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## Applications of Geoinformatics and Mapping in the Development of Divine Hectares Estate at Enugu Lifestyle and Golf City, Nigeria.

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## Introduction

- ❑ Geoinformatics is the science and the technology which develops and uses information technology to address the problems of Surveying, cartography, geosciences and engineering.
- ❑ Mapping, on the other hand, is best understood as the creation of maps to scale through a branch of surveying called cartography.
- ❑ The business of real estate entails the profession of developing, buying, selling, or renting land, buildings, or housing.
- ❑ The real estate market in Nigeria has metamorphosed into a very robust hub; this is as a result of emerging technological trends in Geoinformatics, mapping, engineering and online marketing.
- ❑ In this study, the authors tried to give an insight to the function of a surveyor and the application of Geoinformatics and Mapping in the development of Divine Hectares Estate.

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## Study Area

Divine Hectares Estate is Located within Enugu Lifestyle and Golf City, Nigeria. It lies within longitudes  $7^{\circ} 31' 46.7''\text{E} - 7^{\circ} 31' 48.1''\text{E}$  and latitudes  $6^{\circ} 23' 14.9''\text{N} - 6^{\circ} 23' 3.6''\text{N}$ . The Estate area is about 6.99 Hectares. Enugu Lifestyle & Golf City is arguably one of the most beautifully planned cities in Nigeria with about 1,065 hectares of lush green savannah in Enugu, south-eastern Nigeria.



*Figure 1.0. The location of Divine Hectares Estate in Nigeria.*

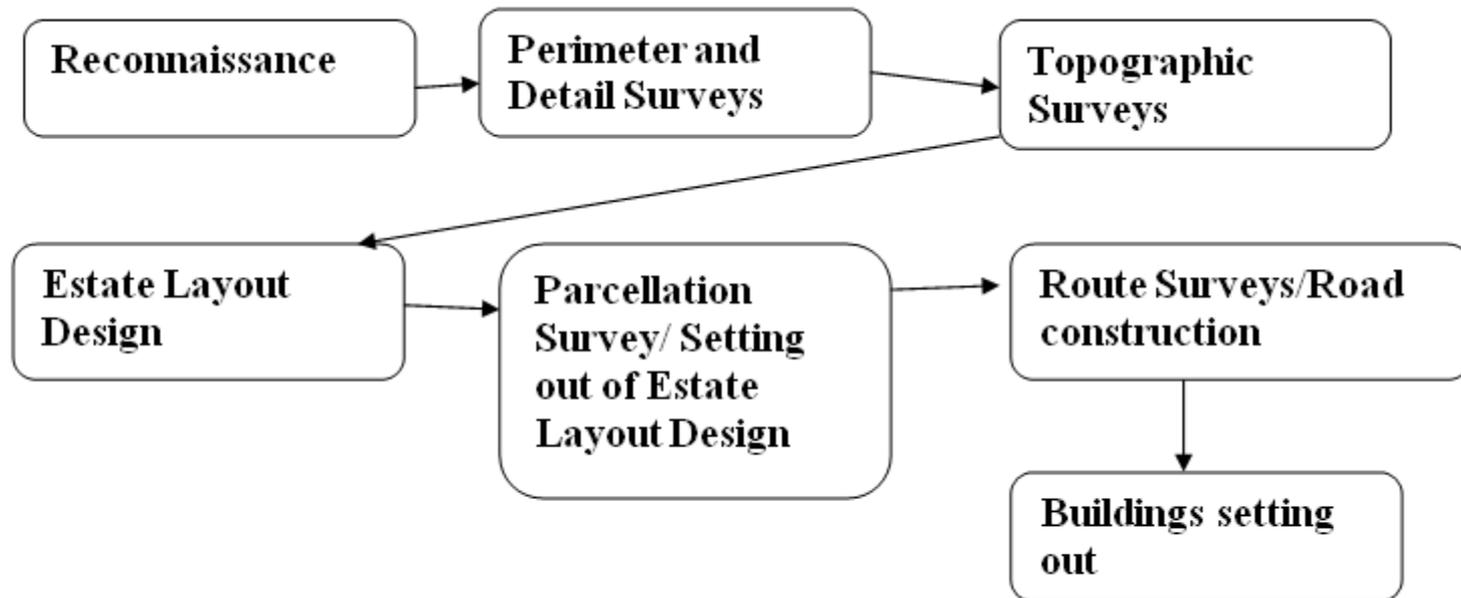
## Surveying Equipments Used

The following Surveying Equipments were used in the course of this study;

- ✓ Hi – Target Dual Frequency GNSS System (DGPS) V30
- ✓ Garmin Handheld GPS78<sub>SC</sub>
- ✓ Hi – Target Total Station ZTS–320R
- ✓ Hi-Target Automatic Level Instrument

## Methodology

Surveying, Geoinformatics and mapping are in phases as well as estate development. The figure below shows the stages/phases of the development of the Estate and the Geoinformatics methods applied.



*Figure 2.0. A flow chart showing the stages of the methodology of the development*

## Reconnaissance

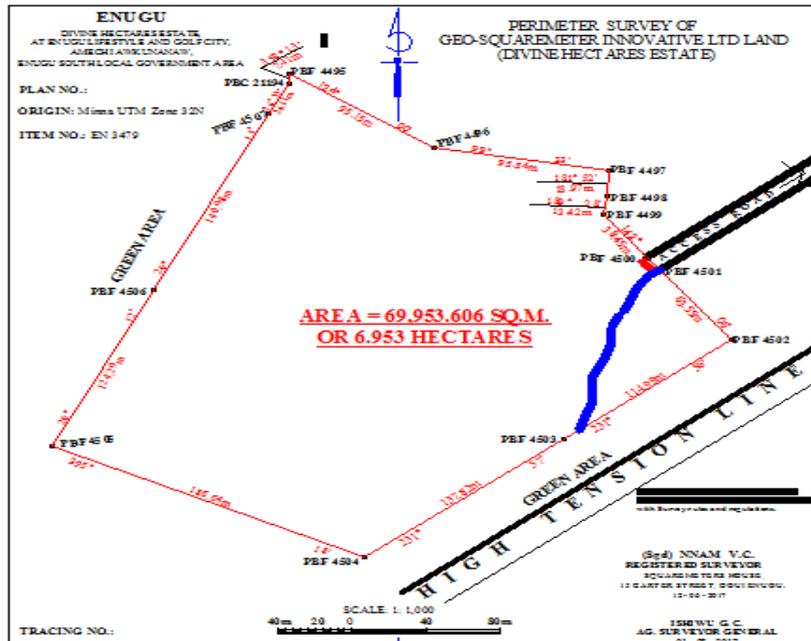
It was done as a preliminary survey in order to note some salient and pertinent physical features in the site, this includes its topography, permanent natural or manmade features. In the past decades, reconnaissance surveys were done with a compass, reece field sheets and drawing materials. In this study, the reece started by a site visit and using a hand held GNSS receiver to take position of salient features, then the coordinates of the features were plotted on satellite imageries downloaded from Google earth. These guided the company in choosing the most suitable location within the centenary city to site the Estate project.



*Figure 3.0*  
*Google Earth Satellite Image of Divine Hectares Estate*

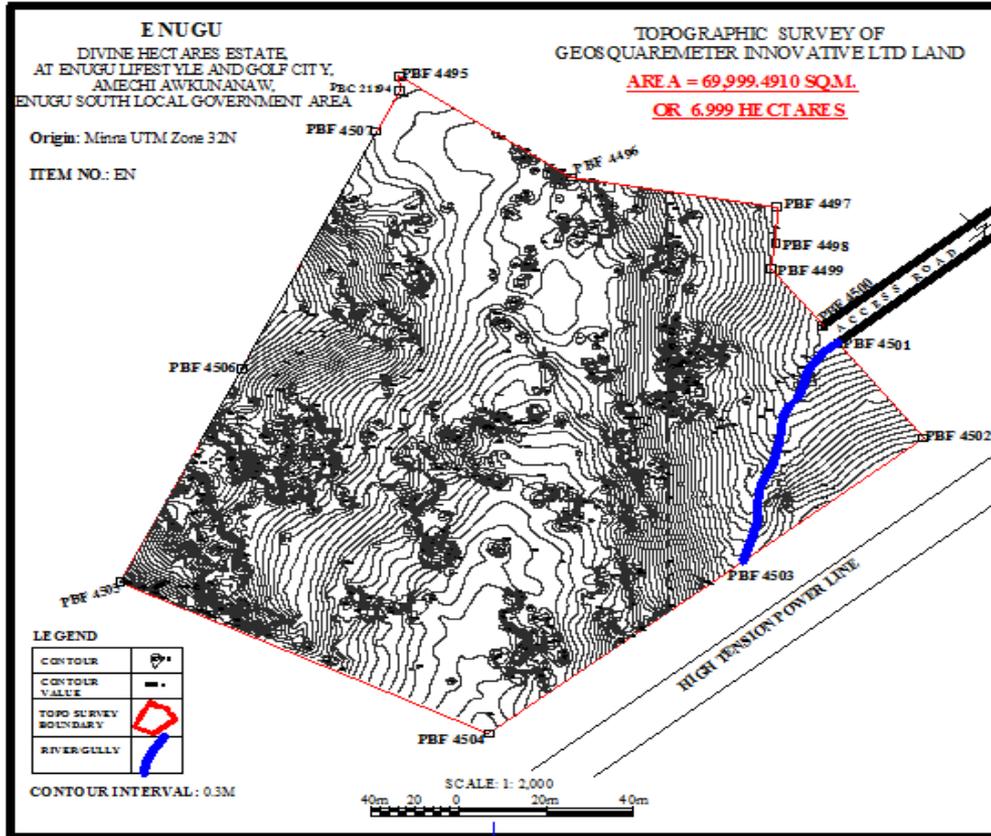
## Perimeter and Detail Surveys

Perimeters survey are cadastral. The measurements were taken and plotted in order to produce a registerable cadastral instrument. Detail survey is the survey of the positions of permanent natural features within a cadastral boundary. In this study, the perimeter survey and the detail surveys, fig 4.0, were done simultaneously. A Hi-Target differential GNSS equipment was used on a Real Time Kinematic (RTK) mode to observe the capped beacons.



**Figure 4.0 Plan Shewing the Perimeter and detail Survey of the Study Area.**

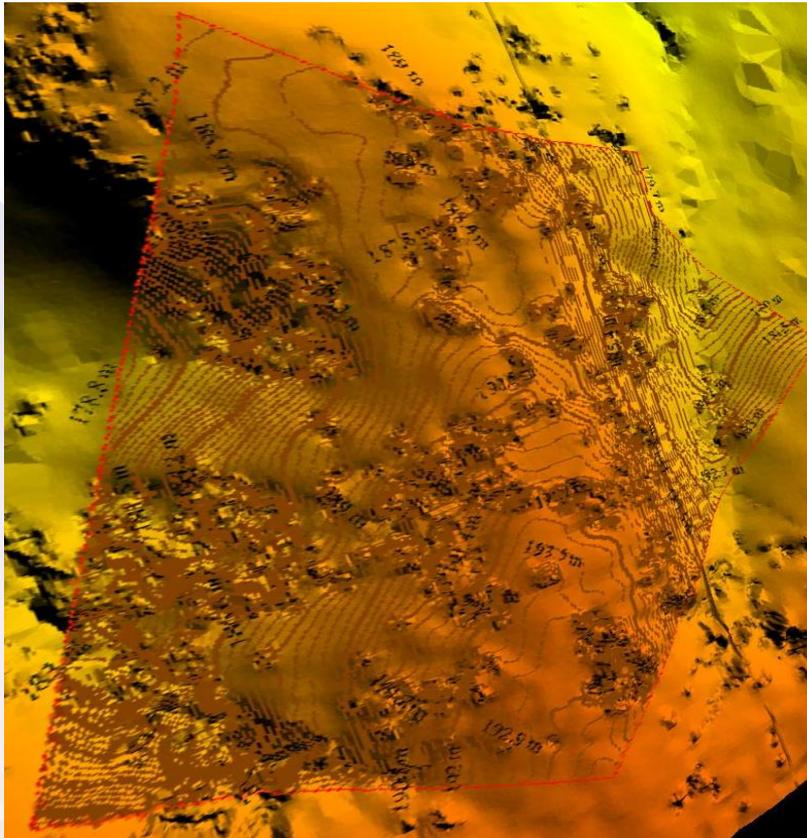
## Topographic Surveys



Topographic survey is a very vital survey in real estate development and engineering/construction. In this study, because of the ruggedity of the terrain, a topographic survey was painstakingly done using a Hi-Target total station. The spot heights were taken in a grid of 5mX5m; this interval was used in order to get more graphic details of the terrain. The spot heights were downloaded into the system and plotted using AutoCAD Land Development, as seen in fig 5.0 and also global mapper software shown in fig 6.0. below. The results were saved in AutoCAD format for the Use of the surveyors and town planners.

**5.0: Topographic and Detail Survey of Divine Hectares Estate in CAD format**

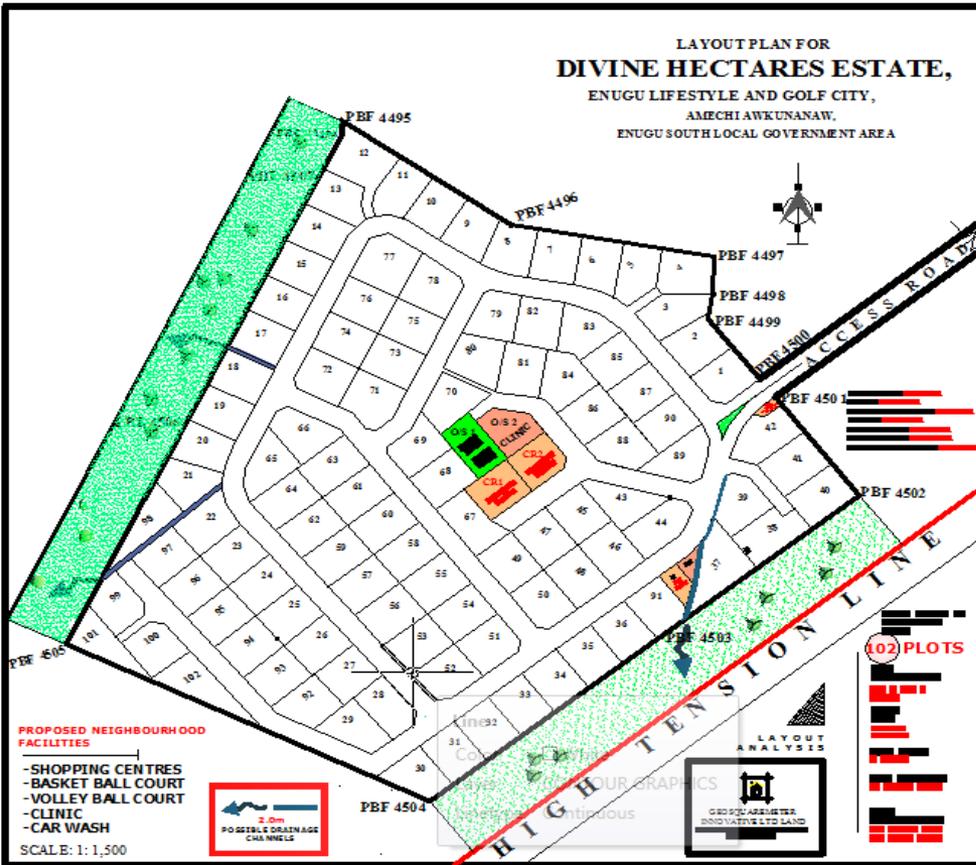
## Topographic Surveys Contd



The spot heights were later exported through spreadsheet into global mapper software, an application specially designed for the analyses and interoperation of geoinformation in three dimensions. The software displayed the three dimensional illustration of the terrain of the study area. This information helped the planners to make informed decisions about routes and drains.

*Figure 6.0: The 3D topographic survey in Global mapper environment.*

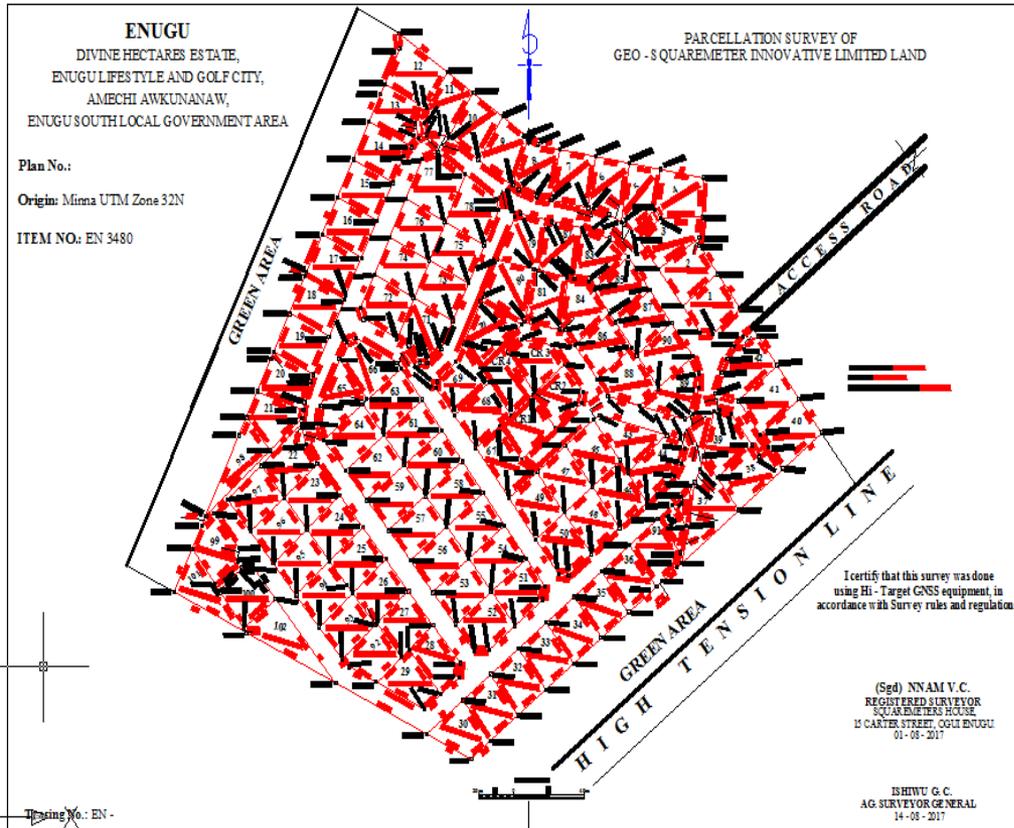
## Estate Layout Design



The perimeter, detail and topographic surveys were handed over to a Licensed Town Planner in an AutoCAD format for designing, planning and scheming. The estate was planned as a medium density housing community for the Nigerian middle class. The plots were designed to the area of approximately 500sqm. It was designed with amenities such as security house, shopping centre, clinic, volley/basket ball court, car wash, refuse dumpsites, electric transformer point, etc. All the professional planning codes were observed in order to deliver a functional housing estate. The town planner delivered his work in a CAD format.

*Figure 7.0 Estate Town Planning Design of Divine Hectares Estate*

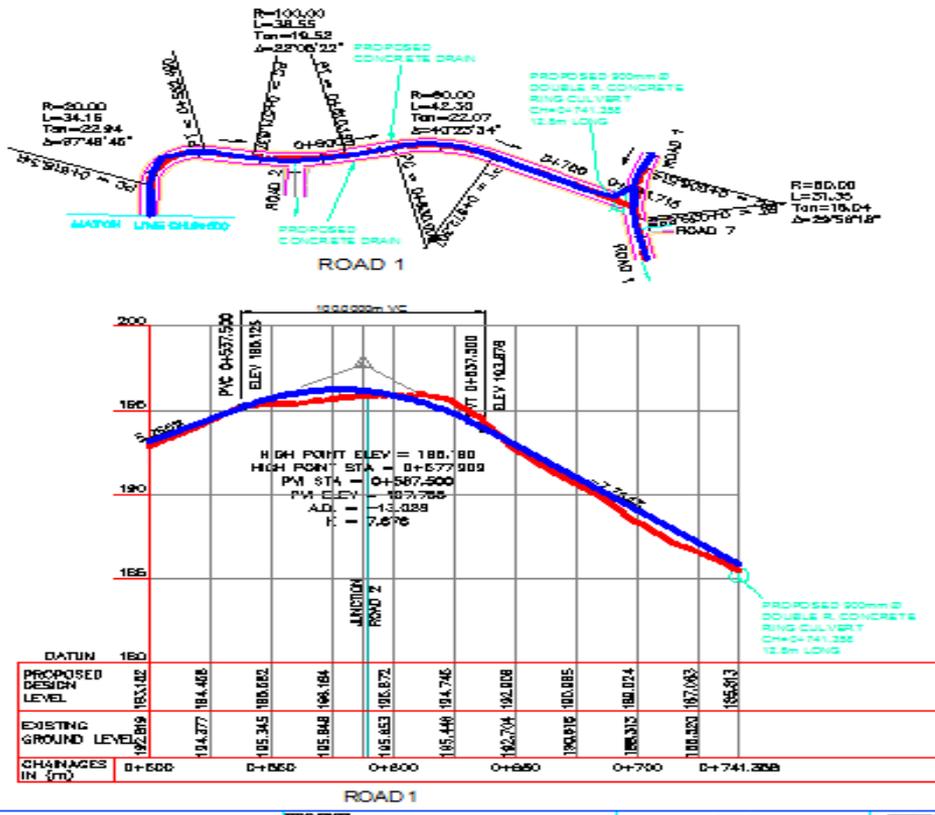
## Parcellation Survey/ Setting out of Estate Layout Design



Parcellation surveys were carried out in order to subdivide a property into cadastral parcels. When the Layout design of the estate was received from the town planners, the design was first edited to survey format, and then point features and line features were created. Beacons were numbered on the CAD, and then the survey points were extracted with the beacon numbers as unique identifiers and exported to spreadsheet. The spread sheet (.csv) data sets were uploaded into Hi-target differential GNSS equipment for setting out Real Time Kinematic (RTK) mode. The beacons were buried as the points were being set out, they were also capped and numbered after being buried, as shown in figure 7.

**Figure 7.0 Layout Survey Plan of Divine Hectares Estate**

## Route Surveys



After the parcellation surveys, beacon points along the routes were flagged; this helped the route surveyors to be guided on the route boundaries. The centre lines of the routes were marked at 10m chainages and the route plan was surveyed along the centre lines; the longitudinal section profiles were carried out in 10m chainages while the cross sections were carried out in 2.5m intervals. A Hi – Target Total Station ZTS–320R used in carrying out the route surveys.

As shown in figures 9, the results of the route surveys were used by the civil engineers to design the roads.

*Figure 9.0: Route Plan and Profile of part of Divine Hectares Estate.*

## Buildings setting out

The building prototype design was received from the architects in CAD format; it was digitally interoperated with the estate geodatabase which contains all details in CAD format. In the CAD environment, the building design was fixed in each parcel, adjusted and rotated to face the road since all plots are not of the same orientation. Point and line features were created on the building corner points and their coordinates extracted into a spreadsheet (.csv) formats. The building point coordinates were uploaded into the total station and were set out.

During construction, the building point's coordinates were used in monitoring the development to ensure compliance with the design. Figure 12.0 depicts the details for one of the plots.

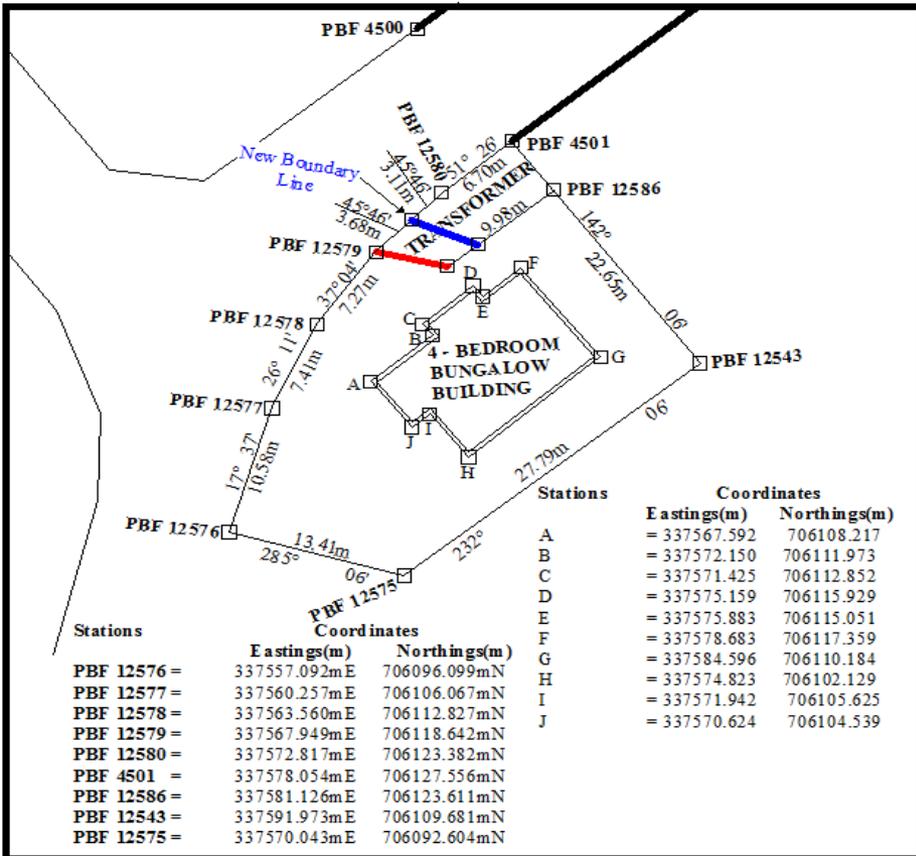


Figure 12.0 Building setting out details for Plot 44, Divine Hectares Estate

## Geoinformation Inputs

- ✓ The digital method of reconnaissance survey demonstrated a lot of advantages over the old analogue methods, it aided informed decision making towards the project.
- ✓ Hi-Target Differential GNSS equipment used in the perimeter survey and detailing was faster, more accurate and more reliable than traditional methods of traversing.
- ✓ Mapping possibilities were showcased in the topographic survey Phase. It was required in order to present an optical illusion of the terrain of the study area for designing and planning.
- ✓ The Perimeter, Detail and topographic surveys in CAD format helped the Town Planner to do an exquisite design of the Estate.
- ✓ After the Estate Layout Design, since the design were in digital form, it was easy to convert point data to coordinates and extract the coordinates into a total station for setting out. Thus the whole estate layout was set out.
- ✓ Because the Estate Layout is set out and marked with beacons and metal pegs, it was easy to run the route survey.
- ✓ The results of the route survey were submitted to a consultant Civil Engineer in CAD format for route design. The cut and fill volume was easily determined based on the difference between the natural route surface and the designed route surface.
- ✓ The monitoring of the building construction was easy and fast because of the data interoperability between the building design and the layout design. The building points were simply converted to coordinates and uploaded to a total station for monitoring during construction.

## Conclusion

- ❑ Metamorphosis is a virtue for adaptation in flora and fauna; the ones who do not change, improve or adapt to a constantly changing weather die off in the times of adverse weather.
- ❑ This is applicable in the realm of professionalism, professionals who do not update and improve in this fast and constantly changing digital world may lose relevance in the near future.
- ❑ Digital possibilities have metamorphosed the surveying, Geoinformatics, geomantic and mapping profession from taking and plotting measurement to managing, analysing and interoperating geoinformation.
- ❑ This study has been able to depict the application of Geoinformatics and mapping in the development of Divine Hectares Estate in its entire ramification.
- ❑ It is evident from this study, that the surveyor is meant to be part of the entire processes of the estate development.
- ❑ This paper demonstrated the position of the authors on what the application of Geoinformatics and Mapping in real estate development should be.