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### Application of Classical Method for Third Order Survey Control Densification from Itolu Junction to Oja – Odan, Ilaro, Yewa-South Local Government Area, Ogun State, Nigeria

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**Abstract:** The first basic principles of surveying emphasize the starting of all surveying-based data acquisition from a known point (control), which must not be in isolation to the national frame work. It is to this that series of controls are to be established to third order accuracy using classical method. The three dimensional coordinates were obtained using classical methods. For the classical method, the traditional method of traversing was used to obtain the planimetric coordinates of the points using South Digital theodolite for angular observation on four zeros while the SOUTH Distomat Electronic Distance Measurer was used for the distance measurement. The coordinates obtained were analyzed, represented, presented and structured in data base after the application of all necessary corrections and transformation.

**Keywords:** Surveying, Controls, network, Third-Order, classical-method

#### I. INTRODUCTION

The need for surveying had become more pronounce than ever before most especially on land information, therefore surveying is very important to the successful execution of any physical development on land. This is because the knowledge of terrain nature and accurate position fixing are required by development [2]. [5] Defined control survey as way of establishing precise horizontal and vertical control position of network of reference monuments to serve as the basic originating frame work for such layout design property boundary, planning and topographic mapping. [3] Defined traversing as the process of determining the position of a sequence of point measuring the distance between successive points and at each observing the direction of the neighboring points. [1] Make it clear that traverse may be either a closed traverse or open traverse. The traverse proceeds from one coordinated point to another coordinated point is known as a "closed traverse" while a traverse runs from neither coordinated point to unknown coordinated point is called an open traverse. However [4] stated that in all traversing is a misclosure in angle (angular misclosure) and misclosure in position. Control can be defined as a way of establishing precise reference monument to determine distance, direction and difference in elevation between two points on the earth by triangulation, traversing and leveling [6], [4]. There is several orders of control which depend on the accuracy required when using traversing method, they are:

- Precise traversing (cadastral frame work) for mapping with accuracy: 1:100,000,
- First order control (primary) for mapping with accuracy: 1:50,000,
- Second order control (secondary) for mapping with accuracy 1:20,000,
- Third order control (tertiary) for mapping with accuracy 1:5,000,
- Minor order control for mapping with accuracy 1:500.

This project however is based on control densification using the classical survey method. The order of the job adopted for this method is third order. The classical survey method refers to the old traditional method which involves obtaining data with a lot of attention to field work. The horizontal co-ordinate can be obtained by traversing, triangulation or trilateration while the heights are obtained from leveling or trigonometric heightening. The final results are arrived at after cumbersome computations.

Controls cannot be neglected since they form the frame work to any survey operations. Control densification is a way of establishing precise horizontal and vertical positions of a network of reference movements to serve as the basis for originating or checking subordinate surveys for projects such as topographic and hydrographic mapping, property boundary derivation, route and construction planning, design and layout[7],[6]. However, control is a basic concept of surveying because it is used as a connection and form a framework which is normally used or required by any survey regardless of its size in order for it to be surveyed at accuracy closer to the higher accuracy required of the survey. Also, it is the system of different categories:

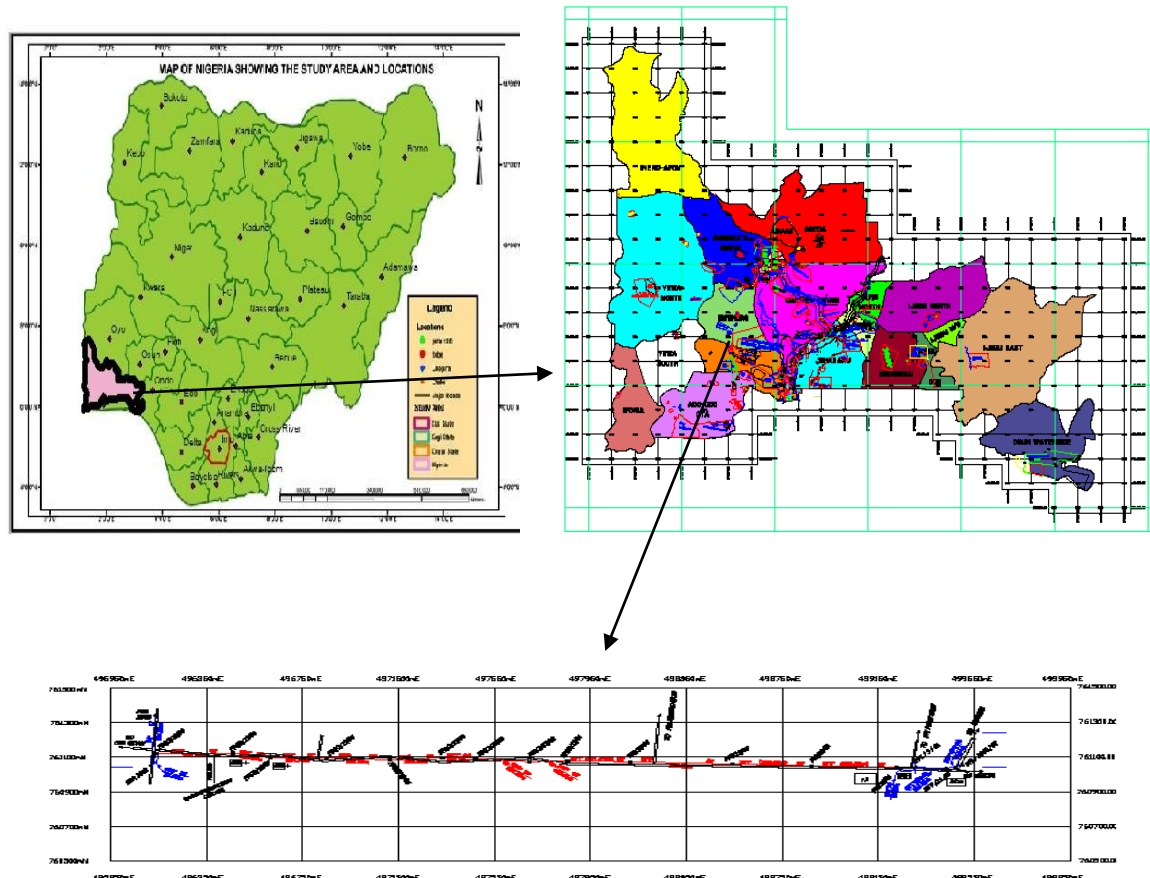
- a) **Vertical control:** This is the determination of elevation only (z).

- b) **Horizontal control:** This is determination of horizontal location (x,y).
- c) **Ground control:** This is obtained by the ground survey method.
- d) **Photo – control:** This can be determined by photogrammetry method.

## II. STUDY AREA

Nigeria is located between latitude  $4^{\circ}\text{N}$  &  $14^{\circ}\text{N}$  of the equator and between longitude  $3^{\circ}\text{E}$  &  $15^{\circ}\text{E}$  of the Greenwich meridian. Ogun state is situated between latitude  $6^{\circ}2'00''\text{N}$  and  $7^{\circ}8'00''\text{N}$  and longitude  $3^{\circ}\text{E}$  &  $5^{\circ}\text{E}$ . The project site runs from Itolu Junction to Oja – Odan, Ilaro, Yewa South Local Government Area, Ogun State, which lies between latitude  $6^{\circ}53'10''\text{E}$  &  $6^{\circ}53'13''\text{N}$  and longitude  $2^{\circ}57'51''\text{E}$  &  $2^{\circ}59'34''\text{E}$ .

Figure I Map of Nigeria showing Ogun State showing the Study Area



## III. METHODOLOGY

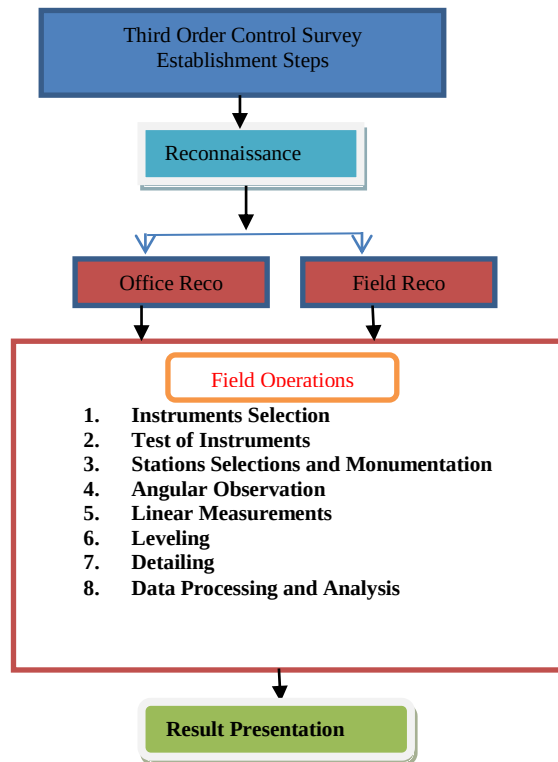
This project exercise was carried out using the classical. The method was used in accordance to the survey rules and regulations. The flow chart of the methodology is shown in Figure 2 below.

### III (A). PROJECT SPECIFICATION

These are the conditions stipulated for third order traverse in accordance with survey regulation:

1. The minimum linear accuracy is  $1/5000$
2. The angular misclosure must not be more than  $30''\sqrt{n}$
3. Traverse legs must not be less than 350m but depends on the terrain of the area.
4. Heightening of beacons to be determined by the trigonometric heightening.
5. Beacons should be build institute and reinforced by an iron rod of 1 -2m long and centrally placed with a nail to form the centre marks.
6. The types of instruments to be used for distance and angular measurements must be standard.

**Figure II Flow chart of Methodology**



#### IV. RESULT PRESENTATION

**Table I shows the list of Final Coordinates generated from Classical Method**

| STATION     | NORTHING<br>(M) | EASTING<br>(M) | HEIGHT<br>(M) |
|-------------|-----------------|----------------|---------------|
| FPI/13/01   | 761042.249      | 499226.059     | 77.107        |
| FPI/13/02   | 761049.792      | 498873.179     | 78.238        |
| FPI/13/03   | 761060.304      | 498543.725     | 77.484        |
| FPI/13/04   | 761073.002      | 498115.413     | 66.281        |
| FPI/2/13/01 | 761079.724      | 497854.157     | 55.004        |
| FPI/2/13/02 | 761072.971      | 497697.862     | 45.486        |
| FPI/2/13/03 | 761092.173      | 497470.889     | 57.477        |
| FPI/2/13/04 | 761095.900      | 497334.145     | 73.506        |
| FPI/2/13/05 | 761083.801      | 497113.925     | 73.904        |
| FPI/2/13/06 | 761097.283      | 496851.574     | 72.345        |
| FPI/2/13/07 | 761095.708      | 496616.842     | 70.456        |
| FPI/2/13/08 | 761123.039      | 496460.294     | 71.345        |
| FPI/2/13/09 | 761121.937      | 496143.630     | 70.984        |

#### IV (A). RESULT ANALYSIS

**Table II Result Analysis**

| EXPECTED ACCURACIES                         |                    |                      | OBTAINED ACCURACIES   |                    |                      |
|---------------------------------------------|--------------------|----------------------|-----------------------|--------------------|----------------------|
| ANGULAR<br>MISCLOSURE<br>( $30''\sqrt{n}$ ) | LINEAR<br>ACCURACY | LEVELING<br>ACCURACY | ANGULAR<br>MISCLOSURE | LINEAR<br>ACCURACY | LEVELING<br>ACCURACY |
| $0^{\circ} 1' 56''$                         | 1/5000             | 0.043mm              | $10''$                | 1/84000            | 0.011mm              |

#### V. INFORMATION PRESENTATION

This phase involved the digital representation and presentation of the processed data. The information was duly represented using the proper conventional signs and presented on both the hardcopy and softcopy.

On completion of all data computation and processing, one original plan was drawn for the group at a scale 1/10,000. The plan shows all the traverse stations, details as roads, culvert. From the original plan, a traced copy was produced on a transparent sheet and hereby submitted along with true records.

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