

MATERIAL HAULAGE TRUCK SIMULATION

NURIZON

CASE STUDY

SALDANHA, WESTERN CAPE, SOUTH AFRICA

PROJECT OVERVIEW

Sound Mining initiated a Preliminary Feasibility Study (PFS) for a proposed coastal strip-mining heavy mineral operation located near Saldanha Bay. A critical component of the feasibility phase was the optimisation of mobile mining equipment and trucking logistics over the life of the mine. Given the capital-intensive nature of mining equipment and the long-term operational cost implications, Sound Mining required a data-driven, simulation-based solution to support strategic decision-making.

NURIZON SCOPE OF WORK

Scope included:

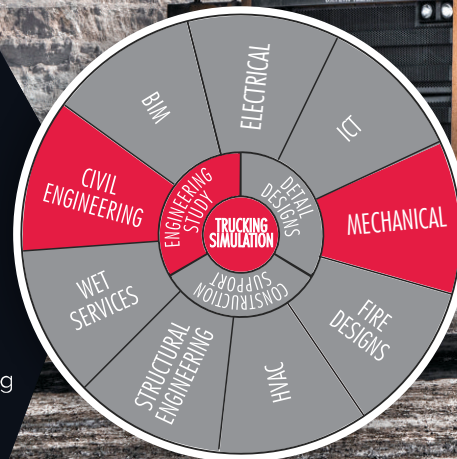
- Development of a dynamic simulation model for mine haulage
- Evaluation of multiple equipment and fleet size scenarios
- Integration of production targets across the Life of Mine
- Assessment of operational cost drivers, including fuel consumption
- Review of traffic flow, congestion, and safety risks
- Support to mine planning and feasibility decision-making

ENGINEERING DISCIPLINES COVERED

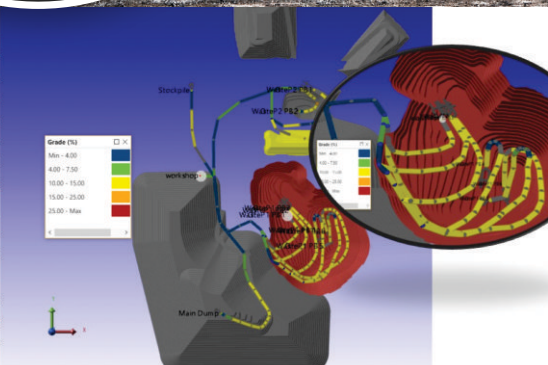
The project required an integrated, multidisciplinary engineering approach:

- Simulation Modelling
- Mine Planning
- Fleet Logistics
- Operational Costing
- Traffic Engineering
- Mining Safety Engineering

This ensured that technical optimisation was balanced with cost efficiency, safety, and operational practicality.



Route Name	Average Distance round trip (m)
Pit1PB1 to Stockpile	3,870.19
Pit1PB2 to Stockpile	4,401.86
Pit1PB3 to Stockpile	4,891.81
Pit1PB4 to Stockpile	5,239.52
Pit1PB5 to Stockpile	5,744.16
Pit1PB6 to Stockpile	5,676.41
Pit2PB1 to Stockpile	4,158.55
Route Name	Average Distance round trip (m)
Pit1PB1 to Main Dump	3,908.95
Pit1PB2 to Main Dump	4,440.65
Pit1PB3 to Main Dump	4,930.60
Pit1PB4 to Main Dump	5,278.31
Pit1PB5 to Main Dump	5,782.95
Pit1PB6 to Main Dump	5,715.19
Pit2PB1 to Main Dump	5914.23



KEY PROJECT INFORMATION:

Item	Detail
Project Name	Sound Mining – Trucking Simulation
Location	Saldanha, Coast of South Africa
Mine Type	Heavy Mineral Coastal Strip Mining
Construction Value	R58 million (Mobile Equipment)
Design Duration	8 weeks
Construction Duration	6–8 months (equipment lead time)

Key Challenges:

Balancing equipment cycle times across multiple potential tip locations

- Optimising haul road distances without fixed routes
- Aligning productivity targets with equipment availability
- Managing fuel consumption and operating costs
- Ensuring safe traffic interaction between mobile equipment
- Achieving long-term alignment with Life of Mine production targets

UNIQUE PROJECT CONSTRAINTS

- Every mining schedule is unique, requiring a custom-built model
- Coastal strip-mining introduces changing haul profiles over time
- Capital expenditure decisions had to be justified over the entire Life of Mine, not short-term outputs
- Safety risks increase significantly when haulage routes are not predefined
- These constraints ruled out rule-of-thumb or static calculations.



SOLUTION APPROACH

Nurizon developed a bespoke trucking simulation model tailored specifically to Sound Mining's operational parameters.

Key features of the solution:

- Dynamic modelling of haulage cycles and distances
- Scenario-based analysis of fleet size and equipment selection
- Integration of production schedules and material movement
- Quantification of capital vs operational cost trade-offs
- Evaluation of traffic interaction and safety performance
- Ability to test multiple "what-if" operational scenarios
- The simulation allowed Sound Mining to evaluate decisions before committing capital.

UNIQUE VALUE DELIVERED

The trucking simulation provided a unique, project-specific solution that could not be achieved using standard design methods.

Key differentiators:

- Fully customised to Sound Mining's evolving mine plan
- Enabled informed, data-driven decision-making
- Reduced financial risk associated with equipment procurement

RESULTS AND OUTCOMES

What was achieved

- Optimised equipment selection, balancing capital and operating costs
- Identification of the most cost-effective fleet configuration
- Improved alignment between production targets and haulage capacity
- Reduced long-term fuel and operating costs
- Enhanced traffic safety and operational efficiency
- A robust, defensible input into the Preliminary Feasibility Study

CONCLUSION

This Trucking Simulation project demonstrates Nurizon Consulting Engineers' capability to deliver high-value, simulation-driven engineering solutions for complex mining operations. By combining simulation modelling, mine planning, logistics, and safety engineering, Nurizon enabled Sound Mining to optimise mobile equipment investment and operational performance over the full Life of Mine. This case study highlights the importance of advanced engineering analysis in reducing risk, improving efficiency, and supporting sustainable mining development.