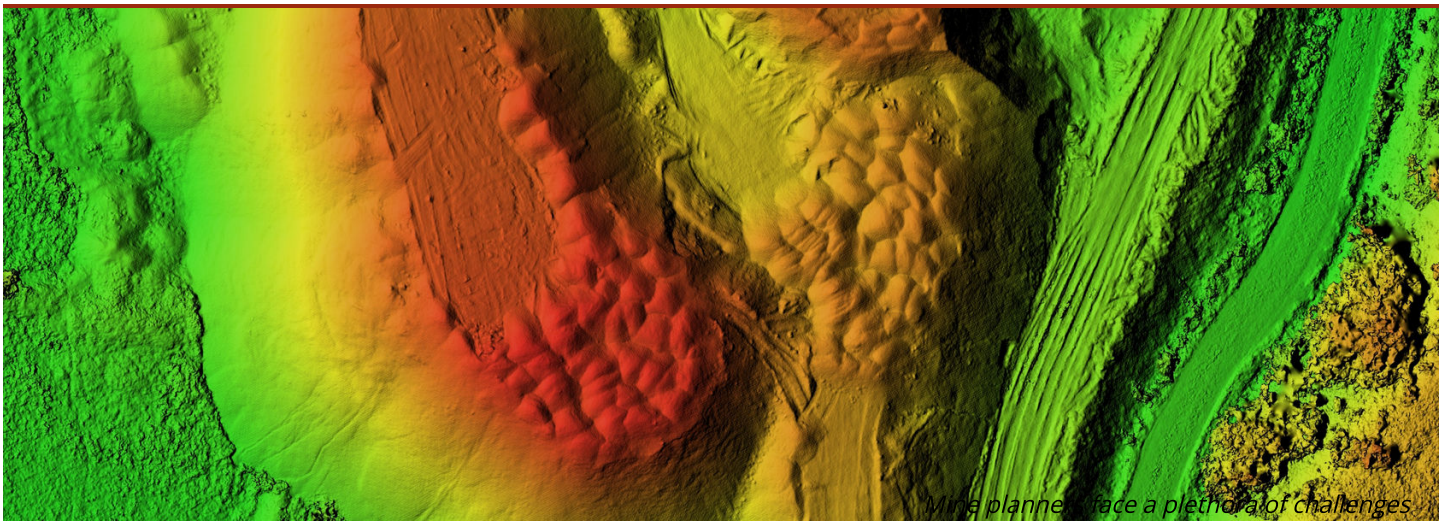
Mining Magazine

Mine planning needs a shakeup

Too much focus on achieving records and too little built-in time for variability leaves operators chasing their tails



Mine planners face a plethora of challenges

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Mine planning is a central component of pushing a mine towards development and production, and often appears to people in the industry to be irreproachable in its approach.

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Long-time Australian mining engineer Mark Bowater has had frustrations with the mine planning approach for some time, and self-published an e-book this year called *Crimes Against Mine Planning* to develop these points.

Bowater previously served as a senior planning engineer for Rio Tinto Coal Australia, Production Superintendent for Rio Tinto Iron and Titanium, and Technical Services Manager at Thiess. He also owned Echelon Mining Services for 13 years, which provided assistance on studies and technical projects on mining projects throughout Australia.

One of his critiques of mine planning is how mining plans across the world are more frequently becoming similar, regardless of geology, process, and metal.

"The prevalence of mining companies with multiple mine sites, often spread across multiple countries, has led to greater uniformity across mines globally," he writes in his book.

> ' failing to consider the unique
> pects of the deposit and the process,
> ine planners have made it harder to
> ow mining to be carried out in an
> ficient, safe manner, and have
> gatively impacted decision-making at
> e mine site.
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> oblems stem from the very start of
> e process, with competing visions of
> ny and for whom the mine plans are
> devised.

"When you ask what mine plans are for, if you ask 10 people you get 10 different answers," Bowater said.

The key is to separate mine plans into the three different categories of execution plan, information plan, and decision plan, to match with their purpose.

"The execution plan is for working out what you're doing for next week, ensuring all pieces fit together, and finishing tasks on time before starting something else," he said. "Life of Mine plans, for me they are primarily about how many tonnes per year we can produce if we assume a certain ore price, what sort of money can we make, and what point will we stop being cash positive, etc."

The middle frame is primarily needed to influence decision making, in a one- to three-year time frame. This includes deciding where the mine will be in a few years' time in terms of resources available, whether another pit is required, and

what will need to be completed before mining another pit.

Front office staff may have a different understanding of what mine plans are for, Bowater said.

"The production people think mine plans are to tell them what to do so they can hit the necessary targets," he said.

"I think financial people [at mine companies] think that mine plans are primarily to produce budgets and some understanding of future cash flows. I think when you get to the executive level, they see mine plans as providing them the necessary information to give market guidance to give stakeholders."

More flexibility needed

The biggest problems in mine planning come down to the continued use of what Bowater calls "deterministic schedules" which allow for no variability.

"We build deterministic plans, we put the work into the assumptions that go into them, but they have no variability built into them at all," he said.

One major problem with needing to target 100% compliance to mine plans is that it fails to consider the variability of machines.

"There is an extremely high variability, and it's almost ignored in mining plans," Bowater said. "I'm amazed that in my 30 years in the industry, it's just like it was 30 years ago."

Technology needs to catch up so that mining planners can incorporate variability into their plans, he said.

"I haven't been able to find mainstream off-the-shelf mining software that builds variability in," Bowater said. "Technology has had that capability for 20 years at least, and hardware exists that can run 1000 iterations of the schedule."

He places the blame squarely on the shoulders of the mining industry, for not conveying the need for this technology to software developers.

"We [the mining industry] think that we like change, but I don't think we actually like change," he said. "We have a comfort zone, and the change from a deterministic schedule to a probabilistic schedule requires a change in thinking."

Probabilistic planning would require everyone from mining executives to mining planners and workers to speak in terms of ranges, and not definitive numbers, he said.

"We need to develop this mindset," he said. "Right now, our customers aren't ready to be given answers in ranges."

Likening mine production a factory line is a standard but problematic assumption, Bowater said.

"There's a lot of thinking around the idea that we should be similar to factories," he said. "But there's a massive difference in variability between a factory line and a mine site."

Mine plans are not performance metrics

What also needs to change is how mine plans are often used to manage worker performance, Bowater said.

"I get where this driver comes from," he said. Mining plans dictate what production teams need to do and do effectively. However, mining executives want there to be some level of increased productivity built into the plans.

"That puts us in the position where generating a plan has to have some level of improvement built into it," Bowater said. "Most mining plans have this improvement built into it, but it doesn't have a plan as to how this improvement is going to be created and established."

This can lead to several outcomes, he said.

Ten to 20% of the mines Bowater has worked on have had improvement plans that were too optimistic, which led to teams being chronically behind in their tasks. This, in turn, led to an increased number of shortcuts taken, he said.

"They would get so far behind the plan that the plan was no longer of any use," he said.

It can also lead to a culture of insubordination by teams, Bowater said.

"It creates a culture of negativity to some extent," he said. "Mine planners get sick of producing plans that can't be achieved and that site workers think are a bit of a joke. Production teams then say mine plans can't be followed and call mining plans a waste of time."

One-off records are problematic

One recent development in mine production is the focus on a one-day record of production and/or processing, with more and more mine sites eager to announce this news.

Bowater believes this practice of aiming for record days is guaranteed to cause problems in the production line.

"To achieve a record shift or day normally means that the next shift afterwards is one of the worst shifts you'll have," he said. "Effectively, you've almost abused the process to get one good shift or day."

Almost invariably record shifts will be followed by low production, and requiring tweaks to the process to get it working more continuously again.

"Every time there's a record, you need to look at the rolling three or four days, and these would be below average."

This all comes down to his larger point on the need to respect the variability in the mining processes, and place more of an emphasis on continuity.

"We don't focus on consistent processes in mining," Bowater said. "For me, short-term production is never something to be focusing on. You need to keep your processes in control, and therefore within a certain level of standard deviations."

Scheduling a must

One thing that continues to puzzle Bowater is why mine operators fail to schedule drilling and blasting.

"Digging dirt is the glory, digging dirt gets the priority, it's drilling and blasting's poor cousin," Bowater said.

Mining operators and planners need to remember that they will not be able to dig if they don't complete the blasting portion first.

"We have a wrong focus in that we prioritise digging," he said, adding that without drilling and blasting it is very possible to be focusing on the less rich and less economical section of earth.

Bowater said he's seen some companies which have not scheduled drilling and blasting, preferring to assume that step will take place without taking the necessary steps to give this step the time it deserves.

"Instead of focusing on inventory management, let's focus on the right broken dirt on the right place," he said. By focusing only on shovels and not on the required drilling and blasting materials, mine planners are setting themselves up for a more dangerous path, he said.

The solution for this problem is to review the long-term planning process and see if it can be simplified, Bowater writes in his book.

Another problem is that mine planners and mine operators are scheduling items that do not need to be scheduled, he wrote. Engineers should not take the time to map out destination scheduling and truck haulage modelling, Bowater wrote.

"Those sites...are working harder, not smarter and those engineering hours could be used so much more effectively elsewhere," he wrote.

Mine planners are facing a multitude of pressures coming from various sources, Matthew Robb, VP at mine planning company John T. Boyd, told *Mining Magazine*.

"First off, resource deposits being developed are of lower quantities or lower grades, or they are in closer proximity to developed communities," Robb said.

"All of this plays a significant role in planning for the mine," he said. "Additionally, mining companies who are applying for new licences or amendments to current permits are always subject to increased scrutiny and an increased focus on stakeholders in the mining space and in ESG."

These factors lead to a delay in the time it takes to achieve permits, particularly in North America, Robb said. This makes it harder for mining companies to realise opportunities or mitigate the risks associated with quick-changing markets.

Financial pressures are also increasingly coming into play in mine planning, Robb said.

"Mining is inherently capital intensive," he said. "Given the depletion of primary source deposits, and payback periods being more extended, as well as the ESG demands on companies by shareholders, this increases capital requirements and decreases margins."

Mine planners have less room to maneouvre than ever before, he said.

"Because of higher operating costs, lower revenues, and lower rates of production, we see a greater need to increase sensitivity analyses efforts in the due diligence period in mining projects, to make sure that mine operations are going to be able to operate when there are changes in market conditions," Robb said.

Mine planners will also need to take new technologies into account when developing their plans, Robb said, ranging from electric-powered trucks and new power sources.

In the future, Robb expects to see the streamlining flow of geologic models, that will update with real data on a real-time basis.