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Influence of pit wall stability on underground planning and design when transitioning from open pit to sublevel caving

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ABSTRACT

This research sought to address the influence posed by the pit wall stability and instability on underground planning and design when transitioning from open pit to underground. Conventionally, empirical methods are used and they sometimes lack consideration of rock mass behaviour, groundwater effects, structures as well as geological considerations. This can potentially result in massive failures of pit slopes and subsequent loss of infrastructure, excavations, loss of machinery and human lives. It was against this background that this research sought to reduce mining exposure to the above mentioned hazards. In line with the aims and objectives of the study, this research investigated stress changes around the pit slopes with progression of mining and also the influence of geological and geotechnical conditions on mine planning. This was done so as to determine the zone of geotechnical influence from which planning of the underground mine would be done. Elastic 3D numerical modelling approach was used to determine the expected underground back break and its influence on the underground structure, pit slopes as well as the primary access. Different Factor of Safety shells were modelled, so that the corresponding zone of influence for each Factor of Safety could be correlated to the mine design. The results suggested that a Factor of Safety of two was ideal for this research for underground infrastructure to be outside the zone of geotechnical influence from start to finish of mining the first slice until the last fourth slice of the sublevel caving. This approach yield better projections of rock mass and slope behaviour since it considers a broad range of parameters that include rock mass strength properties, geology, geo-mechanical parameters, groundwater and rock behaviour.