

**EXTENSION OF GEODETIC REFERENCE NETWORK USING
SATELLITE POSITIONING TECHNIQUES FOR GEOSPATIAL
APPLICATIONS**

(A Case Study of Nyeri and Kirinyaga Counties)

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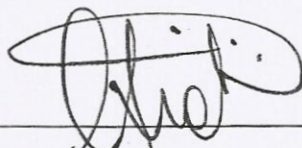
Department of Geomatic Engineering and Geospatial Information Systems

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Science in Geospatial Information Science and Remote Sensing in
Dedan Kimathi University of Technology**

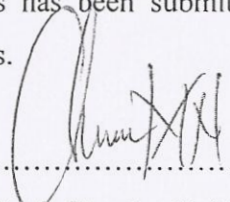
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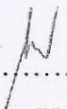
DECLARATION

This thesis is my original work and has not been presented for a degree in any other university.

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This thesis has been submitted for examination with our approval as the university supervisors.

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ABSTRACT

A national geodetic network provides the fundamental support for land surveying, mapping, Remote Sensing, engineering and related applications and is the basis for integrating all such activities. About 80 per cent of the primary geodetic control points in Kenya, established in the early twentieth century on hilltops, have been destroyed. This has resulted in expensive and time consuming operations and processes for geospatial professionals and scientists. This situation is even worse in the Central Region of Kenya, hence, the need to extend geodetic control by establishing more control points on secure and accessible sites for use by geospatial professionals and scientists in a wide variety of applications.

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In this study, modern satellite positioning techniques have been utilised to extend geodetic reference network in Nyeri and Kirinyaga Counties. Four (4) existing geodetic control points were used to establish up to sixty one (61) newly constructed geodetic control points distributed within the Counties. Field observations were carried out using geodetic Global Positioning System (GPS) in eighteen (18) sessions. The raw data was downloaded, edited, processed and adjusted using Leica Geo-Office GPS processing software. The resulting final adjusted coordinates had maximum standard deviation of 2cm and 5cm on horizontal and vertical coordinates respectively and the general loop misclosures of less than one parts per million (ppm). The results showed that the quality of establishment of control point positions was high and demonstrates extension of geodetic control network using modern satellite positioning systems and efficient computational techniques in situations such as the one prevailing in Kenya currently.

High resolution satellite image (Quick Bird, 0.6m resolution) was georeferenced using the achieved high accuracy geodetic control points. The image was then used to develop a digital land use/cover map of Dedan Kimathi University of Technology that was quite accurate as compared to the existing topographic map of the same area. The digital map is also quite flexible in that it can be updated any time to reflect the real situation on the ground besides being printed whenever one needs a copy.

Therefore, the relevant authorities and stakeholders are encouraged to embrace the modern GNSS technologies and high resolution satellite images to develop modern digital maps and other geospatial files at large scale in order to phase out the old topographic maps. This will play a big role in promoting socio-economic development and realization of Vision 2030.

This study therefore, recommends the modernization and extension of the geodetic reference network using modern GNSS technologies and make the control data available to the Geospatial scientists, Surveyors and the public for use in a variety of surveying, mapping and infrastructural developments geared towards achievement of the Vision 2030.

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The study also recommends the use of and accessibility to satellite images and aerial photographs of high resolution in developing digital topographic maps, land use/cover maps and various geospatial files for multi-disciplinary applications geared towards socio-economic, research and scientific development.