generators. This led engineers to try to vent steam to relieve reactor pressure, which in turn blew out the containment walls. Japanese authorities have long-term plans to increase safety, which include coastal levees and emergency power source vehicles on sites.

More bit.do/fukushimafacts

SURVEY
FUTURE SAFETY

Want more input on this theme? Three people from different fields give their views to help paint a broader picture.

Gustaf Höök & Frida Valentin

01 Going forward, what do you consider to be the main goals in the field of health and safety at work?

02 What needs must be met in order for those goals to be reached?

Cecilia Andersson

Work Environment Expert, Svemin (Swedish Association of Mines, Mineral and Metal Producers), Sweden

01 **"WE HAVE A** zero vision for work injuries, so that's still the main goal for us. This also includes organizational and social factors that can affect health and safety at work. Another goal concerns safety related to new technical development. Many risks have decreased or even disappeared, but we will have new risks related to the new technology to prevent. We need to be one step ahead and think about new types of risks that may occur with, for example, automated vehicles, remote control and borderless work."

02 **"FIRST OF ALL**, companies need a good safety culture, which includes routines and adapted methods for risk analysis. In addition, authorities need to adjust the laws to suit modern working life. It's also important for companies, unions, researchers, machine manufacturers and authorities to establish strong cooperation in relation to health and safety. Everyone needs to be aware of the risks in order to achieve the goals."

Marianne Thyssen

European Commissioner for Employment, Social Affairs, Skills and Labour Mobility, Belgium

01 **"EUROPE IS A** frontrunner in protecting workers against health and safety risks, and we want to keep this up in the future. We should continue updating legislation in line with scientific advances and keep an eye on new and emerging challenges. In doing so, it is vital that we keep in mind the realities of micro- and small enterprises. They need more support as they face the biggest challenge of putting these rules into practice."

02 **"WE ARE WORKING** hard to adapt EU rules on health and safety at work to new developments. Addressing cancer on the work floor has been a major focus. We have limited exposure to 26 cancer-causing chemicals at the workplace during this mandate. We have to continue working on this, as there is more to be done. At the same time, we want to ensure that the EU's health and safety framework is future-proof: to create a level playing field across the EU, to raise awareness and to improve compliance and enforcement on the ground."

Jan Johansson

Professor at Luleå University of Technology, division: Humans and Technology, Sweden

01 **"WHEN TALKING ABOUT** safety, it is easy to get hung up on technical solutions and automation. I think it's important to not be that narrow, but instead to broaden the concept of safety to include the creation of attractive workplaces that empower employees and challenge their creativity. Even automated systems need maintenance by humans. By creating a sense of well-being in the workplace you make room for a safety culture to blossom."

02 **"INVOLVE THE EMPLOYEES** when it comes to designing workplaces and work tasks. There is often an initial skepticism when crossing over to digital solutions. But, when the employees themselves are involved and believe in the work process, you reach better solutions and greater social acceptance. There needs to be trust between employers and employees, and companies must have confidence that their employees are willing to take responsibility for productivity and want to feel proud of their company."

More bit.do/eusafetyandhealthfacts

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Safety above all

In the words of Thomas Hobbes, life in the state of nature was "solitary, poor, nasty, brutish, and short". Here are a few things society has accomplished to make us safer – and one human trait that hasn't.

07 The Peltzman Effect

The tendency to have overconfidence in safety measures, leading to riskier behavior. For example, the introduction of anti-lock brakes in cars actually led to a rise in fatal accidents since people using them felt they could drive more aggressively. People are only as safe as they choose to be.

01 Clothes

Ever since humanity migrated from the comforts of its ancient African home, we human animals have needed protective gear to shield ourselves from our surroundings; ranging from furs and woolen underwear to body armor, hard hats and diving suits.

06 Airbags

Airbags have come a long way, from the sometimes lethal explosive contraptions back in the 70s to the slick, efficient and life-saving devices surrounding us on all sides in modern vehicles. These days, even cyclists can protect their heads with airbags.

02 Inoculation

Exposing immune systems to weakened strains of pathogens to trigger antibody production, thus providing immunization, surely was the discovery of the year in 1798. Since the start of vaccination programs, deaths from diseases like measles and smallpox have plummeted.

05 Ergonomics

The science of comfort, some say. The study of human interaction with products, processes and systems according to others. In any case, ergonomics has greatly helped us to reduce human error, increase productivity and enhance safety over the years.

04 Parachutes

A piece of cloth to increase air resistance? When you put it like that, it doesn't sound overly exciting. But the application of parachute technology to various fields like air safety, space travel and dragster racing has certainly saved numerous lives.

03 Procedures

A procedure is basically an algorithm for humans. Standardizing tasks – and the order thereof, no matter who does them – guarantees identical results every time, ensuring safety and other factors. Safety checklists are a must in any hazardous environment.

Next issue [Feature] Innovation is essential for progress and for successful business. But how do you accomplish it? Make sure not to miss next issue's Feature.

MY WORK:
ASSEMBLY ENGINEER

Epiroc's greatest asset is our employees. We take pride in offering them an outlet for their creativity in order to provide the best possible value to our customers.

Sanna Persson
Kunal Rathod

"Records are meant to be broken"

Assembly engineer **Jitendra Bhamare** ensures that the drill rigs in Nashik, India are assembled on time. Last year, he and his team reached the highest production level ever, but he already has his mind set on going further.

"A normal workday for me is filled with different activities; surprises, fun and many times challenges – which I love. Being faced with challenges pushes me out of my comfort zone, sharpens my skills and shifts the paradigm. It inspires me to make the impossible possible. As an assembly engineer, my daily work consists of production planning, material scheduling, quality issues, follow-ups and resource allocations. I am also part of a new product development team and our prime focus is on meeting monthly production targets, using optimal capacity and achieving higher efficiency.

THERE IS A VAST SCOPE of creativity in my daily work. Fixture developments, process settings and building the competence in my team are some of the areas where I can use my creativity to execute day-to-day activities in a smoother and more effective way.

The biggest challenge in my work is to achieve set monthly production targets. Customer needs are getting more demanding and production targets are growing. To tackle this challenge, we have implemented flow assembly in our production line. While working on a monthly production plan, we take into consideration the delivery schedule, our capacity and material inflow for the respective month. To maintain a smooth assembly workflow, we make sure that the workload is distributed equally among all the assemblers. Our management has given us tremendous support in establishing this production flow assembly. It certainly contributed to us reaching the highest production of drill rigs from Product Company Nashik in 2018, compared to previous years.

JITENDRA BHAMARE

Age: 32
Job: Assembler, Product Company Nashik, India
Joined the company: 2010
Best part of the job: "Adding the finishing touches to the products that are to be offered to the customers"

HOWEVER, I BELIEVE that records are meant to be broken, and with dedication and determination we will be aiming for even greater achievements in the coming years. I always accept new challenges and I am sure we will continue to achieve a world-class quality of rigs that are completely customer-oriented and value-adding for all the stakeholders of Epiroc." ×

The daily tasks as an assembly engineer are varied – including production planning, material scheduling and quality issues – causing **Jitendra Bhamare** to face challenges that he relishes.

Christian Tarras Ericsson Epiroc, Markus Pettersson

ROCK REINFORCEMENT DELUXE

Lightning Bolting

As underground mining operations move ever deeper underground in the search of ore. Difficulties surrounding rock reinforcement in increasingly difficult ground conditions are growing – but now there's a new process in town.

[On Location]
Sweden

1 THE CHALLENGE

ROCK REINFORCEMENT has become the bottleneck in the drill and blast tunneling process. Mechanized rock bolting drill rigs are usually very efficient in installing rock bolts and mesh. However, with deeper mining operations, increasing rock stresses often lead to increased fracturing of the rock, which leads to difficulties in rock bolting.

Peter Bray
Global Product Manager, Rock Reinforcement Equipment

IN LKAB UNDERGROUND operations in northern Sweden, it can take up to eight hours or more for their cement grouted rock bolts to cure and be able to hold loads from the rock mass. With increasingly fractured ground, the installation of these cement grouted rock bolts is becoming harder to achieve with acceptable productivity figures.

"We started a project at the LKAB mine in Malmberget with the main objective of making the rock bolting process twice as fast as LKAB's existing bolting systems," says **Peter Bray**, Product Manager at Epiroc.

"We were pretty much given a blank slate and brainstormed a wide scope of ideas. We then whittled it down to the best approaches that could give reasonable results within a reasonable time frame."

2 THE SOLUTION

AN EXISTING solution to cement grouted bolts is to replace the grout with resin cartridges, which results in a substantially faster setting time. But the cartridges are difficult to install in fractured ground. What if you could instead inject the resin with the bolt already in place?

"We partnered with resin suppliers to develop a pumpable type of resin with fast setting times and a ketchup-like consistency to prevent the resin from dripping from the bolt hole," says Peter Bray.

In parallel to the resin work, an existing type of rock bolt – a Self Drilling Anchor, or SDA – underwent modification to allow the pumping of the resin. The SDA bolt is essentially a hollow steel tube with a drill bit welded to the end. It acts like a drill steel during installation and like a bolt when installed in the rock.

A MAJOR HURDLE to overcome during the development of the pumpable resin system was finding a solution for flushing the resin mixer elements to enable repeated use of the mixers without clogging. After several trials, a simple solution was discovered that provided robust and reliable flushing while maintaining a closed system with no release of unmixed resin. Finally, all aspects of the design were working in harmony.

3 THE RESULT

A MODIFIED Epiroc Boltec E machine performed a four-month field test at LKAB's Malmberget underground iron ore mine between May and August of 2018, with the machine being operated during the day shift. The results achieved were very promising.

"We improved productivity by 64 percent compared to existing cement grout solutions, which was quite acceptable to LKAB. The operators felt that productivity will improve even more once they have more experience with the machine," says Peter Bray.

One of the major advantages of the pumpable resin system is that it requires significantly less cleaning and maintenance compared to cement grout machines, which need cleaning several times per shift.

"It's very low maintenance. At the end of the shift, the operator simply turned the Boltec off and walked away. They loved the machine, and were very upset when the field test ended," says Peter Bray.

Pumpable resin with SDA bolts has also been tested with extension drilling out to 15 meters in total bolt length with excellent results. Extension bolting further adds to the flexibility of the system, potentially replacing cable bolting in poor rock conditions.

"In some rock conditions, this machine provides the best solution available," says Peter Bray.

More www.epiroc.com/rockreinforcement

Tom Azzopardi Juan Carlos Recabal

Yordan Rojas, one of the operators of the Epiroc Scooptram ST7 Battery at the Atacocha mine.

[On Location] **Peru**

Founded in 1936, **Nexa Resources'** Atacocha mine is located in the heart of the Peruvian Andes.

Electrifying mining

The electric vehicle revolution is coming to mining – cleaner machines will not only reduce the industry's carbon footprint but will mean workers can breathe more easily.

In an underground mine, the heavy machinery required to break, load and haul rock generates noise, heat and fumes that can make uncomfortable working conditions even more difficult.

AT ITS ATACOCHA MINE in Peru, Nexa Resources is testing the next generation of mining equipment that could represent the future of the industry.

Since January 2018, the mining company has been testing out Epiroc's Scooptram ST7 Battery, an electric version of its narrow vein loader.

Rather than a roar, the vehicle only gives out a quiet growl as it advances through the mine's muddy tunnels. More importantly, there are absolutely no emissions and very little heat.

"I have never seen a machine like this…there is no pollution, no gases," says operator Yordan Rojas. "It is more comfortable for the operator and everyone else there."

DIESEL ENGINES CAN emit large quantities of carbon monoxide and other pollutants, which can be damaging to the workers' health.

"The diesel engine is quite dirty, and the amount of smoke it generates sometimes prevents us from working," the fourteen-year veteran of Atacocha explained.

Yordan Rojas
Operator,
Nexa Resources

"A clean machine also improves productivity," adds mine manager Rudy Espinoza.

"With the diesel Scooptram, we have to wait thirty minutes for the gases to disperse before we can send in personnel to perform the next task," the engineer explains. "With this machine, they can go straight in."

And the electric motor seems just as powerful as the diesel version, notes Rojas.

The one disadvantage is that, unlike a tank of diesel, the battery does not last a whole 12-hour shift. However, changing the battery has proved a cinch – using an overhead crane, Rojas needs just fifteen minutes to remove and replace the battery.

THIS IS THE FIRST time one of Epiroc's electric vehicles has been deployed outside of Canada and it is the first to be operated at high altitude (the Atacocha mine sits more than 4 000 meters above sea level). Unlike diesel engines, electric motors do not lose capacity in the rarified air of the Andes.

Given the advantages, Nexa wants to electrify its whole mine fleet within five years. The problem is that electric versions are not yet widely available for most of the vehicles used in open pit and underground mining. ×

1 Zero emissions

The electric motor generates no emissions of carbon monoxide and other pollutants. It also emits less heat and noise.

2 Good for the planet

Charged from Nexa Resources' hydropower plant, the electric motor generates no greenhouse gases.

3 Greater productivity

The lack of emissions means personnel can be deployed immediately without waiting for toxic gases to disperse.

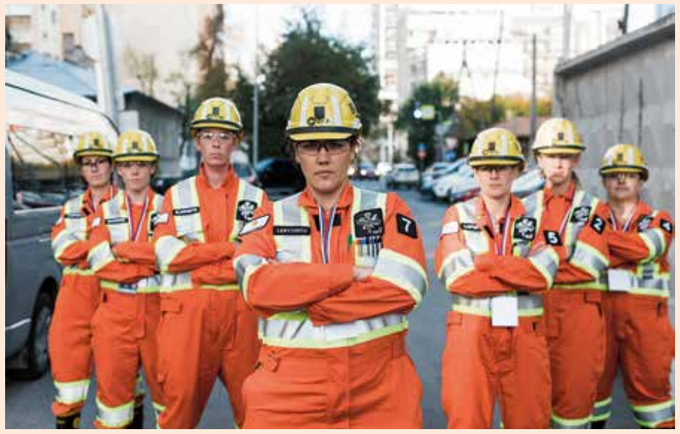
4 Lower costs

Electricity is not only cheaper than diesel, but also avoids the need for a constant convoy of tankers to the mine.

5 More versatile

The high reach longer boom means that it can load haul trucks without the need for a platform. Its narrow turning circle is another advantage.

Frida Valentin Brandy Bloxom



Kari Lentowicz, freelance Emergency Management specialist and former employee at Cameco Corporation.

BREAKING NEW GROUND BELOW THE SURFACE

[On Location] **Russia**

Canadian team Diamonds in the Rough proves that women can do mine rescue just as good as men.

WOMEN IN MINE RESCUE COMPETITIONS are unusual, and those who do compete tend to do so in teams with men. But in September 2018, the first step towards a change was taken when all-female Canadian team **Diamonds in the Rough** competed in the International Mines Rescue Competition (IMRC) in Russia – a country where women are not allowed to work underground.

To pay for their travel costs, the team launched a successful GoFundMe campaign and also received funding from sponsors, with Epiroc being one of the donors. For Kari Lentowicz, it was a dream come true when Diamonds in the Rough crossed the finish line having completed the competition.

"People around us said it would never work, but we proved that it can. The support in Russia was absolutely amazing and the feedback was overwhelming. This is the best experience in my life," says Lentowicz, founder and one of the eight team members.

THE IMRC IS AN annual competition – the first of which was held in Louisville, Kentucky in 1999 – that consists of the following parts: firefighting, first aid, theory exam and mine rescue relay.

Kari Lentowicz
Freelance Emergency Management Specialist and former employee at Cameco Corporation

The teams are assessed based on how they approach problems, whether they use the right equipment and whether they treat injuries properly. The participants must be certified and experienced in mine rescue.

"Teamwork is the key. We formed a strong bond after only ten days of training and living together, which was crucial for us. I hope we can encourage more women to compete," says Kari Lentowicz.

THE FACT THAT Diamonds in the Rough ended up in 15th place out of 25 teams made her very proud – but the biggest reward would be for the team's feat of influencing countries that do not allow women underground.

"Overall, the conditions for women in the mining industry must be improved and comments that women aren't good enough shouldn't exist," says Lentowicz. ×

More en.imrc2018.ru

BLAST FROM THE PAST
YEAR 1992

Innovative products and a wide array of customers: Epiroc is a new company with a long and rich history, dating all the way back to 1873. In each issue of Mining & Construction, we take a glimpse in the rearview mirror.

Gustaf Höök
Brad McGinley

Portfolio:
Hanging Lake Tunnel

Running across America, from Pittsburgh, PA in the east to Cove Fort, UT in the west, **Interstate 70** took 36 years to complete. It is one of the biggest public works projects ever undertaken in the United States. The last link involved threading the four-lane highway through the limited space at the bottom of the Colorado River gorge east of Glenwood Springs in Colorado. This involved constructing two 1190 meter tunnels through a building containing lighting and ventilation controls, and excavating approximately 250 000 cubic meters of rock. To ensure efficient drilling, contractor **Frontier Kemper** decided to switch from pneumatic equipment to hydraulic drilling jumbos. Two **Atlas Copco Rocket Boomer H245** rigs were employed, along with **Boltec H351** rigs for bolting, and the performance was well beyond the customer's expectations. This contributed to the Hanging Lake Tunnel being completed way ahead of schedule.

More bit.do/tunnelfilm

Frida Valentin Shutterstock

AT YOUR SERVICE

Closer than you might think

OUR CUSTOMERS ARE located all over the world and so are we. There is always an Epiroc office to turn to, making us truly local. At the same time, we are a global enterprise with worldwide resources. We have Customer Centers in 33 regions. In each one, there are one or more Service Centers.

All this supports our goal: Count on us to listen, collaborate and deliver the right solutions for you.

- 01 Canada — Toronto
- 02 USA — Denver
- 03 Mexico — Mexico City
- 04 CVCA — Bogota
- 05 Andean — Lima
- 06 Chile — Santiago
- 07 Brazil — São Paulo
- 08 Argentina — Buenos Aires
- 09 Sweden — Stockholm
- 10 Finland — Helsinki
- 11 Norway — Oslo
- 12 UK & Ireland — Hemel Hempstead
- 13 Europe 1 — Essen
- 14 Southern Europe & Northern Africa — Milan
- 15 Spain — Madrid
- 16 Portugal — Lisbon
- 17 Central Europe — Prague
- 18 Turkey & Middle East — Istanbul
- 19 Russia — Moscow
- 20 Mali & Burkina Faso — Bamako
- 21 Ghana — Obuasi
- 22 Eastern Africa — Nairobi
- 23 Southern Africa — Johannesburg
- 24 India — Pune
- 25 Central Asia — Nur-Sultan
- 26 Mongolia — Ulaanbaatar
- 27 Gr. China — Nanjing
- 28 Southeast Asia (South) — Jakarta
- 29 Southeast Asia (North) — Bangkok
- 30 South Korea — Seoul
- 31 Japan — Yokohama
- 32 Australia — Perth

[In focus]
Bangkok, Thailand

Hello there!
What's happening in Bangkok?

Somnath Dutta Majumdar
Regional General Manager Southeast Asia (North)

SOUTHEAST ASIA IS one of Epiroc's fastest growing markets, and the future looks promising. The goal for 2019 is to increase sales in Vietnam, Laos and Thailand through newly appointed distributors TCMP, and Italthai Industrial, as well as the new Epiroc presence in Laos. Epiroc is also on the verge of securing a distributor in Cambodia. **Somnath Dutta Majumdar**, Regional General Manager Southeast Asia (North), elaborates.

What will the new distributors mean for both your customers and Epiroc?

"Both distributors in Thailand and Vietnam are local companies. Our distributors are closer to our customers and the local market. They understand our customers' needs and wants, which will improve our ability to service them. The distributors will strengthen our visibility in both Vietnam and Laos, and Epiroc will gain an even better reputation."

What was important for Epiroc when choosing distributors? Could you describe what process was involved to reach the agreements?

"It took two years before agreements were finalized, and all of our Epiroc business areas were involved. It's really important to have a common vision and share the same passion in what we do. We have already seen that our new partnerships are delivering results."

Find Epiroc in your country: epiroc.com


D65
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