



## **Performing geo-mechanical characterization of carbonate rock masses in underground caves through Laser Scanner Technique**

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Terrestrial Laser Scanning (TLS) survey provides a product consisting of millions of geo-referenced points, to be managed in space, to become a suitable database for morphological and geological-structural analyses. Studying by means of TLS a rock face, partly inaccessible or located in very complex environments, allows to investigate slopes in their overall areal extent, thus offering advantages both as regards safety of the workers and time needed for the survey. In karst environments, with particular regard to underground caves, the use of laser scanners might become a very crucial tool to have the opportunity to cover logistically difficult sites. At the same time, TLS alone cannot be used for a complete geo-mechanical characterization, but it needs to be integrated by specific elaborations, addressed toward the identification and measurement of the main discontinuity sets in the rock mass, and their interactions with the rock walls, depending upon the orientation of these latter.

In this contribution we describe the activities carried out at the site of the Grave of the Castellana Caves, a famous show cave in Apulia, southern Italy. The Grave is the natural access to the cave system, produced by collapse of the vault, due to upward progression of instabilities in the carbonate rock mass. It is about 55-m high, bell-shaped, with maximum width of 120 m. Given the morphology of the wide bell-shaped cavern, and the overhanging walls at several locations, there are some potential instability problems which needs to be carefully evaluated, since the site is visited by a high number of tourists.

Through the use of the innovative TLS survey techniques, and detailed elaborations and analyses of the point cloud, we were able to characterize the carbonate rock masses from the structural and geo-mechanical standpoints. This work was further integrated and checked by the collection of field data through the classical approach, by performing geological and structural surveys on rope and at the base of the cavern. The comparison among the data obtained from different technique showed a good agreement, thus confirming the validity of the outcomes from the TLS technique.

The final part of the contribution deals with the potential use of TLS technique in karst and underground environments.