

MINE TWIN CASE STUDY

USING SIMULATION TO EVALUATE IMPROVEMENT OPPORTUNITIES AT COMPLEX UNDERGROUND MINE

THE CHALLENGE

A complex underground mining operation in North America, with multiple ore bodies, development areas, and shared infrastructure needed a way to evaluate different improvement opportunities. Traditional planning approaches, relying on static schedules and spreadsheets, struggled to account for:

- Dynamic equipment interactions
- Resource competition across levels
- Surface infrastructure constraints

THE SOLUTION

We developed a MineTwin simulation model based on:

- Full mine layout, including stopes, headings, muck bays, ore passes, rail infrastructure, and surface logistics
- Equipment interactions for mucking, drilling, hauling, and mill feed operations
- Multiple ore production zones with dedicated crew and fleet

We imported Deswik designs and validated the simulation logic with mining personnel.

THE RESULTS

Simulation provided answers and insights on all initiatives tested:

- Adding additional ore passes did not improve throughput, but yielded 13% efficiency gains (less travel, reduced fuel consumption)
- Additional crew in 3 of the production zones resulted in 20% increase of the mine's throughput
- Drilling capacity is the bottleneck: + 1 Drill rig = +10% throughput
- Muck haul becomes constraint when mining both SLE and MCF

THE CLIENTS

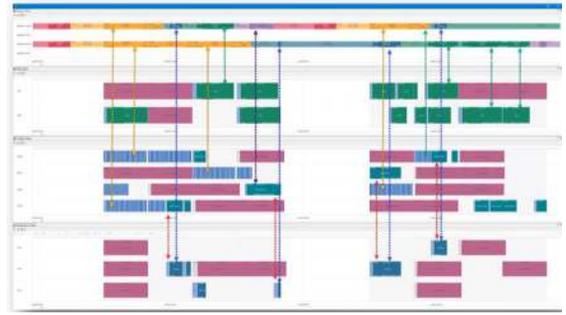


MOSIMTEC empowers businesses to make better decisions amid constant change -- from climate shifts to supply chain disruptions, automation, and global events. By guiding organizations along the simulation modeling and digital twin continuum, MOSIMTEC helps them not just prepare for change, but embrace it.

The mining client – Due to the sensitive nature of the project the final client will remain anonymous, and all the data presented here is sanitized from any identifying information. Screenshots are from a similar but different mine.

Background

The mining operation was under pressure to improve throughput while keeping costs under control. Although several improvement initiatives had been identified, ranging from equipment changes to crew reallocation, the team lacked the time, resources, and capital to test each one in the real world. They needed a safe, risk-free way to evaluate these ideas, quantify their potential impact, and prioritize the most effective strategies due to limited budget and time. To achieve this, they partnered with MOSIMTEC to develop a simulation-based digital twin of the operation.



Objectives

- **Evaluate improvement initiatives** in a risk-free environment by simulating operational changes without disrupting real-world activities.
- **Quantify the impact** of proposed changes on throughput, efficiency, and cost to support data-driven decision-making.
- **Prioritize initiatives** based on ROI and feasibility, ensuring limited time and capital are focused on the most effective strategies.

Why MineTwin

MineTwin is a simulation tool designed specifically for mining operations. It allows detailed simulation of drill, charge, blast, mucking and loading operations. This includes scheduling, truck and loader interactions, queuing, haulage delays, and stoppages.

It supports fast, flexible testing of fleet size and scheduling scenarios, helping mine planners and top management make informed decisions based on realistic operational behavior.



Analysis of Mining Cycle

Using MineTwin’s reporting and Gantt chart visualizations, the team analyzed the full mining cycle to identify bottlenecks. A key finding was that drilling was the bottleneck during most of the simulated period. Unlike other equipment, drills could not move independently and required loaders (LHDs) and crew to be repositioned between headings, which makes static calculations to determine the exact bottleneck almost impossible.

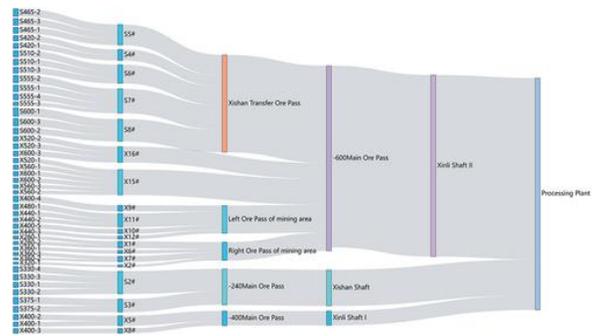
The simulation revealed there were enough LHDs, but not enough drills to keep stopes ready. Scenario testing showed that the biggest gains came from adding both drills and crew, with crew availability delivering the highest overall impact.

Determining Benefit of Additional Infrastructure

One of the major initiatives tested in the simulation was the addition of more ore passes throughout the underground mine. Operations had long believed that increasing the number of dumping points between levels would ease material flow, reduce wait times, and ultimately increase overall production throughput.

However, the MineTwin simulation revealed a surprising result: ore hauling was not the limiting factor in the system. The model showed a 13% gain in logistical efficiency, with total loaded travel distance decreasing, leading to a modest drop in fuel consumption – not higher throughput.

This counterintuitive insight proved critical. Without simulation, the team was prepared to invest heavily in new infrastructure, believing it was a key to unlocking capacity. By validating this through data, the operation avoided a multi-million-dollar capital expenditure and was able to redirect focus to changes that truly improved performance.



MINE TWIN

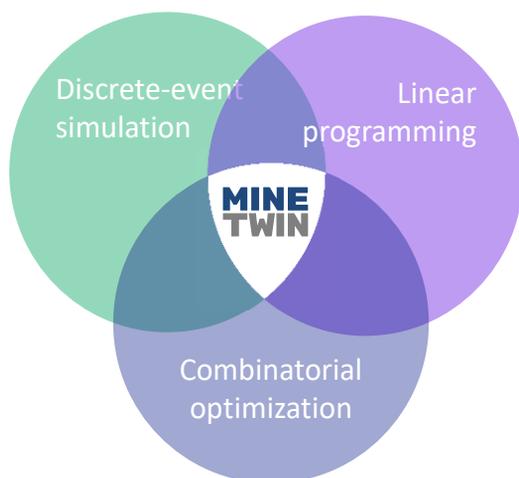
What Is MineTwin?

MineTwin is a configurable, simulation-based decision support tool designed for both underground and open-pit mines. It captures the majority of operational constraints and interdependencies found in real-world mining environments.

How MineTwin Works

MineTwin builds a simulation model—a high-fidelity digital representation of an actual mine’s operations.

It is the only platform on the market that integrates discrete-event simulation with linear programming and combinatorial optimization, enabling the creation of realistic digital twins of mines.



What Tasks Is MineTwin Best For?

Check the **feasibility of mining plans** and evaluates the impact of improvement initiatives by using a dynamic model of mining operations. Able to capture non-linear factors like queuing, dynamic ore pass stocks, coordination standby delays, etc.

Provide the means for **comparison of several potential future states** of an existing or future mine. Estimates the operational and financial KPIs of every option.

Provides the scenario analysis functionality for determining **equipment fleet configuration and size**.

Allows mine planners to verify and adjust plans and schedules based on **foreseen bottlenecks** (lack of mining fronts to work in, insufficient blasting frequency, ore and waste flows imbalance, insufficient backfill rate).

Learn More

Visit us at <https://minetwin.com>

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