MINE TWIN

CASE STUDY

OPTIMIZING STOCKPILE AND FLEET CONFIGURATION AT A SOUTH AFRICAN COAL MINE

THE CHALLENGE

Determine whether a buffer stockpile is needed in front of the conveyor—and, if so, define its optimal size

Identify the minimum number of trucks, dozers, and excavators required to reliably meet production targets after the mine's expansion

Evaluate plan fulfillment rates under real-world equipment availability constraints

THE SOLUTION

MineTwin was used to build a detailed digital model of the mine's production cycle, including:

- Realistic replication of mining sequences, haul distances (0.8–3.5 km), and equipment cycle times
- Simulation of operations with and without intermediate stockpiles
- Scenario testing to evaluate multiple fleet configurations

THE RESULTS

Simulation confirmed that a 10 kt ex-pit stockpile improves operational stability and reduces the probability of plan shortfall by 90%

The model identified optimal fleet sizes needed to achieve high fulfillment rates under constrained availability

It was determined that an additional 7 dozers and 6 trucks will be needed to sustain operations after the mine's extension

THE CLIENT

One of South Africa's largest open-cast strip coal mines

contact@mosimtec.com | +1 (855) 677-3342 | 297 Herndon Parkway, Suite 302, Herndon, VA

Client and Project Context

The study was conducted at one of the largest open-cast coal strip mines in South Africa, characterized by haul distances ranging from 0.8 km to 3.5 km.

The mine operates with a truck–shovel–conveyor system, and its managers sought a simulation-based approach to improve fleet planning and evaluate buffering strategies at the conveyor intake.

Business Questions

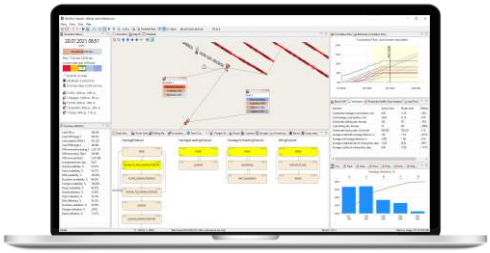
The study was initiated to answer several interdependent planning questions:

Buffering: Is a stockpile required in front of the conveyor system? If so, what should its optimal capacity be?

Fleet Sizing:

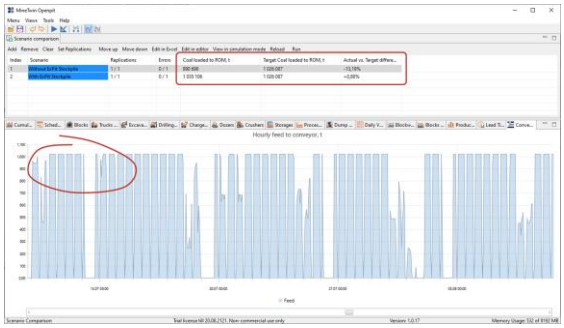
- How many trucks are needed to meet the plan?
- How many dozers are required to maintain dumping and cleanup operations?
- What is the minimum number of excavators required to consistently hit daily targets?

All scenarios were evaluated under 95% equipment availability, reflecting real-world maintenance and reliability expectations.



Stockpile Buffering Impact

Buffering Impact. Introducing a 10 kt buffer ahead of the conveyor significantly reduced system delays and allowed for smoother operation, especially under fluctuating haul cycle times.



Fleet Optimization

MineTwin identified right-sized fleets that could meet production targets with minimal redundancy:

- Overestimating fleet size did not proportionally improve throughput.
- Undersized fleets quickly led to plan shortfalls, even with high availability.
- Determined that additional 7 dozers and 6 trucks will be required to sustain the operations after the mine's extension

		Dozers count			
		4	5	6	7
Trucks count	4	-35,19%	-23,80%	-9,37%	-5,81%
	5	-36,64%	-19,20%	-4,53%	-1,66%
	6	-33,39%	-17,73%	-5,99%	0,61%
	7	-33,52%	-16,71%	-1,73%	0,54%

Why MineTwin?

MineTwin is purpose-built for mining. Unlike generic simulation or planning tools, MineTwin is designed specifically to replicate the operational realities of both open-pit and underground mines. It models detailed interactions between equipment, including truck–shovel coordination, queuing delays, and haulage cycles. This level of specificity allows it to capture non-linear constraints and cyclical dependencies that are typically overlooked by spreadsheets or linear programming models.

MineTwin bridges strategy and execution. Its simulation-based approach allows planners to test the feasibility of mine plans under realistic conditions, accounting for equipment availability, geological uncertainty, and process interdependencies. This makes it an effective link between high-level mine planning and on-the-ground operational decisions.

MineTwin is scalable, configurable, and in-house friendly. MineTwin enables mining companies to build internal competence centers that support multiple sites with a single modeling platform. It is flexible enough to adapt to different mine layouts, workflows, and business rules. Once deployed, MineTwin empowers mine planners to independently run scenario analyses, optimize fleet configurations, and evaluate operational changes—supporting continuous improvement and better investment decisions.

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

North American Representative

MOSIMTEC LLC
297 Herndon Parkway, Suite 302, Herndon, VA
contact@mosimtec.com
+1 (855) 677-3342

Mine Twin

MineTwin – Amalgama Software Design
Office 150, Al Diyar, Al Wasl, Dubai, UAE
info@amalgamasimulation.com
Middle East: +971 056 208 6327
Europe: +351 911 999 319