

Rock Slope Stability Comparison Between Deterministic and Probabilistic Block Theory Analyses for an Open Pit Mine in the USA

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Abstract

A new formulation is developed to perform a probabilistic block theory analysis. Based on that a new procedure and algorithm are developed to perform both deterministic and probabilistic block theory analysis. The variability of the discontinuity orientation and shear strength is incorporated in the probabilistic block theory analysis. Discontinuity orientation is treated as a bivariate random variable including the correlation that exists between the dip angle and dip direction. The developed new procedure was applied to perform both deterministic and probabilistic block theory analyses for a part of an open pit mine in the USA. Needed geological and geotechnical data for the analyses were obtained from field and laboratory investigations. The variability of the discontinuity orientations resulted in important differences between the probabilistic and deterministic block theory analyses results. The results confirmed that the design value selected for the Maximum Safe Slope Angle (MSSA) for a particular region in the open pit mine based on the deterministic block theory analysis can be on the unsafe side. In summary, the results clearly showed the superiority of probabilistic block theory analysis over the deterministic block theory analysis in obtaining additional important information with respect to designing rock slopes. The calculated values agree very well with the existing almost stable bench face angles reported by the mining company.

Reference

- [1] Zheng, J., Kulatilake, P.H.S.W., Shu, B., Sherizadeh, T. and Deng, J. "Probabilistic block theory analysis for a rock slope at an open pit mine in the USA", *International Jour. of Computers and Geotechnics*, DOI: 10.1016/j.compgeo.2014.06.002, Vol. 61, pp. 254-265, 2014.