MINING INSIGHTS

10 Things You Should Know About Mine Planning for Open Pit Stratified Deposits

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"Open pit strip mining requires a lot of mine planning effort to provide quality product at lowest cost possible. Appropriate approach and mine planning methods facilitate this task and add value to the business."

Foreword

Many approaches can be taken when planning a stratified open pit project for the first time. The best method allows the mine planner to work with the deposit's unique characteristics. When planning to mine a stratified deposit by open pit methods, planners should consider the following points:

01 | Your project is different from others, think what's important!

Typical considerations associated with stratified deposits include: *bulk mining* including common commodities such as bauxite, coal, iron ore, manganese and oil sands & shales; deposits that cover *large surface areas*; and *blending ore types* to achieve desired product quality.

02 | Choose suitable planning tools and methodologies before commencing your study

Often, grid models can be used to characterise stratified deposits in a more appropriate way than block models. They also provide additional flexibility for mine planning. If you are familiar with planning tools and methodologies associated with metalliferous deposits, consider alternative approaches before commencing your study.

03 | Three main approaches to apply mining dilution and losses to roof and floor contacts are[1]:

Exclusive - mining loss is applied at the ore/waste contact without dilution; *Inclusive* - mining dilution is applied at the ore/waste contact without losses; *Standard* - both mining dilution and losses are applied at the contact. Alternatively, a hybrid of these methods can also be applied. Choosing an approach to dilution and loss will relate primarily to the assumed mining equipment, quality considerations and the economic margin of the ore.

04 | Economics are the primary driver that defines pit limits

Pit limits may be influenced by several factors including hydrological constraints, lease or permit boundary, topographic gradient, the location of related infrastructure, and quality cut offs. Good mine planning of a stratified deposit includes defining pit limits through a pit optimisation process that is supplemented by margin ranking. To define an optimal project case, it typically requires multiple iterations of scenarios to assess dilution/loss approaches and quality cut off options to determine saleable material types.

[1] *P. Westcott, G Pitkin, T Aspinall – Monograph 12 – Australasian Coal Mining Practice, Chapter 18, Open – Cut Mining, p. 430*

Figure 1: Margin Ranking Inputs

05 | Margin ranking is indispensable when developing mining strategies

Margin ranking allows a deposit to be assessed using vertical columns of mining blocks to establish an economic value or margin. Margins are the difference between estimated revenue and cost associated with mining the column, including ore and waste material. Economic margins can then be assessed for the entire column or incrementally if multiple horizons are present.

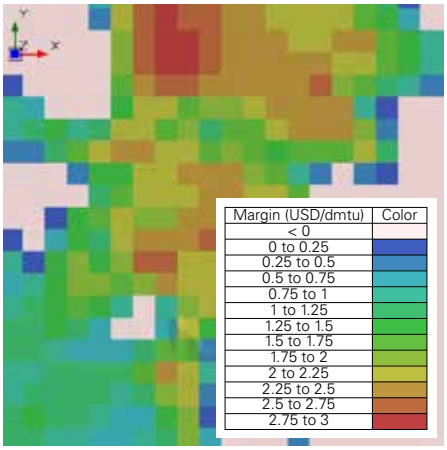
06 | Use contour maps of key planning parameters to guide your approach

Prior to designing pits, contour maps should be generated to visualise physical properties of the deposit and to verify results of the margin ranking exercise. Typically, the most common contour maps are created for elements such as strip ratio, ore thickness, waste thickness, key quality parameters and margin value. Use these physicals properties to guide the mining sequence.

07 | Cut-off grades and product specification play important roles

Product specifications and the associated cut offs that define volumes of saleable product are generally of higher importance than a typical economic mining cut off grade calculated for most metalliferous deposits.

Figure 2: Block Margin Value Distribution



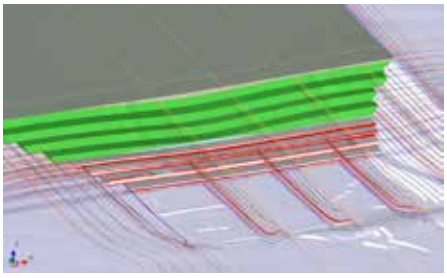
08 | Geotechnical analysis is not only about pit slopes, excavatability is equally important

Due to large surface areas covered by strip mining, the geometry of the pit walls can be of lesser importance than regular open pit operations, although pit slopes angles are still a material consideration for high strip ratio deposits. In stratified deposits, there is often potential for high productivity mining methods using surface miners, scrapers, draglines, or equipment for ripping and free digging. Analysis of excavatability as part of geotechnical studies will help to better define the most appropriate mining method.

09 | Take advantage of mined areas to shorten haulage distances by introducing backfill

Strip mining creates a mined void that can be backfilled with waste. This process can reduce haulage distances, equipment requirements and lead to lower mining costs. Good mine planning and sequencing will minimise ex-pit waste storage and maximise the use of the in pit void.

Figure 3: Mine Planning and Geology



10 | Pit wall geometry may be simple but haul routes need good planning and design

Side walls allow for horizontal ramps to connect mining faces with advancing backfill. Ensure to match the elevation of those ramps with mining areas and with the backfill. Think ahead of operational aspects like trafficability and access to road building materials.

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