

# Simulation of Grade Engineering® mining processes

PROJECT P2-005

The aim of this project is to develop models to simulate, validate and optimise Grade Engineering (GE) approaches for an operation. Models are being developed to test impacts or run simulations to find the optimal combination of equipment and technologies for a given mine plan (factoring in a variety of operating scenarios and control parameters). The models forecast the behaviour of the mining system, helping identify potential bottlenecks, resourcing and sequencing issues. This will reduce implementation risk and increase the success of deploying new GE solutions. The models can be imported into the Integrated Extraction Simulator (IES), allowing mine planners to regularly simulate scenarios during the operation of a mine, with a view to maximising mineral extraction value.



## Research collaboration



This project brings together knowledge, skills and technologies from Mining3, CRC ORE, and the University of Queensland. Mining3 will manage the project and conduct the research in mining process modelling, discrete event simulation, in-pit mining systems, and minerals processing.

The University of Queensland School of Mechanical and Mining Engineering is a member of Mining3 and brings research and industry experience to this project, specifically in In-Pit Crushing and Conveying (IPCC) and time utilisation modelling for mining systems.

Working closely together with CRC ORE the models will be developed to be able to plug into the Integrated Extraction Simulator (IES) for scenario planning based on value metrics. CRC ORE will provide example data, model validation, and Grade Engineering® expertise to support the development of new mine process control strategies.

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**Project Leader:** Erik Isokangas, Mining3  
**Timing:** July 2017 – December 2018  
**Participants:** Mining3, CRC ORE, University of Queensland School of Mechanical and Mining Engineering

Image: GE SIM visualisation. Image supplied by Mining3.

## Background & aims

Novel Grade Engineering® solutions such as in-pit crushing and screening, add a level of complexity to resource management and the decision-making process in a mine. Complexity is introduced through material transport time, equipment resourcing, along with planned and unplanned delays. Ore is typically mined from multiple faces, potentially impacting on heterogeneity. These all affect the characteristics and stability of the material delivered to the ROM and the total value achieved.

This project aims to develop the methods and models to improve the understanding of material flows and resource utilisation in complex operations. It will allow for development of appropriate operationally sustainable methods of Grade Engineering®. Modelling methods will also be developed for short-term scenario planning, identifying the actions which will maximise the value of the final grade engineered product.

## Focus on outcomes

The project will deliver:

- A method to incorporate GE processes, such as grade-by-size block models, into discrete event time-based simulation systems.
- Discrete event equipment and process models that employ GE control levers, reliability and time-usage functions.
- An interface to IES to provide a feedback mechanism to inform and control mining process models based on total value metrics.
- A method for IES-integrated scenario planning; simulating thousands of variations in time-dependent mining parameters, to identify the best opportunities to maximise value of the GE solution.