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Terrestrial laser scanner and infrared thermography in rock fall prone slope analysis

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The stability of a rock slope is strongly conditioned by its geomechanical characteristics, mainly by the discontinuity distribution within the rock mass. Discontinuities, such bedding planes, joints and faults, are planes of weakness cutting the intact rock, so failure tend to occur preferentially along these surfaces. Most of the discontinuity properties are determined in the field. These include orientation, roughness, spacing, persistence and infilling. From the discontinuities' properties, the main sets can be identified and a stability analysis can be performed. To collect information on the discontinuities' properties, observations are typically carried out with a traditional geomechanical survey, in which the direct access to the rock mass is necessary for a detailed investigation. Recently, the 3D terrestrial laser scanning (TLS) technique has been proposed as an alternative technique to perform geomechanical analysis in a remote way. With respect to the traditional survey, the TLS technique has many advantages: acquisition of the 3D geometry of the rock mass surface, without a direct contact with the slope, high density of the acquired point cloud, leading to a high accuracy the identification of the discontinuity surfaces, and high grade of automation that can be implemented, allowing to save time both in the acquisition and elaboration steps. The data provided by a TLS survey, after georeferencing, can be used in order to obtain information about the discontinuities geometry and, in case of very detailed surveys, in order to analysis the roughness of the discontinuities surfaces. In order to obtain information about the fracturing condition of the rock mass, the infrared

thermography (IRT) has been also applied. It is a rapid and non-destructive testing providing information about the temperature distribution of the investigated surface. Transient IRT can be used to determine time variation of heating and cooling on the rock surface, allowing improving the quality of the 3D rock mass geometry obtained by TLS. In fact, the thermal characteristics of the body are hardly conditioned by the macroscopic and microscopic fracturing of the rock mass. This procedure has been applied in a test site characterised by a rocky quarry face, located in the Euganean Hills (Padova, northern Italy).