Status of Geodetic Control Network in Anambra State, Nigeria

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Abstract

There are disparate surveys being carried out in Anambra state. These are linked mostly to non-availability of geodetic infrastructure at every area needed. The paper examines the status of geodetic control coverage and their physical conditions. Field exercise was embarked upon to visit and identify these controls at their various locations. Also, some survey practitioners and survey units in the government ministries were visited. It was found from our studies that geodetic controls are concentrated in some particular local government areas (i.e. Awka, Onitsha and Nnewi) of the state. Again, some of the geodetic controls have been mutilated or displaced or totally destroyed due to construction activities and deliberate attitudes of the populace of not taking care of geodetic infrastructure. It is concluded that there is a very poor coverage of geodetic controls in Anambra State. Therefore, it is recommended that serious effort of extension/densification, caring and unification of geodetic controls should be intensified to take care of various applications and areas that need geodetic controls in Anambra State.

Keywords: Geodetic controls, unification, geodetic control coverage, disparate surveys.

1.0 Introduction

The geodetic control is a monument placed on the ground whose 2-D co-ordinates or 3-D co-ordinates have been observed, processed, and all the necessary adjustments made. These geodetic controls are established in many places forming a set of interconnected lines called geodetic network. These geodetic networks had been established to support all mapping and surveying activities. In Nigeria, the existing geodetic control network was established in the 1930's. It was expected to cover the whole country of which Anambra State is part of it. This geodetic network is a 2-D network called the Nigerian Triangulation and Traverse Stations.

Over the years, the existing 2-D network has been found inadequate in supporting the basic spatial framework for the sustained management and development of the

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environment and natural resources. Further, the coverage is sparse, many of monuments have been destroyed or defaced and the reliability is confirmed to be very low (Omoigui, 1973; Ono, 2002 and Uzodinma, 2005).

Nowadays, new technologies are emerging; new data types and methods of data collection are available. In Anambra State, there are many environmental problems requiring geodetic infrastructure but not much has been done. This study was carried out to evaluate and assess the status of geodetic control network in Anambra State for various applications. It discussed the availability, the spread or coverage and physical conditions of these 2-D geodetic controls in Anambra State made up of twenty one local government areas as shown in Fig. 1 below.

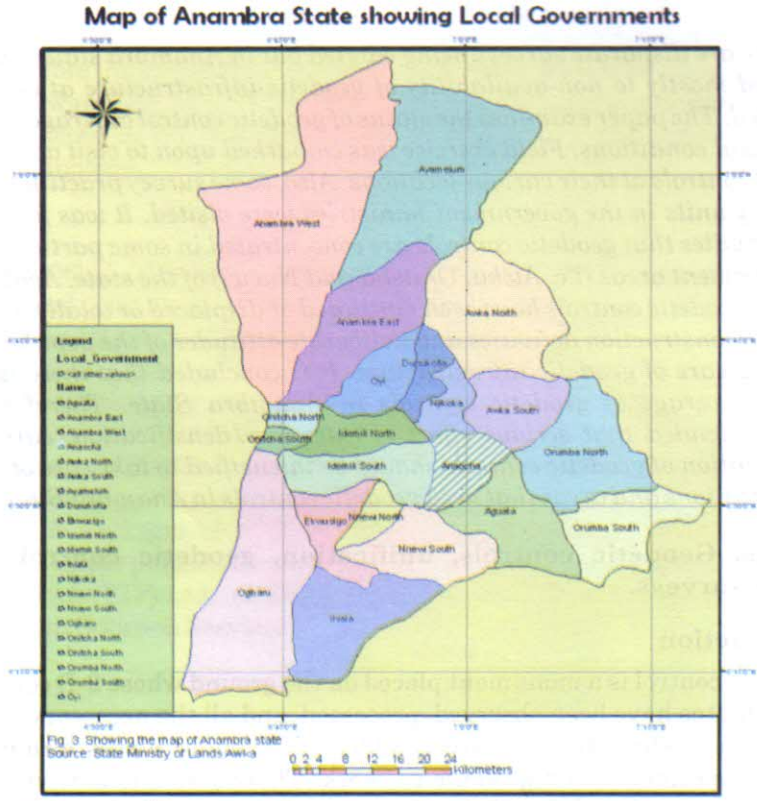

Fig. 1: Map of Anambra State with Twenty-one Local Government Areas

2.0 Geodetic Control Network Classification

Geodetic controls are established for various purposes and uses based on some hierarchical order of classifications as summarized in Table 1.

Table 1. Geodetic Hierarchical Classifications and Uses

Types	Specifications		Uses	Methods
Zero order	1ppm		Geodynamic studies and Seismic activities	GPS, SLR, VLBI
First order	10ppm		Multipurpose control, Scientific studies	Triangulation, GPS, EDM or Total Station
Second order	Class one	20ppm	Multipurpose densification, Urban control	Multipurpose densification, Urban control
	Class Two	33.3ppm	Control for mapping, inter-Cadastral connections	EDM, GPS, Triangulation
Third order	Class one	100ppm	Urban mapping purposes.	EDM, GPS, Tape
	Class Two	200ppm	Rural mapping	Tape, EDM, GPS

Sources: Ono (2002), SURCON (2003), SAMOAN (2005)

The many uses of geodetic control are encapsulated thus:

(i) Establishment and development of National multipurpose horizontal and vertical control networks.
(ii) Densification of controls for production of topographic maps, cadastral maps, seismic maps etc.
(iii) For more effective siting of communication facilities, census, administration, intra and inter state boundary delineations.
(iv) Determination of the geoidal heights, ellipsoidal heights, satellites orbits etc.
(v) Geophysical prospecting, extensive engineering projects, crustal movements, gravity observation, etc.

3.0 Nigerian Geodetic Control Datum

The Nigerian 2-D control network is based on Clarke 1880 ellipsoid with the following parameters: a=6378249.145m (semi-major axis), (1/f) inverse flattening=293.465. The network consists of triangulation chains and traverse lines established based on the legislation by the former colonial government, who saw it as an aid to exploration, exploitation and evacuation of the nation's natural resources (Omoigui 1973, Fajemirokun, 1980). The network has nine loops of eighteen triangulation chains and three loops of traverse. There are five base stations for scale check, and also azimuth observations to check orientation (Agajelu 1985). The origin of this geodetic control network is located at L40 in Minna, Niger State of Nigeria and the geodetic coordinates adopted for this point are:

Geodetic latitude (φ): 09° 38' 09"
Geodetic longitude ( ): 06° 30' 50"
Orthometric height (H) = 279.6m.

It was assumed that at Minna Datum the geoid undulation (N) is zero (see Fig. 2) and this implies that ellipsoidal height (h) and orthometric height (H) are equal i.e. h=H. Ordinarily, geoid – ellipsoid relationship is as shown in Fig. 2 below:

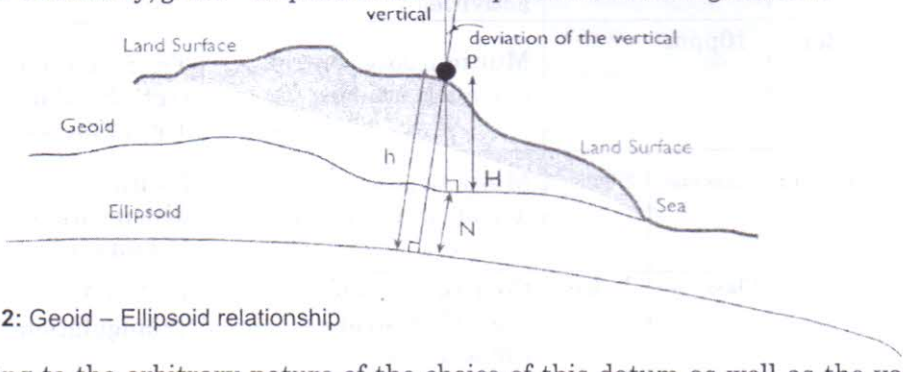

Fig. 2: Geoid – Ellipsoid relationship

Owing to the arbitrary nature of the choice of this datum as well as the various distortions inherent in the observations, Nigeria geodetic control (2-D) network is ill-equipped to meet the demands of modern positioning projects. As such, the Federal Surveys (Office of the Surveyor General of the Federation, OSGOF) has plans for upgrading the network. These plans will come in form of observations and re-observations of some lines, adjustment and strength analysis employing new technologies. Much recently, re-definition of the geodetic datum for Nigeria has been proposed in Uzodinma (2005).

4.0 Methodology

The well known geodetic control is the Nigerian triangulation and traverse network which has been characterised as sparse in coverage and with so many inherent errors. Hence, the following objectives were set down.

(i) To seek and collect all available controls (1st Order, 2nd Order, and third Order) in Anambra State.
(ii) Visit of location of the controls on the ground to describe the present physical conditions,
(iii) Putting of the controls on a map of Anambra State for the spatial coverage representation.

In order to achieve this, the following data were sought and collected:

(i) The township mapping controls of Onitsha (OMS controls).
(ii) The township mapping controls of Nnewi (NFCS) controls.
(iii) The CFH controls sites within the State.
(iv) The GPS controls in thet State.
(v) The U-chain triangulation controls within the State.