Terrestrial Laser Scanner and Close Range Photogrammetry point clouds accuracy assessment for the structure deformations monitoring

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Key words: Deformation measurement; Engineering survey; Laser scanning; Low cost technology; Photogrammetry

SUMMARY

The research concerns a series of tests performed to evaluate the accuracy achieved with the geomatic methodology of Terrestrial Laser Scanner (TLS) and Close Range Photogrammetry (CRP) in the study of deformations of structures subject to phenomena disasters such as earthquakes, fires etc. Through this study the methodologies of elaboration and the treatment of the results have been defined.

The experimentation involved the study of deformations of two reinforced concrete beams subjected to loading and unloading operations.

For each loading phase, surveys were performed with both TLS and CRP. To validate these results and to univocally define the Reference System (RS) to which all the measurements and in particular the vertical displacements refer, two metrological system were used:

● The Leica Laser Tracker AT402 (LT), with its target system;

● The AICON MoveInspect DPA System with Nikon D3x Camera (DPA), with its target system.

For measurements and processing with TLS, the Focus 3D laser scanner and the JRC Reconstructor Software were used.

For the CRP measurements, two low-cost cameras from Canon were used, the Powershot S110 and the EOS M6. The image processing was performed with the Photoscan software.

To obtain the values of the z coordinate, on the point clouds of TLS and CRP, two types of

processing were carried out:

- mesh2mesh, to calculate the values of the z coordinate in the sections corresponding to the location of each DPA target;

- modelling, in Matlab, the top profile of the beam in the different load conditions with second degree polynomials and extracting the z values at the location of each DPA target.

The calculation of the displacements was obtained by the difference between the z coordinate in the initial condition and the z coordinate obtained in each load condition.

Moreover, for the CRP the displacements on DPA targets were measured collimated, both automatically and manually.

The results obtained on the comparisons between the two techniques and the DPA showed an TLS global rms of about 0.6 mm in the modelling technique and about 1 mm in the mesh2mesh technique. For the CRP the rms values are higher, about 0.9 mm for the CRP with automatic collimations and about 2 mm for the manual ones. For point clouds, rms of about 1 mm in the modelling technique and about 2 mm for the mesh2mesh technique were found.