

THESIS SUMMARY

EVALUATION OF STOPE SUPPORT USING A SYSTEMATIC BUSINESS APPROACH

EVALUATION OF STOPE SUPPORT USING A

M.J. PRETORIUS

ROCKMASS STIFFNESS APPROACH

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Degree:

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the requirements for the degree of**

The study that is described in this thesis deals with stope support design using a rockmass stiffness approach. Three models were developed and combined into a single one in the third model. The first model describes stope support design using a rockmass stiffness approach. The second model describes rockmass behavior and is referred to as the rockmass demand. The two models are represented on a stress-strain load-deformation graph during the third model of the study. Here the design of stope support is determined according to the position of the rockmass demand curve on the graph. The third model is a design configuration of stope support and rockmass interaction.

PHILOSOPHIAE DOCTOR (ENGINEERING)

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THESIS SUMMARY

EVALUATION OF STOPE SUPPORT USING A ROCKMASS STIFFNESS APPROACH

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The study that is described in this thesis deals with stope support design from a rockmass stiffness approach. Three models were developed and combined into a single one in the third part of the study in an attempt to describe and quantify the stope support and rockmass interaction.

The first model describes stope support with all the factors having an influence on its performance, where this is referred to as the capacity of the stope support. The second model describes rockmass behaviour and is referred to as the rockmass demand. These two models are represented on a common load-deformation graph during the third part of the study. Here the demand of the rockmass is compared to the capacity of the stope support as a whole. In contrast to previous design attempts, both the demand and the capacity for any given situation are considered as variables. The demand varies according to the position relative to the abutments and the capacity varies according to the state of deformation of the support. Each combination of mining configuration, rock type and support type results in a unique base set within which variation is allowed according to position.

This is achieved by:

- (a) comparing the energy released by the rockmass to the energy absorbed by the support system for a given deformation interval; and
- (b) comparing the rockmass stiffness to that of the support system at any given point of deformation.

The methodology is tested by two case studies on Beatrix Gold Mine. In the first study the condition of unstable failure of the support was evaluated where the support failed and the stope collapsed in a relatively short span of time. This is referred to as unstable failure of the stope. The underground observations were confirmed by the outcome of this study. The energy released by the rockmass, that is rockmass demand, exceeded the capacity of the stope support after a given stage of mining. The absolute value of the rockmass stiffness was also less than the absolute value of the load-deformation curve of the stope support for the same mining interval.

During the second case study some elements of the stope support failed while the excavation remained open and stable. Underground observations again confirmed the model during this study. Here the Pencil Props failed some distance from the stope face. In this case the absolute value of the rockmass stiffness was less than the magnitude of the negative load-deformation curve of the Pencil Props, while the Matpacks have a positive load-deformation behaviour throughout the deformation process. In the latter case the total energy generated by the rockmass never exceeded the capacity of the permanent stope support. This is referred to as stable failure of the stope support.

The study proves that it is possible to evaluate stope support even when a combination of different supports is used as permanent support. The latter is achieved by adding the capacities of the stope support as deformation takes place and comparing that to the rockmass demand for the same mining steps.

KEY WORDS:

1. Stope support
2. Tabular orebody
3. Rockmass demand
4. Support capacity
5. Influencing variables
6. Stability analysis
7. Energy
8. Stiffness
9. Unstable failure
10. Stable failure

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(Sturges as we know it today) as well as that of the Miners, including all the services that are related to the stope including that of the Surveyor and the Clerk of the Recorder.

Agriens identified certain geological environments but did not have the necessary technical knowledge that we have today to determine the problems or even the solutions to the geological properties of the rockmass as being "harder" and "harder" and "harder". He has stated: "Since the whole mountain, or most especially the whole hill, is underlain, it is necessary to leave the natural pillars and arches of the place undisturbed". This will be described as pillar rock mass support in today's terminology.

He further went on to say: "But sometimes when a vein is very hard it is broken by the fire, whereby it happens that the soil pillars break up, or the timbers are burnt away, and the mountain by its great weight sinks into itself, and then the shaft buildings are swallowed up in the great substance. Therefore it is advisable to sink some shafts which are not subject to this kind of ruin, through which the materials that are excavated may be carried out, and only while the pillars and underpinning still are whole and solid, but also after the supports have been destroyed by fire and have fallen". We would refer to this as stalling layout and having a second outlet.

In the latter part of the book he simplistically states that the rock mass in a stope tunnel that is "crumbling" or "hard" requires "more timbering" than the other, and in some instances the "harder" and "harder" rocks do not require any support at all. It is evident that timber played a major part in the mining process and it was clear that a mine be situated where trees and water were readily available. The timber used