



Detecting the eroded caves behind a shotcreted slope protection using thermography: a case study

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Taiwan is a mountainous country, and 75% of the landform is hills and mountains. Heavy rainfalls and typhoons are primary external forces to damage slopes, and thus slope prevention is a vital task for the disaster prevention. Shotcreted slope preventions are usually used to maintain the integrity of the rock mass at slopes neighboring the mountainous highways in Taiwan. However, the highway authority of Taiwan found that erosion behind shotcreted prevention is primary reason to result in the damage of a shotcreted slope prevention. In addition, evaluating the integrity of the rock mass behind high shotcreted preventions remains a question, as well as, checking a huge amount of slope in a short period of time. This paper attempts to apply thermography to solve this question. A field study was conducted at a highway slope next to the Tsenwen Reservoir at Tainan County to identify the existence of eroded caves behind a shotcrete-protected slope. The temperature variation, calculated from the highest and lowest temperatures measured at each point on the shotcreted surface by the thermography, is utilized to evaluate the integrity of the rock mass behind the concrete. In addition, ground penetrating radar (GPR) is performed at three selected locations near the toe of the slope of concern; while the necked eye observations and knocking tests are conducted at two of the selected areas were applied to confirm the results. The soils, taken out from the rock mass and the abnormal sonic echo, as well as strong GPR reflection patterns, demonstrate the existence of eroded caves behind the shotcreted surface. In addition, the locations of strong GPR reflection and large temperature variations coincide with each other and thus verify the applicability of thermography in evaluating the integrity of rock mass behind the shotcreted surface.

Key words: Thermography, shotcrete, ground penetrating radar, slope