FINAL PROJECT SUMMARY

# Enhancing Value through Grade Engineering - a heuristic method for optimal production scheduling of mining operations

Project number: P4-007
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## PROJECT OUTCOMES

- The implementation of new models using exact method generates up to 11% higher value and using simulated annealing based new algorithm generates up to 20% higher value for problems that integrate GE into the system.
- The new SA-algorithm reflects better performance and efficiency for both with and without-GE problems. It generates a net present value within 4.1% by consuming 83% less time to solve the medium-scale problems as compared to the true optimal solution from the exact method.
- The new SA algorithm efficiently solves the large-scale instances of the with and without-GE problems in up to a maximum of 960 minutes. The traditional exact method failed to solve these instances of the problems.

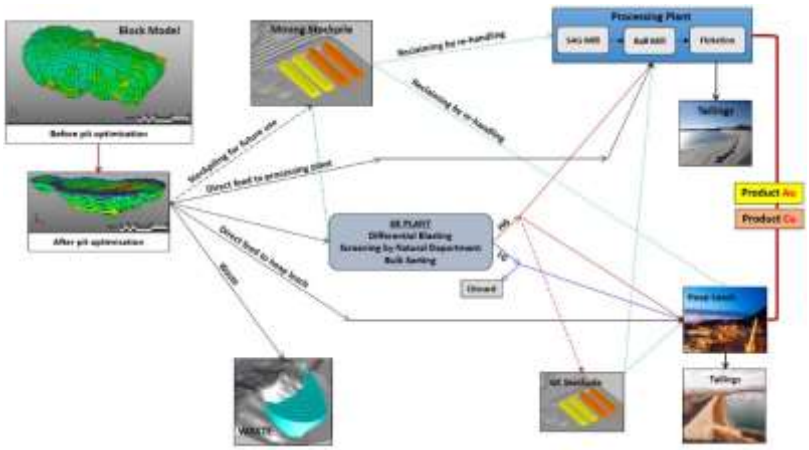
## RESEARCH COLLABORATION

This project was a collaborative effort between Curtin University and the Cooperative Research Centre for Optimising Resource Extraction (CRC ORE). Curtin University brought significant expertise to this project. The project was supported by a PhD student with a strong background in mathematical modelling, algorithms, and computer programming. Curtin University's computing facilities were utilised. The supervisory team included three academics with significant expertise in mine planning and industrial optimisation. CRC ORE staff provided exceptional support during this research. Specifically, the support around the access and understanding of the inputs to the models as well as review of research outputs (journal and conference articles) facilitated the successful completion of this project.

## BACKGROUND TO THE PROJECT

An open-pit production schedule defines the flow of materials (ore and waste) from source to destinations. The project aims to demonstrate the value of integrating the coarse-separation based Grade Engineering® (GE) techniques into the supply chain of an open-pit mining operation. It aims to:

- Develop new mathematical models with and without Grade Engineering techniques.
- Solve mathematical models through available exact and new metaheuristic approaches using authentic data sets.
- Evaluate the performance new algorithms against available exact methods.
- Report the value created through Grade Engineering techniques.




A framework of an open-pit mining operation with Grade Engineering© techniques