

ABSTRACT

The use of Global Navigation Satellite System (GNSS) reference points plays a crucial role in controlling the accuracy of Unmanned Aerial Vehicle (UAV) photogrammetric spatial data in river boundary mapping. PT Karta Bhumi Nusantara has implemented this method to map elongated areas, such as the Bekasi River riparian zone project. This project requires highly accurate coordinate references to generate products that comply with the 1:1.000 map accuracy standards. Data processing in the project currently relies on a local reference, whereas direct binding to Continuously Operating Reference Stations (CORS) or a combination of both could be alternative options. The extent to which these different methods influence the accuracy of aerial photograph products based on Circular Error (CE) and Linear Error (LE) testing—remains unknown. This condition highlights the need for a study that directly compares these reference differences, particularly within the Bekasi River riparian zone project. Consequently, this final project evaluates the impact of using different control point references on the horizontal and vertical accuracy of photogrammetric products.

This final project utilized data from differential static GNSS measurements at 13 Benchmark (BM) points (comprising 7 ICPs and 6 GCPs) and aerial imagery data from a DJI Matrice 350 RTK drone. The BM RINEX data processing was conducted using Trimble Business Center (TBC) software across three reference methods: local, CORS, and combination. The local reference method utilized a pre-processed reference BM point, which was subsequently used to process the other BM points. The CORS reference method employed BIG CORS stations to process the target BM points. The combination reference method was executed by binding the target BM points to both the CORS station and the local point (reference BM). Aerial imagery data processing was performed using Agisoft Metashape Professional software to generate orthophoto and Digital Elevation Model (DEM) products. These products then underwent geometric quality testing using the Geospatial Information Agency (BIG) standard calculations for Circular Error (CE) and Linear Error (LE). Furthermore, this final project conducted a significance test of coordinate differences across the schemes using a one-way analysis of variance (ANOVA) statistical analysis at a 95% confidence level. This significance test aims to determine whether the differences in map accuracy produced across schemes are statistically significant.

The use of the combination reference point (Scheme 3) proved to be the scheme that produced the most stable horizontal positions among the three methods used. Essentially, all three schemes yielded standard deviation values within the meter range, specifically between 0,001 m and 0,009 m. Photogrammetric product testing for Scheme 3 resulted in a CE value of 0,265 meters and an LE value of 0,050 meters. The significance test was conducted using a one-way analysis of variance (ANOVA) that simultaneously compared the discrepancies (errors) between the photo coordinates and the field BM point coordinates used as ICPs across the three schemes. The results of this test indicated that the calculated F-value for the coordinate components (X, Y, Z) was smaller than the critical F-table value (3,55). This condition demonstrates that variations in the reference schemes (local, CORS, and combination) do not exert a significant influence on the photogrammetric products. The resulting photogrammetric products consistently met the predetermined map accuracy standards, despite the variations in control points.

Keywords: GNSS, Photogrammetry, Reference Point, River Riparian, Circular Error (CE), Linear Error (LE)