

MANDELA MINING PRECINCT
MINDS FOR MINES

Guideline:
Rock Engineering Criteria for Mechanised Mining

science & innovation
Department
Science and Innovation
REPUBLIC OF SOUTH AFRICA

CSIR

MINERALS COUNCIL
SOUTH AFRICA

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About the Mandela Mining Precinct



The Mandela Mining Precinct is a Public-Private Partnership between the Department of Science and Innovation and the Minerals Council South Africa. The Precinct is jointly hosted by the Council for Scientific and Industrial Research and the Minerals Council. The Mandela Mining Precinct is an initiative aimed at revilatising mining research, development and Innovation in South Africa to ensure the sustainability of the industry. This is achieved through the South African Mining Extraction, Research, Development and Innovation (SAMERDI) strategy.

The strategy comprises six research programmes:

1. Longevity of Current Mining;
2. Mechanised Mining Systems;
3. Advanced Orebody Knowledge;
4. Real-Time Information Management Systems;
5. Successful Application of Technologies Centred Around People; and
6. Test Mine.

This summary was developed under the **MECHANISED MINING SYSTEMS (MMS)** research programme. The programme is aimed at providing sustainable mechanised drill, blast and mechanical rock breaking solutions in advancement to facilitate achieving zero harm, whilst maintaining and defending desired production rates at minimised costs, within the Au, and PGM mining industries.

MECHANISED DRILL AND BLAST PROGRAMME: **2018/2019**
MDB18WP4.3.1

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Executive Summary

This research report emphasizes the necessity for a comprehensive understanding of the various factors influencing pillar strength and stability in different reef types, particularly in the context of the South African mining industry. It is highlights that a single test site is insufficient for drawing generalized conclusions, necessitating multiple test sites to account for the variability in geological conditions. It advocates for a scoping project under the supports of SAMERDI to explore the requirements for a large pillar strength project, suggesting that the Hedley and Grant formula may be overly conservative in certain scenarios, thus presenting potential benefits for the industry. The report also discusses the importance of conducting laboratory testing and numerical modelling to assess the impact of weak layers on pillar strength. It recommends initiating a smaller scoping project to evaluate the feasibility and resource requirements for a more extensive study, potentially involving postgraduate students and the establishment of a dedicated research centre. The report underscores the need for further research in this area, indicating that significant advancements and benefits could be achieved for the mining sector through a deeper understanding of rock engineering principles and their application in mechanised mining practices.

Methodology

Discuss results from the literature reviews. Learnings of failures and successes and establish criteria and guidelines for future ventilation design and strategy specifications and requirements.

Research Findings

The Hedley and Grant power-law strength formula is identified as the current best practice in South Africa, although it was originally derived for Canadian uranium pillars and should be applied with caution due to varied geological conditions. Establishing a pillar monitoring program is essential for ensuring ongoing stability, incorporating visual observations, closure monitoring, and stress measurements. Many mines have adjusted the K-value (strength factor) from the classical assumption of K=1/3 UCS based on numerical modeling, requiring careful implementation and monitoring. Accurate assessments of pillar strength necessitate the use of numerical modeling tools capable of managing irregular shapes, with codes like TEXAN or MAP3D recommended for this purpose. The presence of weak layers in pillars may lead to significant stability issues, necessitating alternative design methods or the incorporation of large barrier pillars. Additionally, caution is advised when using the PlatMine formula, as it may overestimate pillar strength and yield unrealistic predictions. Ultimately, due to the uncertainty surrounding pillar strengths, a combined approach using empirical methods and numerical modeling is recommended to investigate potential failure mechanisms, particularly in challenging ground conditions. Further research is necessary to fill existing knowledge gaps, especially regarding pillar strength and geological influences.

Conclusion

In conclusion, additional research into this topic is required and significant benefits from this may be derived by industry. A project with a longer-term duration will also be beneficial to rebuild research capacity in South Africa.

Way Forward

As a next step, a scoping project under the auspices of SAMERDI needs to be conducted to determine the requirements for the proposed large pillar strength project in the South African mining industry. As the Hedley

and Grant formula may be conservative in many cases, the benefits of such a project may be significant for South Africa.