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EMPIRICAL ANALYSIS OF THE ACCURACY OF PULSED LASER SCANNERS UNDER DIFFERENT MEASUREMENT CONDITIONS

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Terrestrial laser scanning is becoming increasingly widely used in engineering surveying, especially in the area of displacements monitoring and performing diagnostic measurements. Empirical assessment of laser scanner accuracy in real measurement conditions is of great importance when assessing the suitability of scanners for specific engineering applications. This paper describes an empirical analysis of the accuracy of two pulsed laser scanners: Leica ScanStation C10 and Riegl VZ-400i. The tests were conducted in two measurement environments: inside and outside the building, where test bases were designed and made in the form of a set of several reference points, i.e. reflective targets. During the tests, the deviations of spatial distances, spatial angles and coordinates were analysed obtained on the basis of the results of scanner measurements in relation to precise total station measurements treated as reference.

The obtained results indicate that the values of spatial distance deviations between pairs of targets for measurements performed inside the building are comparable for both scanners. The mean absolute error (MAE) was 1.6 mm for the Leica scanner and 1.9 mm for the Riegl scanner. For measurements outside the building, the Leica scanner proved to be more accurate. The MAE of spatial angle deviations between targets for measurements inside the building was 54.2^{cc} for the Leica scanner and 96.3^{cc} for the Riegl scanner, while outside the building it was 28.7^{cc} for the Leica scanner and 73.0^{cc} for the Riegl scanner. The average error of matching the local scanner system to the reference coordinates inside the building was 0.9 mm for the Leica scanner and 1.3 mm for the Riegl scanner, and outside it was 0.8 mm for the Leica scanner and 2.5 mm for the Riegl scanner. Additionally, the accuracy of the reference sphere approximation was tested. The analyses carried out prove that even older scanner models (ScanStation C10) have high measurement accuracy, useful in engineering surveying, despite the significantly slower measurement compared to modern scanner models.