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## A comparison of multi-view 3D reconstruction of a rock wall using several cameras and a laser scanner

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**Abstract.** This work presents a comparative study between multi-view 3D reconstruction using various digital cameras and a terrestrial laser scanner (TLS). Five different digital cameras were used in order to estimate the limits related to the camera type and to establish the minimum camera requirements to obtain comparable results to the ones of the TLS. The cameras used for this study range from commercial grade to professional grade and included a GoPro Hero 1080 (5 Mp), iPhone 4S (8 Mp), Panasonic Lumix LX5 (9.5 Mp), Panasonic Lumix ZS20 (14.1 Mp) and Canon EOS 7D (18 Mp). The TLS used for this work was a FARO Focus 3D laser scanner with a range accuracy of  $\pm 2$  mm. The study area is a small rock wall of about 6 m height and 20 m length. The wall is partly smooth with some evident geological features, such as non-persistent joints and sharp edges. Eight control points were placed on the wall and their coordinates were measured by using a total station. These coordinates were then used to georeference all models. A similar number of images was acquired from a distance of between approximately 5 to 10 m, depending on field of view of each camera. The commercial software package PhotoScan was used to process the images, georeference and scale the models, and to generate the dense point clouds. Finally, the open-source package CloudCompare was used to assess the accuracy of the multi-view results. Each point cloud obtained from a specific camera was compared to the point cloud obtained with the TLS. The latter is taken as ground truth. The result is a coloured point cloud for each camera showing the deviation in relation to the TLS data. The main goal of this study is to quantify the quality of the multi-view 3D reconstruction results obtained with various cameras as objectively as possible and to evaluate its applicability to geotechnical problems.

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