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Design of regional pillars for the Khuseleka Ore Replacement Project (KORP) - UG2

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ABSTRACT

Depletion of mineral resources is a reality of mining. It is critical that as resources get depleted, new reserves are subsequently opened up continuously if a mine is to continue operating. Failure to open up new reserves will result in a mining operation running out of reserves and ultimately ceasing operations. Besides the economic considerations of an ore reserve such as the grade and tonnage, stability of the mining operation is of equal importance. A mine should remain stable for the entire period that it remains operational.

Pillars play a critical role in ensuring the stability of an excavation; actually, regional pillars ensure the overall stability of a mine. It therefore goes without saying, pillar design is an integral component of any successful mine design.

This project was undertaken with the objective of ensuring that the new reserves being opened up in the Khuseleka Ore Replacement Project (KORP) section are not only profitable, but also stable. This was done through

a) maximisation of extraction ratio, thereby maximising the mines' profitability.

b) designing the regional pillar layout for the KORP section using current empirical and numerical pillar design methods and comparing the results to come up with the most optimal design.

c) ensuring the stability of the on and off reef mine infrastructure by determining the Rockwall Condition Factor (RCF) values on the footwall infrastructure due to pillars left above and thus prevent damage to these excavations through stress induced failures. Consideration was given to the standard Khuseleka footwall infrastructure layouts for the design based on the planning department's layout of haulages and crosscuts for the KORP section. The layout of the footwall excavations indicated that the pillars would be differently sized thereby having an influence on the APS, pillar strength and factors of safety of the regional pillars.

d) numerical modelling analysis of the effects of leaving stabilizing pillars on the 27 raise line where the haulages intersect the reef horizon.

The methodology employed for this undertaking involved a critical literature review of existing pillar design methods, applying and comparing them, and coming up with an economic and safe design.

To be able to design a pillar layout that met the objectives listed above, engineering design principles had to be applied. It involved gathering the relevant geological and geotechnical

information required as input parameters for the different empirical and numerical analyses methods.

What came out from this project was that each method employed yielded its own set of results. This highlighted the need to understand the context under which a design is carried out and the shortcomings of each method employed. It showed how important it is to have all the relevant information of not only the characteristics of the rock mass in which an excavation will be made, but also on the strengths and limitations of the tools available to design a structure. It highlighted the fact that to minimize uncertainty and have a more robust design, it was necessary to spend time and effort in gathering as much relevant data as possible. In the end engineering judgment was used to decide on the best method or system to employ in the design of the pillars.