PROGRAM 4:
CONTROL

Enhanced value through Grade Engineering®

PROJECT P4-007

This project will develop algorithms and methodologies to integrate Grade Engineering yield-responses into resource block models and scheduling. It will coordinate with plant simulation and optimisation models by considering multiple simulated realisations of some mineral recoveries.

The project aims to develop a mathematical model that incorporates Grade Engineering attributes and simulated realisations of plant mineral recoveries.

The model will be used to generate optimal mine production schedules and add value by allowing greater coordination between the mine and processing stages of the operation. The outcomes will be particularly useful in the planning and scheduling component of the operation as there is no known commercial method currently available for the industry.

Curtin University

CRC ORE

Research collaboration

Curtin University brings significant expertise to this project, including:

- The development of mathematical models and their implementation through exact and heuristic algorithms in diversified computer programming/IT setups.
- Comparative analysis between the new (proposed) and existing (commercial software) methods for optimal production planning of mining operations.

This project will be supported by a PhD student with a strong background in mathematical modelling, algorithms and computer programming.

Curtin University's computing facilities and the supercomputing facilities at the Pawsey Centre will be utilised.

Program Coordinator:	Paul Revell, CRC ORE
Project Leader:	Associate Professor Mohammad Waqar Asad
Project Co-Investigators:	Dr Elham Mardaneh Dr Mehmet Cigla
PhD Student:	Karo Fathollahzadeh
Timing:	Dec 2017 – Jun 2021
Participants:	Curtin University

Background & aims

This project aims to utilise an orebody model with Grade Engineering attributes for the development and implementation of a mixed integer linear programming (MILP) based mathematical model for production planning or scheduling of the mining operations.

The objective of the mathematical model is to maximise the discounted value (NPV) of future cash flows over a given planning horizon. This is subject to a number of operational constraints. These include mining and processing capacities, waste dump capacity, mining block precedence, reserve, as well as any Grade Engineering related constraints.

The mathematical model aims to incorporate the multiple simulated realisations of some relevant parameters (for example, recoveries) generated through the plant simulation and optimisation models. This will help establish a relationship between the mining and processing stages. Including plant simulation will add to the computational complexity of the open pit production planning/scheduling models. The current algorithms in the industry are not able to be used.

The computational complexity in open pit production scheduling comes from the presence of a number of binary variables that represent mining blocks with an intending decision on whether to mine a given block, and if a block is worth mining, what the most suitable time is to mine the block. One of the aims of this study is to develop heuristic approaches to solve this computationally complex mathematical model.

Focus on outcomes

The aim of this project is to provide an improved, realistic, alternative solution to current mine production planning. This will be in the form of a software program integrating:

- Grade Engineering yield-responses into resource block models and scheduling.
- Attributes from plant simulation and optimisation models in terms of mineral recoveries.
- New heuristic algorithms that solve computationally complex problems within reasonable time.
- The ability to generate higher discounted value of future cash flows (NPV) as compared to the existing methods.

crcore@crcore.org.au
www.crcore.org.au

Australian Government
Department of Industry, Innovation and Science
Business Cooperative Research Centres Program

CRC ORE
Optimising Resource Extraction