THE APPLICATION OF GNSS AND PUBLIC PRIVATE PARTNERSHIP IN CADASTRAL MAPPING FOR e-CERTIFICATE OF OCCUPANCY (e-C of O) OF MAKURDI, BENUE STATE, NIGERIA

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ABSTRACT

Government of any state in Nigeria issues Certificate of Occupancy (C of O) to show effective occupation and other benefits but it is usually characterized by long delay. In some cases, it is never issued. An investment model called Public Private Partnership (PPP) and space based surveying technique (GNSS) have been applied to produce Certificate of Occupancy (C of O) electronically called e-C of O for better, faster and safer security features. The space based technique was used in positioning and data collection of Makurdi and environs of Benue State. This involved the establishment and re-establishment of coordinates of each parcel (plots) of land. The data captured were processed and presented as information to produce land title documents for obtaining e-Certificate of Occupancy (e-C of O). Cadastral information and plans arising from this application of GNSS has been used to meet government and applicants' desires in a record time. The reliability and confidence in data are equally ensured. GNSS application to surveying is reflected in the time savings, labour reduction and associated accuracy achievable when compared with conventional methods of surveying. It was observed that the use of digital technology is yet to be in our laws. It has proved successful as it has yielded in many property owners obtaining their certificate of occupancy in good time and with ease and more revenues have entered the coffers of government. It is recommended that appropriate legal framework should be put in place to ensure that this project is sustained

Key words: Certificate of Occupancy, Public Private Partnership, GNSS, e-C of O, Cadastral Surveying, Coordinates.

INTRODUCTION

Global Navigation Satellite System (GNSS) has become a highly successful and tested space based technique in modern surveying and very apt for use in Cadastral Surveying to meet timelines in acquiring C of O for property/land transactions. It gives the current situation of parcels of land and properties. GNSS technique is used for positioning with centimeter accuracy (Mikael et al 2012). Cadastral Surveys are specially designed large scale surveys, generally linked to land ownership and property. It provides land related information to support the certainty of ownership, right to land, facilitates the process of conveyance and give legal protection to land tenure (Appiah, 2013).

Cadastral map (a product of cadastral surveys) shows and documents boundaries of parcel of land and ownership, by production of documents, diagrams, sketches, plans and maps. It shows details like names, boundary beacon numbers, location, plot numbers, zone number, distances and bearings, area, title, scale (both graphically and numerically), road

details, adjoining properties, plan number, name of surveyor, signature and seal, north direction and such others as regulations demand. Survey information from Cadastral Surveying form the basic block or bedrock of Land Information System used for Management of land matters or infrastructure.

Benue State covers a land area of 34,059sq. Km and located between latitude 06° 25'N to 08°08'N and longitude 07° 47'E to 10°00'E. The state has twenty-three (23) Local Government Areas with Makurdi as both State Capital and Local Government Headquarter. The need for up-to-date Cadastral maps for the state is very important and for the State Capital in particular. The population of the state is 4,253,641 according to 2006 census figure.

The need for quick and accurate data for processing Certificate of Occupancy (C of O) has necessitated the use of space techniques (GNSS) in the data capture. The application of GNSS has the capabilities of reducing time taken to process and obtain C of O since the most basic data required; survey information are collected and processed accurately within days.



Fig. 1: Map of Nigeria showing Benue State



Fig. 2: Map of Benue State showing Makurdi LGA in circular shape

Objectives

The objectives of the study are:

(i) To use GNSS techniques to capture necessary data for mapping.

(ii) To produce final survey data and drawing for issuance of e-C of O to applicants.

(iii) To demonstrate that a Public Private Partnership Model can be used to achieve this and indirectly lead to up-dating existing land survey records.

(iv) Produce digital data for take-off of Benue State Geographical Information System (BENGIS).

Scope of the Study

The scope of these studies is limited to Makurdi Township and environs of Benue State. This involved the use of RTK DGPS methods, Hi-Target GPS receivers, excel and notepads Software and SUPVPACK/GEOSOL software for final survey data production and AUTOCAD for drawing survey plans or maps at various scales.

Survey Plan or Map

Cadastral Survey plan is the foundation block of any Cadastre. The plan is produced by Registered Surveyor who does the measurement and keeps a record of the boundaries of each plot of land/property. Information shown on a plan represents the position on currency at that particular time and hence may sometimes be referred to as static in time.

When a survey plan is registered with the appropriate authority, it becomes a legal instrument according to existing legislation. Cadastral Survey plans are used by various professionals for valuation, taxation, real estate transactions, planning of infrastructures for urban renewal, etc and by surveyors to re-establish boundaries like in the ancient Egyptians did after River Nile flooding centuries ago.

The maps are maintained by government and are open to public for sighting and perusal obliging viewers with as much information as possible about land. In all, the map is legal map for recording ownership of property and the boundaries and is one critical foundation for any successful Geographic Information System (GIS) project e.g. for BENGIS. It is also an official document showing that boundaries as shown on the register have legal force.

Theoretical Framework and Choice of Equipment

A line is defined as joining of two points by a straight, while a polygon joins lines to form a closed figure. A parcel of land can therefore be taken as a polygon to enable distance and bearing between connecting lines to be computed and the area enclosed to be calculated.

If we have a parcel of land with points 1 to N, with coordinates (E_1, N_1), (E_2, N_2), (E_3, N_3) to (E_N, N_N), the bearings $(\propto_{12})$ between each line is given by:

$$a_{12} = \tan^{-1}\left(\frac{E_2 - E_1}{N_2 - N_1}\right) \qquad (2.1)$$

and distance l_{12} is given by

$$l_{12} = \sqrt{(N_2 - N_1)^2 + (E_2 - E_1)^2} \qquad (2.2)$$

The area of each plot is computed using coordinate formula.

$$A = 1/2(E_1N_2 - N_1E_2 + E_2N_3 - N_2E_3 + \cdots E_NN_1 - N_NE_1) \quad \ldots\ldots (2.3)$$

GNSS by design captures position of points independently of the others. Most importantly, time taken for observations in Real Time Kinematic (RTK) mode is greatly reduced such that what GNSS can achieve in a day may take classical method a week or longer (with apparent error incurred). Hence, the practical ability to use GNSS in Cadastral Surveys is obvious. Time taken for data capture enables client applications to be handled timely and efficiently and therefore enhancing productivity. Digital Cadastral records produced from use of GNSS techniques are used to process electronic C of O (e-C of O) timely and assist in quick building of GIS database.

GNSS is a general name for all global navigation satellite systems. It comprises the American GPS, the Russian GLONASS among others. They provide timing and positioning information with centimeter accuracy anywhere on the Earth with high reliability and at low cost. It can be operated day or night, under rain or dry weather, and do not require clearing line of sight between survey stations.

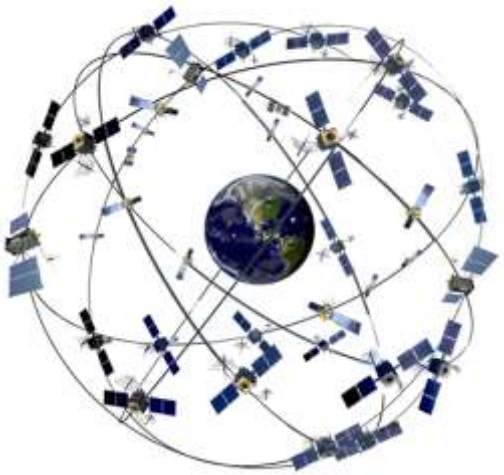


Fig 3 - Picture of GPS constellation (www.ei.lehigh.edu)