

MANDELA MINING PRECINCT
MINDS FOR MINES

Guideline:
Equipment and Communication Utilisation

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**
MDB18WP4.4

Contact details: enquiries@mandelaminingprecinct.org.za
www.mandelaminingprecinct.org.za
Editor: Martin Pretorius, Mandela Mining Precinct
Author: Dr Abrie Oberholster, UP

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

The research methodology was to consult local and international sources including literature as well as industry representatives on current and emerging technologies in addition to learnings from successes and failures. Considering the unique situation and environment of the SAMI, these findings were then consolidated to yield a guideline tailored for the SAMI. As such, it was crucial to incorporate and address factors such as community engagement and sustainable job creation in the literature for later use in the guideline. This required a new philosophy in the decision-making process of mining companies, for which approaches such as multi-objective decision making were found to be ideally situated.

Research Findings

The research methodology involved consulting local and international sources on current and emerging technologies, as well as industry representatives, to develop guidelines tailored for the South African mining industry. Multi-objective decision making, and data envelope analysis were investigated as alternatives to standard cost-benefit analysis to guide mines in decision-making, allowing consideration of factors like community engagement. Successful implementation of mechanisation requires proper change management to address organizational, institutional and human factors. Key considerations for implementing trackless mining systems include technology maturity, availability of skills, proper equipment selection, maintenance strategies, and collaboration between technology developers and mines. Deep learning models were identified as promising for analysing the large amounts of diverse machinery data to better understand performance, health and lifecycle costs. The research emphasized the importance of a holistic approach considering all factors from commissioning through use and maintenance.

Conclusion

A draft guideline for the implementation of mechanised and autonomous mining was developed, specifically for the narrow reef hard rock mining operations in the SAMI. Since each mining operation is unique, the guideline is intended to not be overly prescriptive, but at the same time, it should serve as a pragmatic and useful "tool" to narrow reef hard rock operations in the SAMI. The guideline was developed by combining best practices found through literature review with feedback and inputs obtained from industry workshops. In developing the guideline, careful consideration was given to ensure relevance to operations of different sizes and at different stages in the mining lifecycle. Through the inclusion of several multi-faceted sections,

the guideline gives due consideration to factors such as community and stakeholder engagement, mine longevity and skills development.

Way Forward

TCS approved, implementation of guidelines in mechanised mining operations for the 2021 work. The guideline is a "live" document and will require to be updated frequently to reflect the latest relevant technology developments as well as findings from the RTIMS and SATCAP programmes.