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Application of the 3-D laser scanning method for assessing the stability of fractured rockmass at an underground limestone mine in Korea

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Underground mining is increasing in Korea, primarily due to the depletion of high quality mineral resources from surface open pit mining, and also due to the fact that environmental regulations are gradually tightened and strengthened. For sustainable mine design, safety and environmental issues are the most important factors forcing more specified and systematic guidelines to secure the stability of the mine openings and adits. However, with complex geological settings and various types of rock discontinuities, a geological mapping process to analyze the behavior of fractured rockmass is generally time-consuming. Information on the geologic structures are often collected by visual observation and analyzed based on two-dimensional drawings. Even worse, very limited and unrepresentative data are collected specially at operating mines leading to unreliable conclusions. Hence, construction of three-dimensional hydrogeological models adopting sophisticated surveying techniques has become a routine site investigation process. Laser scanners of high-end specifications are widely used in Korea. In this study, the Trimble X7 with automatic calibration and in-field registration capability has been used to collect accurate geospatial information at an underground limestone mine adopting the room-and-pillar method, with three drifts 9~12m wide and 6m high. For the two pillars of major stability concern, laser scanning was performed to obtain point-cloud data from which a total of 581 discontinuities were extracted. A discrete fracture network was simulated and the stability was evaluated based on the safety factor and displacement using a numerical model.