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Forecasting Mine Seismicity – Towards a More Established Methodology

Vakili A, Harvey F and Greaves H

1. Abouzar Vakili MAusIMM(CP), Principal Geotechnical Engineer, Mining One Consultants, Australia

2. Fred Harvey MAusIMM, Senior Geotechnical Engineer, St Barbara Limited, Australia

3. Harley Greaves MAusIMM, Senior Geotechnical Engineer, Mining One Consultants, Australia

ABSTRACT

Mine seismicity is one of the most difficult geotechnical risks to manage in seismically active mines. There are currently some established empirical and statistical methods that provide quantitative measures for seismic hazard assessment in operating mines. However, these methods are most suitable for quantifying the current or historical seismic hazard and often cannot be directly used to forecast the future hazards. Numerical modelling is the only analytical tool that can capture the level of complexities required for a meaningful analysis of mine seismicity and therefore to facilitate a reliable forecast of future hazards. However, there is currently no widely accepted and established guideline and methodology for analysing and forecasting mine seismicity using numerical modelling.

This paper first provides a background on previously published studies on this subject and then outlines the key aspects that can affect the reliability of the forecasting for mine seismicity. These aspects include a) processing of historical seismic data, b) selection of suitable numerical modelling tool, c) Post-processing and interpretation of the model outputs. A step-by-step guideline is then proposed for forecasting mine seismicity using numerical modelling. Finally, a case study is presented for the Gwalia Deeps Mine where this method was developed. High-quality seismic data for a period of 5 years was used for back-analysis and comparisons with the numerical modelling outputs. After the development of the method, the future seismicity was forecast for the next 12 months and the actual seismicity was monitored against the forecast during this period.

Results of this study show promising potential for the proposed method to be applied more routinely and at other mine sites. However, more validations are required at Gwalia Deeps mine as the mine proceeds to deeper levels. In addition, the method should be tested and validated at other mining operations before it can be established as a proven method.