The mining industry's leading magazine

# Mining Magazine

Established 1909

## Engines in focus
Driving innovation

## Drill & blast
Vibration control

## Healthy closure
AI's new role



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# Dear readers

Despite its often misplaced historical reputation as a safer form of mining, fatalities in surface projects in the US are on track to reach their highest in four years, with 28 deaths recorded so far, according to the Mine Safety and Health Administration (MSHA).

This stark number highlights that not enough is being done by miners in the US and around the world to keep workers safe, especially when it comes to machinery safety in open-pit mines.

"Powered Haulage" is often listed on MSHA reports on these fatalities. For example, an October report from Maple Springs mine states that "a miner was fatally injured when he was struck by a shuttle car and pinned against the coal rib."

Another report from the Genesis mine in September states that "a miner died after the service truck he was operating rolled over and he was ejected".

The fact that load and haul on the surface is the largest contributor to fatal accidents in 2023 and should not go unnoticed by senior mining executives and technicians.

The industry is often accused of lagging behind in investment in new technologies, it is disappointing to see that this issue persists, especially when there are so many suppliers working on collision avoidance, advanced fleet management, and autonomous machines.

> "Dedication to health and safety should stand above any company loyalties"

In addition to technological interventions, new processes and maintenance regimens must also be considered in the wake of these tragedies. This will require better coordination, collaboration, and communication between miners and original equipment manufacturers (OEMs) at all value chain stages, as well as greater openness to data sharing and less focus on copyright protection, bottom lines, and raw competition.

There also needs to be better protection and controls for the brave whistleblowers who report deadly safety dangers before disaster strikes. Dedication to health and safety should stand above any company loyalties, especially in an era when financial pressures may make a worker hesitate to make a remark that could cost them their job or even their home.

Sadly, MM's surface edition comes at a time when, for the first time, workers in open-pit mines are on track to overtake underground workers in the top 10 list of America's deadliest jobs. It is even sadder to note that combining underground and surface miners would push mining even higher on the list among other professions.

Happy reading

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- Mine/project safety

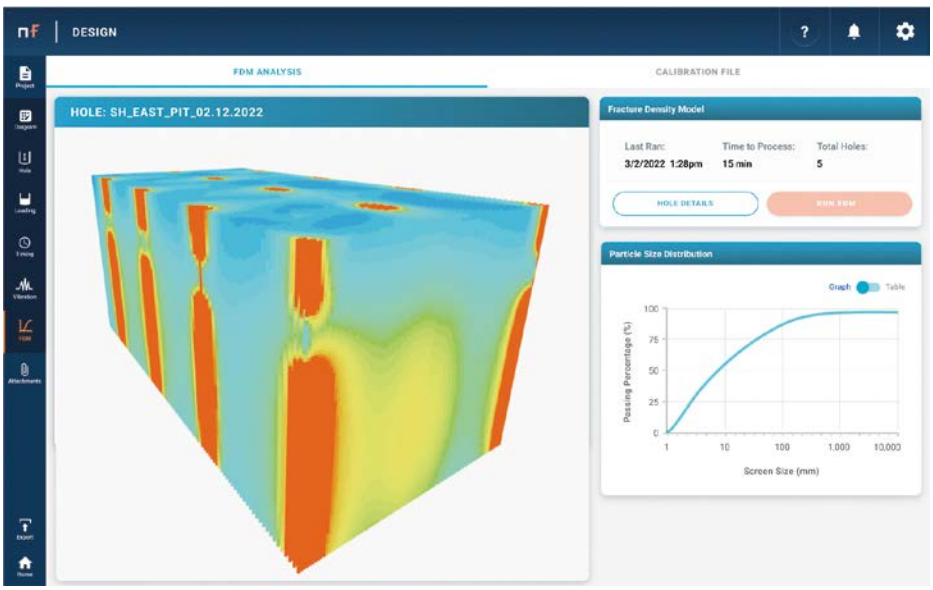
## COVER

Dyno Nobel helps operations of all shapes and sizes optimize their surface blasting programs with their world-class products, people, and services. With a full line offering of explosive products and a Drill to Mill™ view of mining operations, Dyno Nobel analyzes the entire value stream to increase production, reduce costs, and maximize results. Visit dynonobel.com to learn how Dyno Nobel can help your mine reach its goals.

# Dyno Nobel on drill & blast's data sweet spot

The software and hardware involved in drill and blast operations have both evolved hugely over the past decade, with new solutions being implemented to improve safety, environmental impact and efficiency

**By** Craig Guthrie




*Software is a vital tool in optimising drill and blast*

A growing awareness of vibration's impacts on operations, surrounding communities, wildlife, and ecosystems has helped fuel innovation in vibration control.

With more accurate and detailed modelling, drill and blast engineers can better understand how vibration will travel through the ground and how it will affect surrounding structures and communities. This information can then be used to design blasts that minimise vibration and other environmental impacts.

Advances in modelling techniques and fragmentation analysis have also led to significant gains in terms of safety and optimisation.

Fragmentation analysis can help to ensure that blasts produce fragments of the desired size and distribution. This can help to reduce the amount of energy required to crush and grind the rock, which can further reduce the environmental impact of the operation.

***Mining Magazine* talked to Ramsay McKee, senior product owner at Dyno Nobel and an experienced field engineer in mining, about his company's advances in this sector.**

**Q What are the latest advancements in vibration control technology for blasting operations?**

Traditionally, we've seen two main methods of vibration mitigation in our industry: run of the mill regression analysis and signature hole convolution methods. These have worked relatively well, with signature hole analysis being the better of the two. However, that method alone has left much to be desired when the stakes are the highest.

There are many variables that we've frankly been unable to adequately quantify due to variability in geology, confinement deviation, and amplitude and travel variability, as well as constructive wave interference based on angles at the monitoring location. This has led to a reduction in confidence around critically controlled vibration-related projects.

At Dyno Nobel, we've developed a new method that uses a signature waveform approach with a much higher degree of accuracy and confidence. We create a calibrated vibration model based on a previous production blast result, synthetically recreating a known outcome stochastically to account for those previously elusive variabilities that are inherent in blasting.

This stochastic approach gives us a statistical probability but also identifies potential edge cases that help make critical decisions based on the most likely and uncommon, but possible outcomes.

**Q How can advanced modelling techniques, such as fragmentation and heave modelling, be used to optimise blasting outcomes and minimise environmental impacts?**

Continuous improvement can be an expensive process in mining. Even with expert guidance, it still requires trial and error to get to an optimal point, whether we're talking about fragmentation optimisation, cast optimisation, or ore/waste separation.

The likelihood that we get to where we're trying to go on the first try is very low, and this means that we'll wind up with sub-optimal blasts by virtue of that process. When we look at the time and effort required to measure the results of these long projects coupled with the operational costs to allow for this, the costs and time associated often make the old process prohibitive. With accurate, physics-based modelling, the learning curve can be drastically shortened.

Using Dyno Nobel's FDM (Fracture Density Model), which is our physics-based fragmentation modelling tool that is calibrated to your specific geology, or GEM (Geologic Element Motion), our physics-based heave modelling tool,

operations can drastically reduce the costs involved with trial and error.

With FDM, operations can simulate all of their trial-and-error processes until they get the modelled outcome they're looking for, saving significant costs and reducing their environmental impact from sub-optimal blasts. Using GEM to improve heave or solve complex ore dilution problems can significantly reduce the costs associated with field-based trial and error.

Having the capability to predict and forecast fragmentation size, solve ore, and waste separation while also predicting vibration is the optimal way of planning and managing a drill and blast operation.

**Q What are the challenges and opportunities associated with implementing vibration control and advanced modelling in blasting operations?**

The main challenge around implementing vibration control and advanced modelling is measurement. It can be disruptive and time-consuming to continually monitor blasting outcomes on an ongoing basis, depending on the methodology used to collect the field data.

# Dyno Nobel and Fortescue to decarbonise drill and blast

Australian explosives firm Incitec Pivot said its Dyno Nobel subsidary has extended its supply partnership with leading iron ore producer Fortescue Metals Group

**By** Craig Guthrie

The agreement entails a continued supply of explosives technology and collaboration on decarbonization initiatives.

As part of this strategic partnership, Dyno Nobel will invest US$5 million in developing advanced technologies to support Fortescue's decarbonisation efforts in the drill and blast area.

Greg Hayne, president of Dyno Nobel Asia Pacific, highlighted their commitment to decarbonisation efforts, stating:

"We're incredibly proud of our relationship with Fortescue who are at the forefront of efforts to decarbonise the mining industry.

"The agreement will see us ramp up our decarbonisation efforts, including converting our MPU fleet to renewable energy sources and investigating lower carbon footprint, bio-fuel-based explosives. This is about providing technology solutions that lower our carbon footprint and, in turn, our customers'."

Fortescue Metals, known for its sustainable mining practices, welcomed the partnership extension. Dino Otranto, CEO of Fortescue Metals, emphasised the importance of the collaboration, "We're looking forward to continuing our successful partnership with Dyno Nobel, which will deliver blasting services and provide new technologies to help us achieve our industry-leading target of Real Zero emissions across our Australian iron ore operations."

Under the new agreement, Dyno Nobel will supply its explosive products and services to all of Fortescue's Pilbara mining operations: Cloudbreak, Christmas Creek, Solomon, and Eliwana; excluding Iron Bridge which Dyno Nobel supplies under a separate contract.

This agreement will allow Fortescue to utilize Dyno Nobel's DIFFERENTIAL ENERGY solution, which tailors energy delivery within blastholes for enhanced efficiency and reduced emissions. This technology has demonstrated the potential to reduce Scope 1 emissions by up to 25% under standard blasting conditions.

Greg Hayne underscored the positive impact of DIFFERENTIAL ENERGY, "Fortescue has already seen the technology deliver value at their Iron Bridge operations, one of the first sites in Australia to fully benefit from DIFFERENTIAL ENERGY, and the results have been very positive. We are now pleased to be increasing these advantages via a reduced emissions offering. It is just another example of our technology innovation happening on the ground."


*A logo and photo of Dyno Nobel's Mobile Processing Unit 'Sandy' wrapped in award winning Yindjibarndi artist Donna Willis' painting, Grandfather's Country*