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Investigating slope stability in an open pit mine – a case study of the phyllites western wall at sentinel pit

Simataa, Ephraim

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ABSTRACT

Slope stability is critical for final wall in open pit mining operations. Not only is slope failure costly to manage, it might also be accompanied by loss of lives. Factor of safety is very critical during the slope design phase, however, the execution of the design is as important as the design phase itself. Among the many factors affecting stability of highwalls, geology, groundwater and blasting are at the top of the list. This research takes a kinematic stability analysis approach and investigates the possible failure mechanisms in the phyllites rock mass. The data collected from the structural geological mapping along with the window mapping classifies the rock as fair to good rock. The induced failures causing reduced catchment berms and consequently longer bench heights are largely influenced by the prevailing geological conditions, presence of groundwater seeping through the highwall and quality of blasting being conducted.

Amongst the factors influencing slope stability, blasting is the only controllable one. Therefore, adjustments to the blast designs need to be made as mining progresses keeping in mind that rock is not homogeneous. Wall control blasting techniques should be continuously adjusted depending on the Rock Mass Rating or blastability index of the rock mass in that area. Hydrogeological testing of boreholes including Packer testing was conducted in order to estimate the hydraulic conductivity. Adjustments to blast designs were made taking due cognizance of the geological conditions as well as presence of ground water.

Adjustments to the wall control blasting techniques need to be made as mining progresses through the different rock mass zones.

A few blasts on the lower levels (mining benches below 1112RL) were conducted which saw an improvement in the quality of the highwall. Further adjustments to blast designs need to be made as the pit gets deeper and as geological conditions vary.