

130

Simultaneous GIS-Georeferencing Approach of Neighboring Scanned Cadastral Blocks Using Least Squares Solution

Majed Kharabsheh, Yaser Abu Hahook, Ghadi Younis

Palestine Polytechnic University, Hebron, Palestine

Abstract

Cadastral maps are the definitive technical output of land registration, delineating property boundaries and forming a national heritage record. In Palestine, British Mandate authorities first conducted systematic surveys, followed by the Hashemite Kingdom of Jordan in the West Bank and Egypt in Gaza, producing field books and block maps that record parcel extents. While English-era records are largely intact, Jordanian-era documentation is scarce. The Palestinian Land Authority digitized its paper archives twice—initially as low-resolution monochrome scans and later as high-resolution grayscale images—then adopted the resulting vectors as base layers in platforms such as Geomolg. However, unassessed spatial accuracy and misalignments at block interfaces limited their utility for precision surveying.

This thesis presents a unified georeferencing methodology employing a simultaneous least-squares adjustment to align multiple contiguous cadastral blocks in a single solution. Focusing on Jordanian-era maps from the village of Dayouk, we first extract surviving boundary control points—iron posts, stone markers—and recover triangulation and Cartesian intersections. Validation coefficients compensate for missing marks, integrating all observations into one normal equation system. By solving for the complete suite of transformation parameters concurrently, the approach minimizes residual discrepancies along shared block borders, effectively reducing gaps and overlaps.

Comparative analysis against conventional block-by-block georeferencing demonstrates that the simultaneous adjustment yields superior positional accuracy (sub-meter RMSE) and seamless block integration. The outcome is an updated, high-precision cadastral base map that preserves original map detail while providing a robust foundation for land administration and advanced geospatial applications.