Relative Accuracy of Mobile Device Reality Capture

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SUMMARY

The past few years has seen an exponential rise in the availability and adoption of mobile device reality capture solutions. The applications leverage in-built LiDAR and camera sensors to produce visually rich 3D models of small, localised areas. While using mobile devices provides a simple efficient method of capturing data, surveyors are often on the side of caution due to uncertainties regarding positional accuracy. Advancements in RTK rover receivers have significantly improved providing centimetre absolute accuracy although there is still ambiguity when determining relative accuracy between points. Typically, in photogrammetry, relative accuracy ranges between 2-3x the GSD (Ground Sampling Distance) however with the inclusion of LiDAR and non-linear sensor movement further analysis is required. As adoption of reality capture increases, this study aims to determine the relative accuracy of mobile devices when compared with traditional methods and highlight potential factors to consider.

A 4x3 grid of structural monitoring points were installed on a masonry wall to allow for relative comparison of set points along the structure, coupled with wider point cloud analysis. Primary Data for analysis was collected using the Emlid Reach RX, with Pix4D Catch utilising GNSS and RTK modes at three proposed camera locations, 1, 2, and 3 meters away from the structure. Secondary Control data for comparison was captured utilising a TOPCON MS05 AX monitoring station for high precision coordinates, and TOPCON GLS-2000 LiDAR scan for point cloud comparison.

Photogrammetry data processing was conducted utilising primarily Pix4D Matic and Epic Games Reality Scan for comparative data. Created models underwent manual selection of coordinates within subsequent models, allowing for relative accuracies of coordinates between different methods. Coordinate differences were measured and compared with all platforms across the 4x3 grid, with distances ranging from 200-1050mm in horizontal and vertical planes to determine any

discrepancies in accuracy. Further cloud-to-cloud analysis was undertaken on cloud-to-cloud volumetric changes, measurement of model deformation, and the impact of GSD on the overall relative accuracy of outputs.

The results showed a consistent sub-centimetre accuracy across all marked points and average relative distances across samples to be between 0.5-3mm across all testing methodologies. Wider point cloud analysis indicated some section loss across mobile device solutions, with some model deformation noted, particularly in GNSS samples and further disparity of results utilising different processing solutions.